Environment Waikato local area planting guide series 3

What to plant in

Central volcanic plateau ecological region

Taupo and Atiamuri ecological districts

Planting local native trees to preserve our natural heritage and promote our community identity.

www.ew.govt.nz

Environment Waikato REGIONAL COUNCIL

Contents

Acknowledgements

This guide was compiled by Janica Amoore and Karen Denyer, with advice and assistance from:

- Bruce Clarkson, University of Waikato
- Nick Singers, Tongariro-Taupo Conservancy, Department of Conservation
- Catherine Beard, Environment Waikato
- Yanbin Deng, Environment Waikato
- Moira Cursey, Waikato Biodiversity Forum
- Jan Hoverd, Biodiversity Advice Waikato
- Tony Druce (via his extensive detailed species lists of the area)
- Quin Amoore (photographs)
- The New Zealand Plant Conservation Network (for photographs and species lists)
- Sarah Beadel, Wildland Consultants Ltd
- Judy van Rossem, Environment Waikato
- Toni Cornes, University of Waikato.

About this guide

Native forest on the impressive ignimbrite cliffs above Lake Taupo's Western Bay.

The central volcanic plateau ecological region is a dramatic part of the Waikato region's landscape. Home to New Zealand's largest lake, the head of its longest river, and edged by snow-dusted ranges, it attracts local and international visitors year round. However, with just 20 per cent of its land area now in native vegetation cover there is plenty of scope to improve the landscape and its ecology with native plantings.

This area is in need of restoration because:

- most of the remaining native forest is restricted to higher elevation, with little or no remaining natural areas on lower or gentler terrain for winter refuge or for lower altitude plant species to establish
- animal pests such as deer, goats, possums and even wallabies (in localised pockets) and an extensive array of plant pests such as wilding pines and Japanese honeysuckle are a significant threat to native forest regeneration
- the area contains two of the most significant fresh water bodies in the Waikato region; Lake Taupo and the upper Waikato River – protecting their water quality and aquatic life is a matter of national importance, and densely vegetated riparian zones are important to filter out nutrients and sediments
- the area is currently undergoing significant land use change with the conversion of exotic forestry to dairy pasture – this will further reduce habitat opportunities for native plants and birds such as the New Zealand falcon and North Island robin and place greater pressure on already declining water quality.

Planting natives can help overcome these problems. Native plants can be used to:

- replace exotic weeds and prevent other weeds establishing in cleared areas
- stabilise river banks and reduce erosion on bare land and newly created slips
- enhance waterways and provide seasonal food and habitat for native birds
- improve water quality through the restoration of wetland habitats
- provide shelter and amenity value for farming operations
- contribute to the aesthetic and landscape character of the central volcanic plateau ecological region.

Many agencies, community groups, farmers, forestry companies, and individuals are working hard to protect the natural values of the central volcanic plateau ecological region. They are removing weeds, controlling pests, and planting natives to recreate or enhance natural ecosystems.

This guide will help you select and plant local native plants for your gardens, re-vegetation areas, or as specimen or shelter trees for your property.

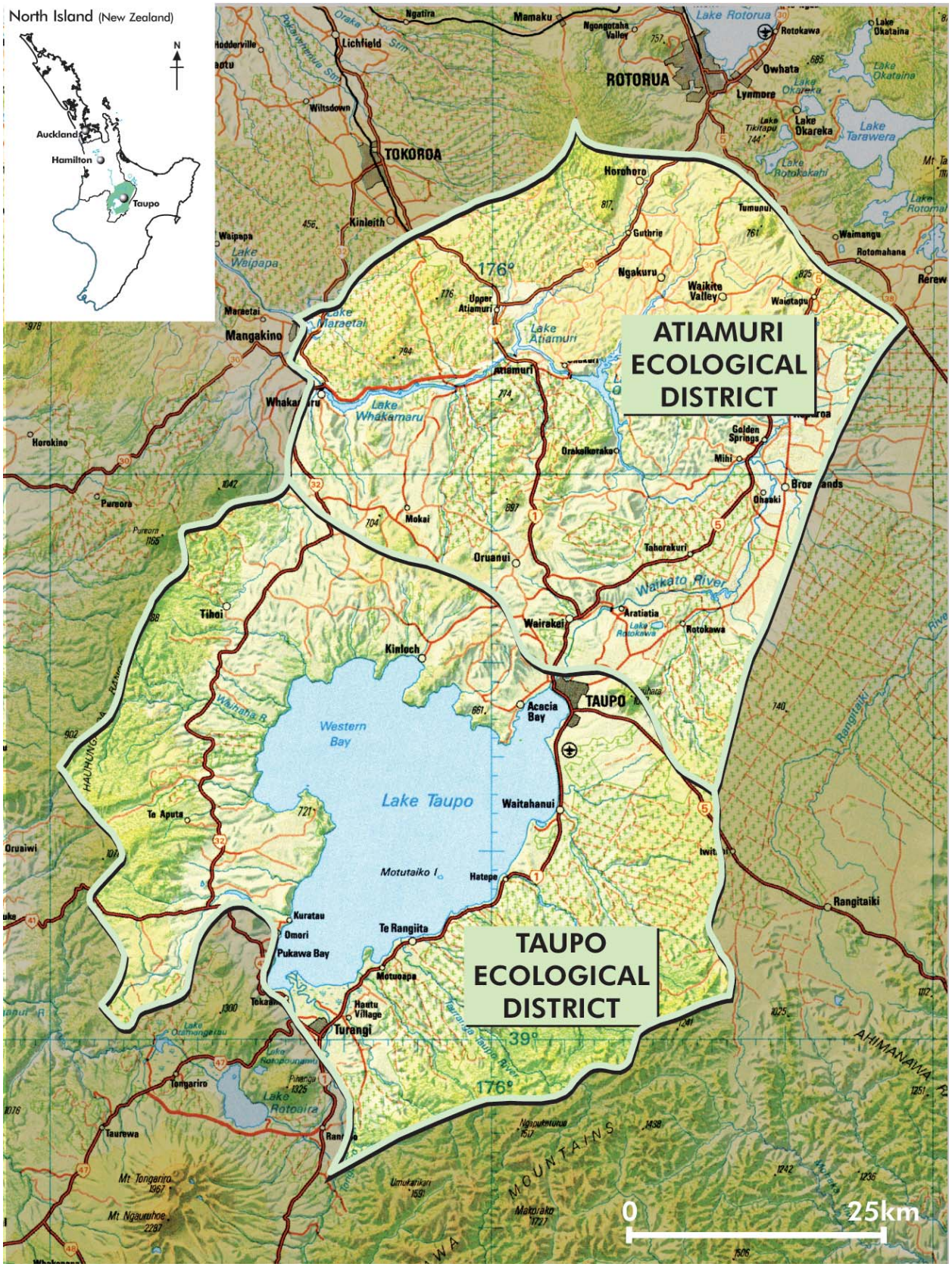
The focus of this planting guide is on native forest species. For ideas on what to plant in wetlands, contact Environment Waikato for a copy of the 'Wetland Management' factsheet series or visit www.ew.govt.nz/water.

This guide is for the central volcanic plateau, comprising two adjoining ecological districts.

The Taupo ecological district stretches from Taupo to Turangi, occupying the basin between the Hauhungaroa range and the foothills of the Kaimanawa ranges.

Atiamuri ecological district is centred on the southern Waikato hydro lakes, bordered by the towns of Whakamaru, Horohoro, Reporoa and Taupo.

Lake Rotorua and the mountains of the Tongariro National Park, Pureora and the Kaimanawa forest parks are outside these ecological districts.



Taupo and Atiamuri ecological districts

Central volcanic plateau ecological region and districts

What is an ecological district?

New Zealand has been divided into 268 ecological districts based on geological, topographical, climatic and biological features that together define a characteristic landscape. Similar districts combine to form 'ecological regions'.

Description of central volcanic plateau ecological region and districts

The central volcanic plateau ecological region, comprising Taupo and Atiamuri ecological districts, is located in the Taupo basin. It occupies a huge subsided area (caldera complex) formed during several catastrophic volcanic eruptions, the last being around 186 AD. These eruptions, along with the evolution of the Tongariro and Waikato river systems, have greatly influenced the formation of the land and vegetation.

Topographically the two ecological districts are very different. Taupo ecological district is a basin dominated by Lake Taupo, occupying one quarter of the district, and edged by high mountain ranges draining down to the lake. Atiamuri ecological district is a plateau, flat in the Reporoa Valley to the east, but blistered by a cluster of rounded lava domes to the south-east, and more dissected ranges to the north and west.

Major landforms generated during and after the Taupo eruptions include:

- high cliffs along the western and northern sides of the lake formed when the land collapsed creating the caldera
- a greatly enlarged Lake Taupo following the caldera formation
- gently sloping rhyolitic ignimbrite and pumice alluvium landscapes of the Hauhungaroa range, the Mamaku Plateau and the Ouaho hills with characteristic rilled (channelled) erosion on the hill slopes, and entrenched rivers and streams with high pumice cliffs
- small volcanic cones of andesite, dacite and basalt such as Rainbow Mountain
- clusters of lava domes including 897 metres Maroanui hill in the Kaingaroa Forest south and east of Atiamuri.

The lower reaches of the Tongariro River delta provide a slow infill of Lake Taupo in the south. The outflow at the north end of the lake is the source of the Waikato River which cuts its way through the north of the ecological region, bursting dramatically through a narrow gorge at the Huka Falls near Taupo. Geothermal areas are a significant feature of the area, with the rising steam visible from a long way away.

Yellow-brown soils formed from volcanic ash have developed on Taupo pumice over most of the area. The soil depth varies with topography, with soils often shallow particularly on steeper slopes. Thick deposits of pumice (up to 6–8 metres) in depth occur on the eastern side of Lake Taupo. Leaching effects range from moderate (in areas of lower rainfall) to severe (in higher rainfall areas), with podzolised soils (strongly leached acidic soil) in areas previously vegetated in rimu-dominated forests. Soils are generally well-drained, though some areas of poor drainage occur in the fomer lakebed of the Reporoa basin.

The climate is the most continental-like in the North Island, with warm, often dry summers and cool winters. Heavy rain, hail and thunderstorms are frequent events particularly on higher altitude areas. Snowfalls are infrequent but ground frosts and fog are relatively common, with 60 or more frosts per year. Droughts occur most years.

The central volcanic plateau ecological region is divided into two ecological districts which are the focus of this planting guide. Each of these ecological districts has a particular combination of landform, soil, vegetation and climate which brands it differently from the rest of the country.

1. **Taupo ecological district**
   Taupo ecological district comprises of the water catchment area surrounding Lake Taupo. The Hauhungaroa and Kaimanawa ranges form the catchment boundaries on the west and southeast respectively. The lower slopes rising up from Lake Taupo are a fan of volcanic breccia, eroded off the surrounding caldera walls. The topography is rolling to locally broken, mostly within the altitude range of 300 to 600 metres, with high points of Mt Tauhara (1091 metres) near Taupo township, and the north-west faces of the Kaimanawa Ranges (1300 to 1500 metres). The current land cover is mostly native forest on the steep ranges to the east and west, with the lower slopes in farmland to the north-west and plantation forestry to the south-east.

2. **Atiamuri ecological district**
   Atiamuri ecological district comprises most of the upper Waikato river catchment. The eastern boundary extends to the Kaingaroa escarpment and, in the west, to Lake Maraetai. The terrain in this district is mostly rolling to rugged hill country with low lying floodplains, and includes a group of rhyolitic domes up to 800 metres elevation and the Paeroa Range (900 metres). A large amount of geothermal activity is centred in this ecological district. The current land cover is dominated by pine plantations and farmland, with very little native vegetation remaining. Much of the plantation is currently being converted to dairy farms.

Vegetation in the Taupo and Atiamuri ecological districts

The Taupo eruption of 186 AD blasted a column of superheated rocks, pumice and ash some 50 kilometres into the air from its vent, the Horomatangi reef east of the middle of Lake Taupo. When the column collapsed it surged sideways at speeds of up to 1000 kilometres per hour, largely incinerating all pre-existing forest over a distance of about 80 kilometres in all directions.

Successful regeneration occurred, and prior to human settlement the land was again almost entirely re-covered in forest vegetation, mainly dense podocarp[1] forest on the lower slopes, with pockets of black, silver and red beech on the more broken country on the eastern side of the lake. Reasonably extensive wetlands existed on plains and in valley floors, many of which still remain.

Repeated wildfires during the 600 years or so of Maori occupation, combined with harsh temperatures, resulted in a landscape dominated by tussockland, bracken fern and scrub, with forest generally being restricted to inaccessible steeper places and damp gullies.

By 1840, much of the forest cover had been burnt and the remaining forest vegetation consisted of four main types.

- Rimu and matai over kamahi forest on well-drained, flat to rolling hill country.
- Dense podocarp (totara, matai and kahikatea) forest on deep, well-drained volcanic soils and on the ignimbrite geology west of Lake Taupo.
- Beech (red and silver) forest on steep slopes at high altitudes, and in gorges where cold air accumulates, particularly on the eastern ranges in the Taupo ecological district north of the Tauranga-Taupo River. South of the river mosaics of red beech and podocarp-dominated forest rose to mountain beech forest above 800 metres.
- Hall's totara over kamahi forest at higher altitude in places such as Mt Tauhara and Oruanui where beech forest was absent.

Tawa forest, with associated mangeo and pukatea, is currently rare in this area, mainly confined to the northern parts of the Atiamuri ecological district and the Hauhungaroa Range of the Taupo ecological district. While these species tend to prefer warmer temperature, their absence may be a result of the

[1] Podocarps are a group of plants that produce pollen in cones but their seeds are either enclosed in a fleshy cover or sit atop a fleshy 'foot', both of which are designed to attract birds that distribute their seeds. New Zealand podocarps include rimu, totara, kahikatea, matai and miro.

relatively recent volcanic disturbance that has favoured the more light tolerant conifer and beech species. Tawa may eventually re-establish as a later successional species in this area under mature podocarp forest.

Secondary vegetation resulting from fire was extensive and consisted of mainly two types.

- Silver tussock on flat plateau country exposed to persistent burning, and gradually colonised by manuka and monoao shrubs.
- Broadleaved scrub (five-finger, kohuhu, kamahi, mahoe, rewarewa) regenerating through bracken on steeper topography less prone to fire and frost.

The vegetation cover of these ecological districts assisted in protecting and building the soil resource, playing a vital role in reducing erosion and the resultant effects of sedimentation and flooding. They helped to maintain a clean, healthy water resource and provide habitat for native animals including blue duck, koaro (a native fish), kiwi and the small-scaled skink.

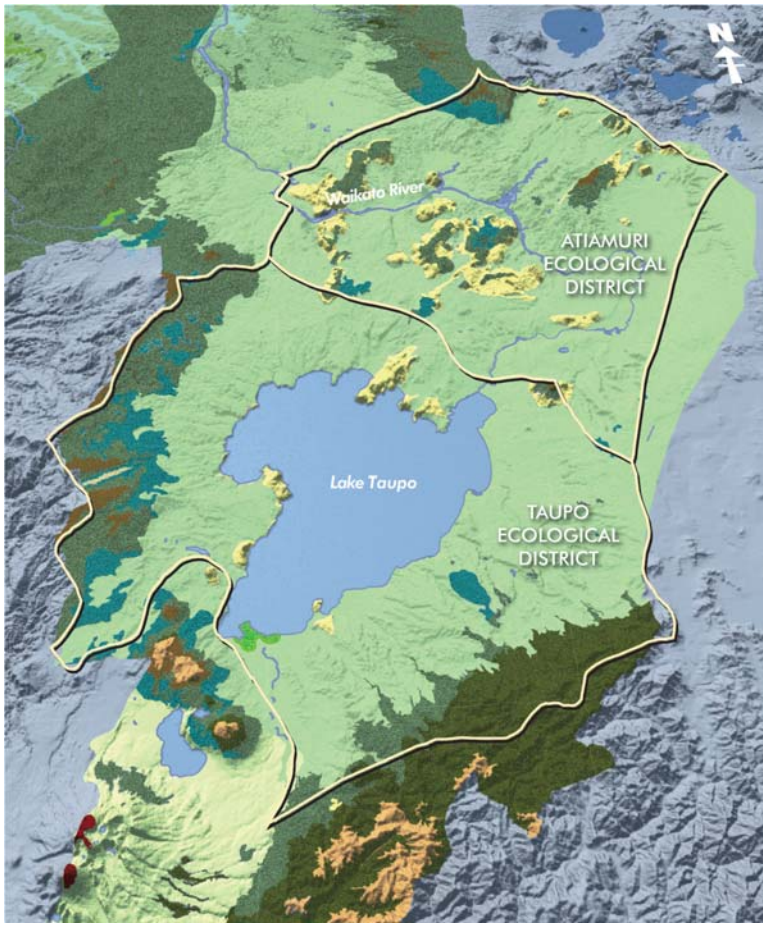
Over the past 150 years, clearance of land for forestry and agriculture further reduced the original forest cover. Only scattered original forest remnants remain today, mostly on higher altitude or steep inaccessible areas with most having been cut over for timber. As a result of efforts to protect Lake Taupo's water quality, approximately 11,000 hectares have been set aside as lakeside reserves and riparian corridors. These areas are now in regenerating scrub and young forest. However, in the Atiamuri ecological district very little indigenous vegetation remains, and the remnants are often small and degraded.

	Total land area (ha)	Portion of land area in native forest (%)	Portion of land area in all types of indigenous vegetation (%)
Taupo ecological district	203,520[2]	29	36
Atiamuri ecological district	222,420	4	7
Total central volcanic plateau	425,940	16	21

Taupo and Atiamuri ecological districts have some special plant communities.

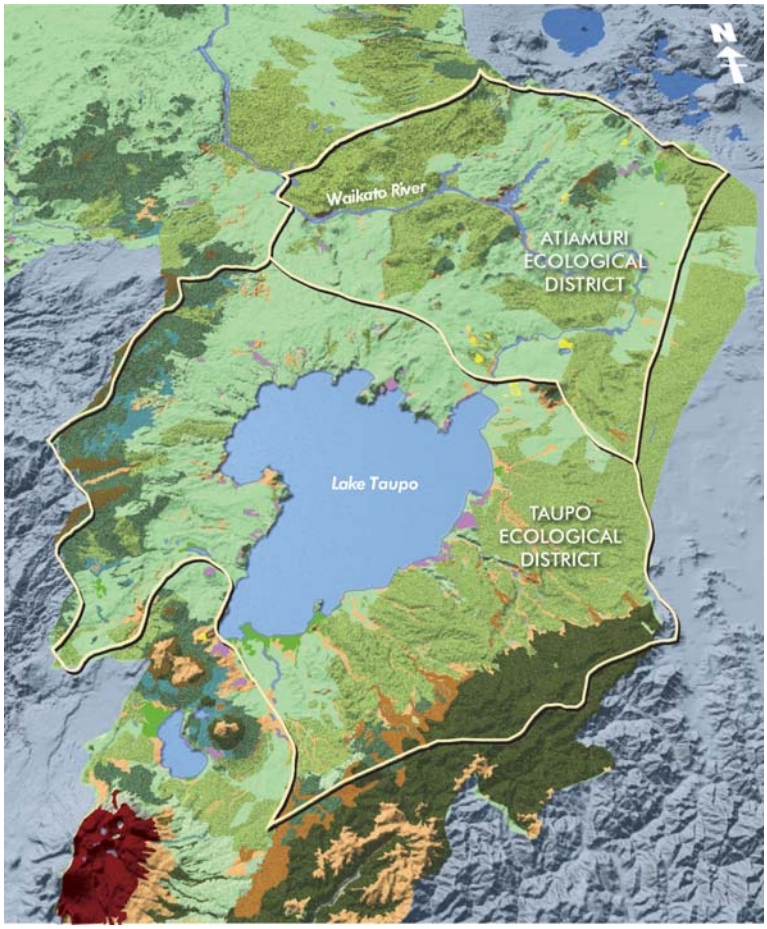
- The expanse of water in Lake Taupo creates a micro-climate enabling many 'coastal' species (about 20) to occur in a harsh inland situation. Species such as pohutukawa grow on or in close proximity (100 or so metres) to the lake shore where temperatures are milder and frosts rare.
- Black beech occurs in several small isolated stands on cliffs and steep ridges around Lake Taupo, on dry, infertile sites. It is thought that, along with red and silver beech, black beech may have rapidly colonised the raw pumice and ash soils after the catastrophic 186 AD eruption destroyed the existing forest cover, but the possibility exists that at least one of these stands, near Te Tawai Point, may be a remnant that remarkably survived the eruption. The rarity of black beech today is attributed to human-induced fires.
- Geothermal vegetation occurs as small steamy patches in a line from Turangi to White Island. Plants here are adapted to tolerate extremely high temperatures and unusual water and soil chemistry.

[2] Area excludes Lake Taupo (61,200 hectares).



Central Volcanic Plateau vegetation cover in 1840

- Beech forest
- Conifer forest
- Conifer - broadleaved forest
- Freshwater wetland
- Lava and debris flows
- Montane conifer - broadleaved forest
- Scrub / shrubland above treeline
- Secondary vegetation on domes
- Secondary vegetation on hill country (Lower Waikato)
- Secondary vegetation on plateaux
- Tongariro ringplain



Central Volcanic Plateau vegetation cover today

- Beech forest
- Conifer forest
- Conifer - broadleaved forest
- Conifer - broadleaved beech forest
- Exotic plantation
- Fernland
- Freshwater wetland
- Geothermal areas
- Lava and debris flows
- Montane conifer - broadleaved forest
- Pasture and general landuse

What is special about these ecological districts?

Special community projects

Lake Taupo at 61,300 hectares is the largest lake in New Zealand and a national treasure, renowned for its excellent water quality and clarity. However concerns have been raised recently about threats to this status.

Prior to deforestation, the densely forested catchment provided a natural filtration system as the water moved across the land flowing through the various wetlands, streams and waterways, eventually reaching Lake Taupo and moving on into the Waikato River as cool, clear water. Following forest clearance, land drainage, land use intensification and the spread of pest species, the natural filter has been disrupted.

The local community, concerned about the impacts of weed invasion, high nutrient levels and increased sedimentation on water quality, is taking action. There are currently over 14 environmental community groups active in the Taupo catchment, involved in voluntary activities such as education and advocacy, animal and plant pest control, fencing and planting, and recovery of threatened species. Local landcare, lakecare, wildlife management and other restoration groups all operate with a common theme of people working together to protect our environment.

Community projects

Taupo Lake Care

Taupo lake Care was formed in 2000 – to represent the farming community in restoration of water quality in the Lake Taupo catchment. Their focus is finding practical, sustainable management solutions to ensure the long-term water quality of Lake Taupo and the economic viability of land management and farming businesses.

Community work in progress.
More than12 environmental community groups are active in the Taupo and Atimauri districts.

Key activities:

- kamahi forest education about the economic, social and environmental impacts associated with non point source water discharges
- funding and facilitating research into sustainable arming practices and the economic impact of a 'nitrogen cap' on farming businesses
- developing workable solutions, such as 'cap and trade' regime, for managing nitrogen inputs in Lake Taupo
- maintenance of riparian waterway planting – over 80 per cent of the catchment's waterways are already retired and planted.

For more information, visit www.landcare.org.nz/action/groups and search on in the key word 'Taupo'.

Waimarino Wetland Restoration

Formed to restore a representative example of the variety of wetland types and associated species that occur within the South Taupo wetland.

Key activities:

- willow control through aerial spraying and hand control
- monitoring bird life
- some replanting including kahikatea.

Pukawa Wildlife Management Group
Formed to restore birdlife to the forests of Pukawa Bay on the south-western shores of Lake Taupo. This group recently received an award for their pest control initiative.

Key activities:
- animal pest control, with the guidance and support of DOC
- bird counts from December to February
- kamahi forest monitoring pest plants such as German ivy and cotoneaster for removal by pest plant contractors
- threatened plant restoration – placing white mistletoe (*Tupeia antarctica*) seedlings on trees.

For more information, visit www.landcare.org.nz/action/groups and type in key word 'Pukawa'.

Torepatutahi Landcare Group
Formed to assist DOC to manage the Torepatutahi Canyon in Reporoa – the headwaters of the Torepatutahi Stream, and an important landscape feature highly used by various outdoors groups.

If you are interested in getting involved with a community group contact Biodiversity Advice Waikato on 0800 BIODIV (0800 246 348) for a list of groups in your area or interest.

Key activities:
- re-vegetating the area for soil conservation
- enhancing access to the canyon
- restoring vegetation by planting local species such as koromiko, flax (*Phormium tenax*) and kohuhu.

For more information, visit www.landcare.org.nz/action/groups and search on the in key word 'Torepatutahi'.

Special native wildlife
Despite the paucity of native forest, particularly in Atiamuri ecological district, most forest remnants contain indigenous birds species which are generally rare or absent from similar sized remnants in the Waikato lowlands, including toutouwai (North Island robin), bellbird, whitehead, tomtit and karearea (New Zealand falcon). This is probably due to the large area of exotic forest surrounding the forest remnants, and forming linkages between native forests such as Pureora and Kaimanawa forest parks and the Paeroa range. Long-tailed bats are present and use both exotic and native forest areas. Reptiles include the common forest and Auckland green gecko and locally the rare speckled skink (*Oligosoma infrapunctatum*).

Lake Taupo, the Waikato River and its hydrolakes have numerous wetlands that adjoin them, and waterfowl and wetland birds are numerous, including nationally threatened and rare bird species such as dabchick, matuku (bittern), and matata (fernbird). Lake Taupo is the stronghold for waterfowl and contains large populations of grey teal, scaup and black swans. A small resident population of black billed gulls is present at geothermal Lake Rotokawa. Large numbers of four species of shags are present, with a nationally significant rookery on Motutaiko Island in Lake Taupo. The same island hosts a distinctive population of the common skink (*Leiolopisma nigriplantare*) and the nationally endangered land snail (*Wainuia clarkia*). The diversity of indigenous fish species is low with koaro, smelt, koura, bullies and native mussels probably being introduced by Maori and Europeans above Huka Falls. Tributaries to Lake Taupo provide habitat for the nationally endangered blue duck (whio).

White heron and royal spoonbill are occasional visitors and are most commonly seen at the Tongariro delta. North Island kaka (more commonly known as kereru) are present closer to larger forest parks. Small remnant North Island brown kiwi populations are known at a few sites though this species will likely become locally extinct in the near future unless protected from predators such as stoats.

Pest mammals, especially ship rats, are major predators of our native birds and are a real threat. Pest control is the best thing everyone can do to assist in providing a safe habitat for native birds.

Special plants

About 130 plant species native to the Waikato region are at risk of extinction. Planting threatened species will help ensure their survival. There are also a number of species of plants in the central volcanic plateau that are uncommon in the wider Waikato region.

The following table lists some threatened species or species which are not abundant that you may like to try establishing:

Maori/common names	Botanical name	Ecological district*	Plant type	Habitat	Status
Mountain wineberry	*Aristotelia fruticosa*	A	Shrub	Montane and frostflat scrub and shrubland.	
Leatherwood	*Brachyglottis elaeagnifolia*	T	Shrub	Montane scrub and forest margins.	
Kohurangi/ Kirk's daisy	*Brachyglottis kirkii var. kirkii*	A	Shrub	An epiphyte on trees in lowland and lower montane forest. Plant in areas free of deer, goats and possums.	Threatened species
Small-leaved tutu	*Coriaria kingiana*	T	Shrub	Montane scrub, stream sides.	
Mountain tutu	*Coriaria pteridoides*	T	Shrub	Montane scrub, stream sides.	
Nehenehe	*Epacris alpina*	A, T	Shrub	Frost flat shrubland.	
Prostrate snowberry	*Gaultheria macrostigma*	T	Shrub	Dry open grass/tussockland.	
	Helichrysum filicaule	A, T	Shrub	Dry open grass/tussockland.	
Niniao	*Helichrysum lanceolatum*	T	Shrub	Dry open scrub, shrubland and forest margins.	
Dwarf mistletoe	*Korthalsella salicornioides*	A, T	Shrub/ hemiparasite	Parasitic plant, locally common on manuka and kanuka.	Threatened species
Mida/willow leaved maire	*Mida salicifolia*	A, T	Small tree	Lowland forest.	Threatened species
Weeping mapou	*Myrsine divaricata*	T	Small tree	Lowland and montane forest, shrub and scrubland.	
Mountain beech	*Nothofagus solandri var. cliffortioides*	T	Tree	Montane forest.	
Black beech	*Nothofagus solandri var.solandri*	T	Tree	Lowland and montane dry ridges and spurs; river terraces.	
Hakeke/ mountain holly	*Olearia ilicifolia*	T	Shrub	Montane scrub and forest margins.	
Shrub daisy	*Olearia nummulariifolia*	T	Shrub	Montane scrub and shrubland.	
	Parahebe catarractae subsp. catarractae	T	Shrub	Damp, open streamsides.	
Turner's kohuhu	*Pittosporum turneri*	T	Small tree	Montane forest margins, streamsides and frost flats.	Threatened species
Manatu/ ribbonwood	*Plagianthus regius*	A	Small tree	Lowland forest – valleys and lower hillslopes.	Regionally uncommon
Raukawa	*Raukaua edgerleyi*	A, T	Small tree	Sub-montane/montane cloud forest/lowland forest.	Threatened species
Poroporo	*Solanum laciniatum*	A, T	Shrub	Lowland forest margins.	
Kowhai	*Sophora tetraptera*	A, T	Tree	Lowland and montane forest margins and streamsides.	Distinctive
White mistletoe	*Tupeia antarctica*	T	Shrub/ hemiparasite	Locally common around Lake Taupo.	Threatened species

*A = Atiamuri, T = Taupo

Threatened species have been identified with a symbol in the plant list on page 25. Some of these plants may be difficult to source, but nurseries may be able to provide them if given prior notice. It is important that these species are eco-sourced (seed collected from naturally occurring plants) from the local district. Some of these plants require specialist techniques for establishment, and some of them will only thrive in montane environments.

Do not remove threatened plants from the wild.

Black billed gull.
Photo: Department of Conservation.

Poroporo, *Solanum laciniatum*.

Planting guide

What should I plant?

In this guide we describe three separate zones, representing the different vegetation types that would have historically clothed the land. We also describe four special planting situations – wetlands, riparian zones, slips and geothermal sites.

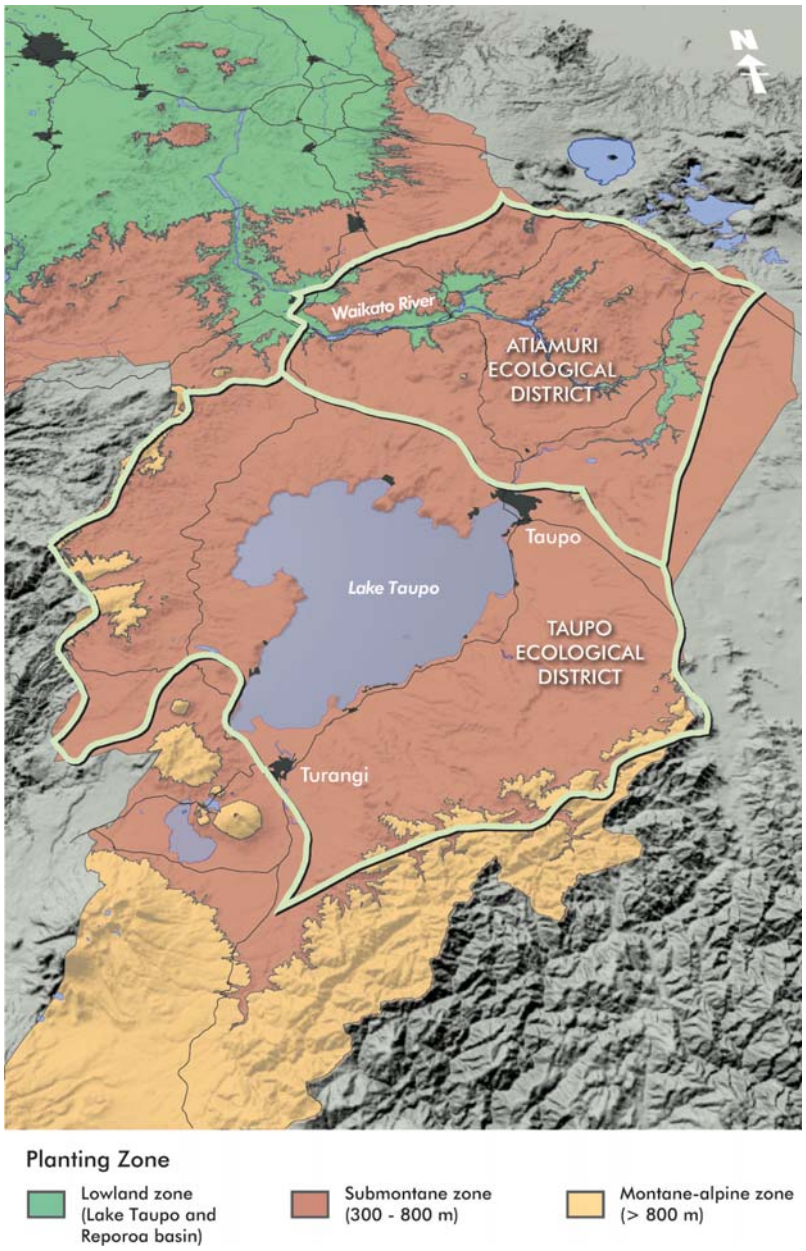
Use the map and zone descriptions on the following pages to find out which zone you are in.

A list of plants that are best suited to each zone, separated into planting sequences is included on pages 24-29. Refer to the plant list for trees, shrubs and climbers that grow naturally in the Atiamuri and Taupo ecological districts. Plant the species that grow in your ecological district.

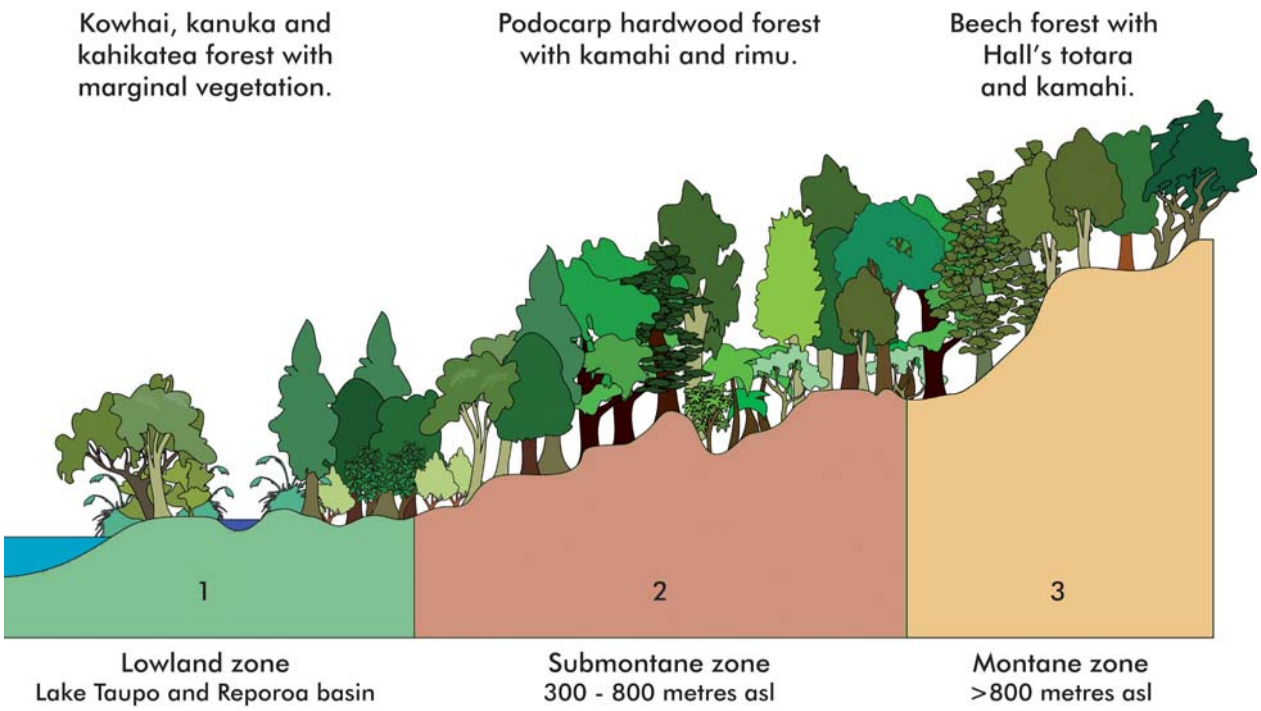
Some species listed in this guide may do well on some sites, but not on other sites in the district. Base your species selection on the local environment – look around your site and see what species are growing in natural areas nearby.

Understanding forest succession is very important when you plant trees. Plant communities change over time – the later stage species grow up in the shade and shelter of the first stage, or pioneer plants. This process culminates in a stable ecosystem condition known as climax.

For species to properly establish they need to be planted in the appropriate conditions at a suitable time. Natural succession can provide you with a framework to understand the appropriate stage at which to plant species. By mimicking natural succession, plant survival and growth is likely to be more successful. Species such as manuka are early stage plants and need to be planted in high light conditions and will establish a canopy cover. Other species such as pukatea need this cover as protection from conditions such as frost. The appropriate times at which to plant these species are listed in the species list under planting sequence. Once early stage plants (one in planting sequence) are established and some canopy cover is attained middle and late (two and three respectively in planting sequence) can be planted.



If you are unsure where your property is on this map you may need to consult a topographic map. Read the zone descriptions to also help determine which zone you are in.



Planting zones – plant the right species for your zone.

Zone 1 – Lowland zone – Lake Taupo and Reporoa Basin
Kowhai, kanuka, kohuhu and five-finger forest, akeake (within 100 m of lakeshore), *Cortaderia fulvida* on stream and lake margins. Lowland totara and kahikatea on basin deposits.

Zone 2 – Submontane zone – 300–800 m above sea level (asl)
River terraces, rolling hillcountry, high altitude plateaus. Totara or kahikatea forest with kanuka on the river terraces, red beech on gravel banks along the eastern side of Lake Taupo. Narrow gullies of tree fuchsia, mahoe, pate, putaputaweta and tree ferns. Slopes and ridges dominated by rimu and totara with understorey of kamahi, black maire, white maire, and hinau; tanekaha on very steep slopes, and black beech on dry, infertile ridges. Matai and Hall's totara forest with kamahi and broadleaf on flat plateaus.

Zone 3 – Montane zone – > 800 m above sea level (asl)
Red, silver and mountain beech, Hall's totara, with kamahi and scrub hardwoods on ridges/bluffs.

Plants to avoid

There are a number of popular native plants that do not naturally occur in the Taupo and Atiamuri ecological districts. We recommend you avoid planting these, particularly in restoration areas, as they could be a threat to the ecological integrity of the area. Some species may do exceedingly well and become weeds, eventually taking over your site. We also recommend avoiding the use of cultivars and nursery hybrids. These lack genetic diversity and do not occur naturally. Some examples of non-local native species are as follows:

- purple akeake, *Dodonea viscosa* var. *purpurea*
- *Olearia lineata*, also known as *Olearia virgata* var. *lineata* or *Olearia 'Dartonii'* – this form has longer, narrower leaves with down-rolled margins than the local plant *Olearia virgata*
- Kauri, *Agathis australis*
- Puriri, *Vitex lucens*
- Nikau, *Rhopalostylis sapida*
- five-finger, *Pseudopanax laetus*.

Some species may only occur in one of the two ecological districts in this guide. Refer to the plant list on pages 24-29 to see which species occur in your ecological district.

We do not include any non-native plants in this guide. While some exotic plants are popular food sources for native birds, they can also be problem weeds – for example hawthorn (*Crataegus* species), tree privet (*Ligustrum lucidum*), banksia and flowering cherry.

Where can I find quality plants?

You can grow your own plants, transplant self-seeded ones (not garden escapees) from areas where they are unwanted (such as under pine forests, or along fencelines), or buy them from a reputable native plant nursery. In addition to planting, you can try spreading seed or forest duff from a similar site into an existing stand to encourage regeneration. Check the seedlings for weed species like privet and climbing asparagus. Avoid collecting forest duff from weedy areas and forest edges.

Ask permission from the land owners before collecting seeds, plants or forest duff.

Following are some native plant nurseries that may have plants sourced from Taupo and Atiamuri ecological districts. Ask for eco-sourced plants – those collected from local naturally occurring native plants.

Local community nurseries

Contact Jan Hoverd on 0800 BIODIV (246 348) to find out if there are any community nurseries in your area.

Commercial nurseries

Naturally Native NZ Plants Ltd
30 Gamman Mill Road
Oropi
RD3, Tauranga
Phone: 0800 33 44 56

Taupo Native Plant Nursery
115 Centennial Drive
Taupo
Phone: (07) 378 5450

SmartPlants
401 Oparure Road
RD 5, Te Kuiti
Phone: (07) 878 7634

Treeline Native Nursery
17 Stewart Road
Kaharoa
Ngongotaha, Rotorua
Phone: (07) 332 3313

Where can I get more information on native plants?

The New Zealand Plant Conservation Network website has photos and descriptions of many native plants, along with notes on where to buy and how to grow them. For more information, visit www.nzpcn.org.nz.

The New Zealand Ecological Restoration Network has several tools to you help restore natural areas. Their 'planterguide' will help you select the best plant for your location, soil type and drainage, while 'plantgrow' has detailed information on how to propagate a large number of native plants. For more information, visit www.bush.org.nz.

See the factsheet 'Planting natives in the Waikato region' for more information on growing, collecting, buying, and planting native plants.

Special planting situations

Wetlands

Visit www.ew.govt.nz for the wetland planting guide, search on the keyword/s'wetland planting guide'.

The Wetland Planting Guide is a general guide for the whole of the Waikato region (administered by Environment Waikato). Many of the species listed are applicable to the Atiamuri and Taupo ecological districts, however the species listed below are not native to these two ecological districts and should not be planted here.

Don't plant:

- *Coprosma areolata*
- *Coprosma rotundifolia*
- *Empodisma minus*
- *Melicytus micranthus*
- *Syzygium maire.*

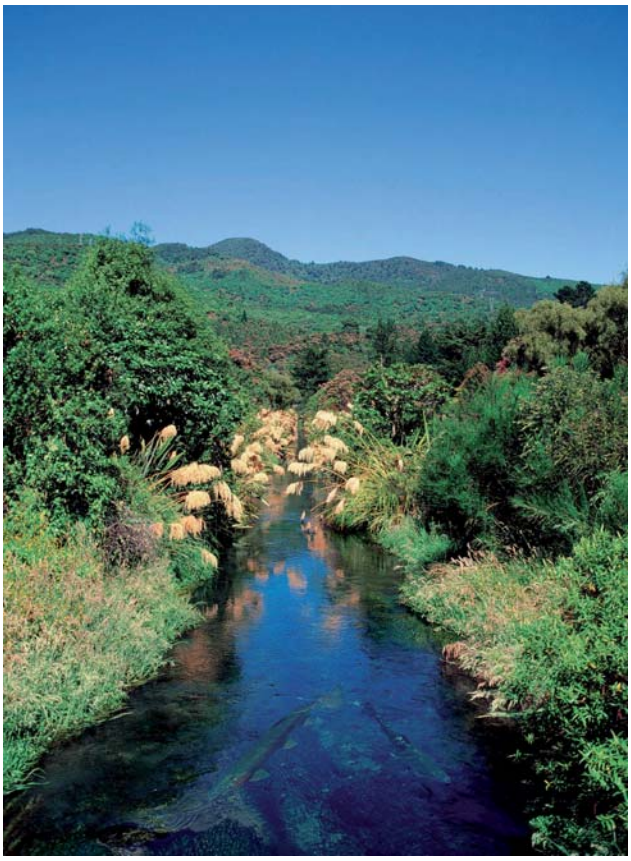
These species (not listed in Environment Waikato's Wetland Planting Guide) can also be planted in the central volcanic region.

Common name	Botanical name	Planting zone	Ecological district*
Standing water			
Small spike rush	*Eleocharis acuta*	Pools in swamps, stream and lake margins.	A, T
Boggy, temporary flooding			
Swamp kiokio	*Blechnum minus*	Swamps, and lake edges.	A, T
	Carex geminata	Lowland swamps.	A, T
	Carex sinclairii	Lowland to montane swamps and bogs.	A, T
	Juncus holoschoenus	Open swamp. Threatened species.	A
Twiggy tree daisy	*Olearia virgata*	Bogs, swamps and shrubland.	A, T
Swamp nettle	*Urtica linearifolia*	Plant in open areas among reeds and long grass. **Warning! Stinging nettle**, plant away from tracks and take care handling it.	A
Moist soils			
Native broom	*Carmichelia australis*	Lowland to montane swamps and streamsides.	A, T

*A = Atiamuri, T = Taupo

Streambanks, river terraces and riparian zones

Well-managed streambank margins are essential to protect our water quality. They assist by improving biodiversity, providing shade, food and habitat for freshwater life, filtering surface run-off, removing excess nutrients, reducing streambank erosion and preventing stock access.



Well managed stream bank margins protect waterways.

The first step is to fence the stream to keep stock off the banks and out of the water. Ensure the fence location is stable, not prone to flooding and provides enough width for desired planting (minimum 5 metres, though 10 metres will achieve a more sustainable piece of bush).

Plant species that can tolerate periodic flooding near the watercourse, including toetoe (*Cortaderia fulvida*), sedges such as *Carex virgata*, flax (*Phormium tenax*), cabbage tree and manuka.

On higher ground, tree and shrub species may be introduced. Plant species that can tolerate harsh climatic conditions first, such as manuka, *Pittosporum colensoi*, wineberry (in less frosty areas), cabbage tree, kohuhu, tarata koromiko, and tutu (poisonous, keep away from stock), with a few karamu, five-finger, lancewood, wheki and wheki ponga. In frosty areas plant wineberry after side shelter has been established. Some canopy species can also tolerate these conditions, for example kowhai (*Sophora tetraptera*), rewarewa, kahikatea, totara and matai.

Blackberry, buddleia and broom are common weedy colonisers and may need clearing or spraying first. On less stable slopes it may be better to create small clearings to plant with native trees among existing weeds, which will eventually get shaded out.

Bracken may also be abundant and is an important nurse crop in these districts, however natural regeneration through bracken can take many decades. If you wish to fast-track regeneration, clear gaps and plant trees and shrubs among the bracken.

Second and third stage planting on the higher ground to increase diversity in the short-term would include miro, hinau, rewarewa, rimu, tawa, tree fuchsia, mamaku, pate, kamahi, mahoe and putaputaweta. In restoration areas which are near existing bush patches, these species will often establish naturally quite quickly.

In damp areas such as seeps or swamps adjacent to the streambank, plants such as mikimiki (*Coprosma propinqua*), *Olearia virgata*, kahikatea and *Carex secta* are suitable.

For information on managing waterways visit www.ew.govt.nz and search on keywords 'Clean Streams' and/or 'Riparian Planting Guide'.

Stabilising slips and road cuttings

Land instability is a significant problem in the soft pumice land of these districts. Fencing erosion-prone areas to exclude stock, and planting with appropriate species will assist in stabilising soil.

Small plants like *Pimelea* can be helpful to stablise crumbly banks.

Plants suitable for restoration of slip faces tend to be those that are more tolerant of low fertility. On large slips plant smaller growing nurse species to achieve initial cover such as tutu (a valuable nitrogen fixer, though toxic to humans and stock), grasses and sedges such as native toetoe (*Cortaderia fulvida*) and *Gahnia pauciflora*, ferns including kiokio and silver fern, and small shrubs such as mingimingi, koromiko, manuka and tauhinu (*Pomaderris amoena*). Once cover is established and the slip has stabilised, tree species may be introduced such as *Olearia* species, kanuka, five-finger, rewarewa and kamahi.

Unstable steep slips and roadside cuttings may be best re-established by distributing seed of native plants onto the bare soil. This is best done as soon as possible to beat the weeds that may otherwise colonise the site. Small plants like kiokio, the sedges *Dianella nigra* and *Morelotia affinis*, and small shrubs like *Pimelea prostrata* and snowberry (*Gaultheria*) species are probably the best plants to establish on steep unstable road cuttings and slips.

Geothermal landscapes

Geothermal vegetation is a special feature of the Taupo and Atiamuri ecological districts with high conservation, tourism and scientific values.

Geothermal environment: rare heat-loving ferns at Orakeikorako.

Atiamuri ecological district has 558 hectares of geothermal vegetation on 38 sites, while Taupo ecological district has 27 hectares on five sites.

Some geothermal plants have physiological and genetic adaptations to tolerate an often extreme environment, with high soil temperatures and unusual soil chemistry. For instance, the characteristic prostrate kanuka, being unable to send roots deeply into super-heated ground, instead sprawls across the surface, forming a dense carpet-like canopy over steaming ground.

Many geothermal plant species are threatened with extinction, including prostrate kanuka and three fern species (*Dicranopteris linearis*, *Christella* sp. 'thermal' and *Cyclosorus interruptus*). These ferns are more common in other parts of the world, but the prostrate kanuka is endemic to geothermal areas in the central North Island.

Different types of geothermal vegetation occur in different habitats including:

- geothermal wetlands – hot swampy ground often indicated by the rare fern *Cyclosorus interruptus*
- steamy environments – on the edges of fumeroles and hot non-acidic streams which support frost-tender ferns that otherwise grow only in the tropics, such as *Christella* and the native ladder fern *Nephrolepis flexuosa*[3]
- heated ground – characterised by short, dense thickets of prostrate kanuka with other shrubs in cooler sites such as mingimingi and monoao (*Dracophyllum subulatum*)
- super-heated ground – where temperatures at 15 cm below ground exceed 60°C and are usually bare of vegetation other than mosses and lichens
- cool but geothermally altered ground – such as old sinter deposits and dried up mud pools that are usually bare of vegetation other than mosses and lichens and a few scattered shrubs and ferns.

Geothermal vegetation is now mainly threatened by weed invasion, particularly from trees like wilding pines that can shade out the shorter native plants.

Community groups or land owners wanting to help restore geothermal systems can assist by establishing a protective buffer zone on cool, safe ground around a geothermal area. Fencing and planting will protect the vegetation from stock and restrict the encroachment of weeds.

Removing pines, pampas, exotic broom and blackberry from surrounding areas will also help limit the spread of weeds. Plant selection needs to consider the degree of substrate alteration. If the soil is warm, but not hot at a depth of 15 cm, plant manuka, prostrate kanuka, and turutu. Mingimingi, prickly mingimingi, and monoao are also appropriate but are very difficult to source from plant nurseries.

Monoao is not easily grown in nursery conditions with current technology and is not generally available – the other two species are only available intermittently. In non-geothermal soil, plant fast-growing shrub species local to the area such as manuka, kanuka, karamu, five-finger, koromiko, cabbage tree, kohuhu and toetoe (*Cortaderia fulvida*), with some kamahi, mapou and lancewood.

Restoring geothermal systems requires specialist knowledge which is beyond the scope of this guide. In addition, these are extremely hazardous areas and should be enjoyed safely from public walkways. Contact Environment Waikato on 0800 800 401 for further information.

[3] Not to be confused with the tuber ladder fern, *Nephrolepis cordifolia*, a highly invasive garden weed distinguished by potato-like tubers on its underground runners.

Central volcanic plateau planting zones

Zone 1 – lowland zone

Reporoa Valley and east Lake Taupo (pumice alluvium derived soils).

Hardy species are important nurse plants.

This zone incorporates the gentler terrain of silty and sandy alluvial pumice sediments deposited by streams after the 186 AD eruption. It occurs west of the Kaingaroa Fault in the Reporoa Valley and on the eastern shores of Lake Taupo.

The landform ranges from low-lying wetlands of the Tongariro delta, to the gently rolling hill country and low pumice cliffs on the eastern lake shores, to the level plains bisected by the Waikato River near Broadlands. Pumice beds are typically deep (1-3 metres) but are unconsolidated and readily eroded, and tend to experience summer drought. Much of the area is currently in pine forest or recently converted to dairy farmland. Pockets of poorly drained peat occur in the Reporoa Basin where lakes once existed.

Around Lake Taupo a gentler microclimate exists with slightly milder temperatures due to the proximity of the large water body. The frequency of frost is less than in the surrounding areas, enabling the establishment of many species not otherwise commonly seen in the Taupo and Atiamuri ecological districts.

The indicator tree species for this zone is large-leaved kowhai, *Sophora tetraptera*. It commonly occurs around the perimeter of the lake and stream margins, and on river delta levees and islands. It is often found growing in association with five-finger and kanuka forest, an early successional forest type that provides a nurse cover for later podocarp forest establishment.

You may need to clear exotic colonisers including blackberry, broom, tree lupin and buddleia, or plant taller growing native species among them that will eventually overtop and shade out the exotics.

Generally, in most instances – manuka, karamu, koromiko, kohuhu and *Pittosporum colensoi* are the best nurse plants, along with some cabbage trees, toetoe (*Cortaderia fulvida*), harakeke (flax – *Phormium tenax*) and in places tutu and kanuka. Also where appropriate, kowhai, totara and rimu can be planted without established cover.

In frosty or drought-prone areas, or recently burned areas, start with the hardiest species like manuka and toetoe (*Cortaderia fulvida*), or even silver tussock to get some cover before planting longer-lived species.

On less frosty, moister, but relatively well-drained areas, such as undulating sites recently cleared of pine forest, plant manuka, koromiko, tutu, karamu, kapuka, lancewood and kohuhu for initial cover. However, often sites which have been recently cleared of pine forests can be managed back to indigenous cover, with a combination of weed control of selected species and carefully considered planting as required.

Frost-hardy and light-tolerant podocarps like kahikatea and totara, with lesser amounts of lancewood, can be introduced in the early stage of planting in this zone.

In wet areas use manuka, cabbage tree, toetoe (*Cortaderia fulvida*) and flax (*Phormium tenax*) to provide initial shelter.

1a) Lake margin, cliffs and ridges

Plant kanuka and large-leaved kowhai, along with cabbage tree, five-finger, akeake (close to the lake), karamu, kohuhu and toetoe (*Cortaderia fulvida*), with lesser amounts of wheki and mahoe.

Plant tanekaha, large-leaved kowhai, akeake, kanuka, black beech, red beech and later kamahi on rocky outcrops.

1b) River terraces

River terraces and large gravelly islands can be planted directly with a mixture of kanuka, large-leaved kowhai, harakeke (flax; *Phormium tenax*), kohuhu, karamu, tree fuchsia, lowland ribbonwood and red beech, and podocarps such as lowland totara, matai and kahikatea, and small amounts of five-finger once cover has established. Plant native toetoe (*Cortaderia fulvida*), kiokio fern and koromiko along the forest and water edge.

1c) Flatter terrain and flood plains

On deep pumice in relatively well-drained sites, plant a nurse cover of manuka and *Pittosporum colensoi*, with lowland totara. Once cover is established then matai, black maire, pokaka, turepo, kaikomako, ribbonwood and *Coprosma* species can be planted. In wetter areas, harakeke (flax; *Phormium tenax*), kahikatea, manuka, toetoe (*Cortaderia fulvida*) and cabbage trees can be planted. Later understorey shrubs include mahoe and pate with wheki.

1e) Gullies and side slopes

On moist, frost-free side slopes plant manuka, koromiko, *Pittosporum colensoi*, wineberry, cabbage tree and tree fuchsia with occasional five-finger, rimu and putaputaweta. Once cover has been established interplant with kamahi, hinau, mahoe, rewarewa, rangiora, shining karamu and kanono. In the darker gully bottoms, plant abundant mahoe and, when the site is sheltered by a good nurse crop, plant pate and kanono.

1f) Stream banks

See page 16 for tips on planting stream banks.

1g) Specimen trees and garden plants

If you don't wish to replant an area of forest, consider the following plants to help enrich this zone. Use them in your garden or in fenced off streamside areas, shelterbelts or for stock shade. Check the planting guide on pages 24-29 to ensure which species are appropriate for your ecological district.

For further information refer to Environment Waikato's 'Trees On Farms' – available from our website www.ew.govt.nz/enviroinfo/land/treesonfarms.htm.

Large trees	Small trees	Shrubs	Other plants
Kahikatea	Large-leaved kowhai	Manuka	Toetoe (*Cortaderia fulvida*)
Lowland totara	*Pittosporum colensoi*	Shining karamu	Harakeke (flax; *Phormium tenax*)
Matai	Cabbage tree	Koromiko	
Red beech	Tree fuchsia	Wheki	
Pokaka	Kanuka		
Black maire	Kohuhu		
Rimu	Five-finger		
Lowland ribbonwood			

See the plant list on pages 24-29 for more species to plant in this zone.

Zone 2 – submontane zone

Rolling hill country and moderately high altitude plateaus (300-800 metres).

This is the largest zone in the Taupo and Atiamuri ecological districts. It excludes the steeplands and high altitude areas above 800 metres in the Hauhungaroa and Kaimanawa ranges, and the pumice alluvial sediments east of Taupo and alongside the Waikato River through Broadlands.

The land form is generally rolling and very steep sided hill country, to high elevation plateaus. The soil of Taupo pumice gravels and sand is of low natural fertility. It occurs in thick beds on areas of flat to gently sloping topography, but is thinner on steeper terrain.

Submontane native forest on the margins of the Tauranga Taupo River, adjacent to an exotic pine plantation (top of photo).

The dominant geology is readily eroded breccia on the Kaimanawa foothills, erosion-resistant welded ignimbrites on the western side of Lake Taupo, with scattered rhyolite lava domes mainly in the north. It also includes the Paeroa Range (a tilted Pliocene ignimbrite block) and Horohoro bluffs.

The indicator species for this zone are kamahi, with rimu on the ridges and slopes and matai on the terraces.

In most situations in these disticts, you will need some cover of manuka, tussock, or in warmer sites bracken to provide shelter for other species to be introduced. This initial phase may take several years to establish. Regeneration in areas currently in pasture is likely to be faster, if initiated around rock outcrops that will provide shelter and moisture to establishing plants.

2a) Plateaus

Early colonising plants appropriate for planting in frosty areas are silver tussock (*Poa cita*), manuka and tutu. Later, plant shrubs including five-finger, kamahi, rewarewa, tarata, kapuka, tree fuchsia, wineberry, mapou, toro and lancewood. Interplant with scattered matai, Hall's totara and occasional miro. When cover is established include occasional pokaka, black maire and white maire.

2b) Frost flats/hollows

In high depressions where cold air accumulates and frosts are harsh, plant a cover of heath shrubs including manuka, among abundant silver tussock. Later interplant with divaricating shrubs *Coprosma propinqua*, *Coprosma tayloriae*, *Olearia virgata*, dwarf mingimingi, *Myrsine divaricata*, *Corokia cotoneaster*, *Pittosporum turnerii*, mountain wineberry, mountain toatoa, koromiko and the native daisy *Celmisia gracilenta*. When cover is dense add *Raukaua anomalus*.

2c) Ridges and spurs

Plant mostly small or tough-leaved plants like rimu, hinau, toro, Hall's totara, akepiro, *Gahnia pauciflora*, kapuka, dwarf mingimingi, mountain horopito and rohutu. Uncommon species such as black beech, *Coprosma foetidissima* and mountain holly (*Olearia ilicifolia*) can be planted under a nurse crop of manuka, karamu and koromiko. Add tanekaha in the Atiamuri ecological district and on the north-western side of Lake Taupo.

2d) Slopes

Slopes should eventually have an emergent layer of scattered rimu, matai and totara, and occasional (in Atiamuri ecological district only) northern rata with a dense understorey canopy of mostly kamahi and silver fern on upper slopes, five-finger, *Pittosporum colensoi*, kohuhu, rewarewa, and on the more fertile lower slopes mahoe, mamaku, katote, lancewood, broadleaf, hinau and pokaka.

Plant manuka and hardy shrubs including koromiko and karamu, first to provide cover before interplanting with the more frost-sensitive species.

2e) Gullies

Narrow gullies should have occasional matai and kahikatea, with abundant mahoe, putaputaweta, wineberry, pate, wheki, mamaku, silver fern, pigeonwood and a thick ground cover of ferns commonly kiokio. Plant tree fuchsia in well lit areas along streambanks. Plant hardy shrubs such as manuka and karamu to create a nurse cover before introducing frost-tender species like pate.

2f) Bush edges

Plant bushy light-tolerant shrub species including manuka, koromiko, five-finger (whauwhaupaku), rangiora, karamu, wineberry, cabbage tree and forest cabbage tree.

2g) Streambanks

For information on managing waterways visit www.ew.govt.nz and search on keywords 'Clean Streams' and/or 'Riparian Planting Guide'.

2h) Specimen trees and garden plants

If you don't wish to replant an area of forest, consider the following plants to help enrich this zone. Use them in your garden or in fenced off streamside areas, shelterbelts and for stock shade. Check the planting guide on pages 24-29 to ensure this species is appropriate for your ecological district.

For further information refer to Environment Waikato's 'Trees On Farms' available from our website www.ew.govt.nz/enviroinfo/land/treesonfarms.htm.

Large trees	Small trees	Shrubs	Other plants
Tanekaha	Kamahi	Kapuka	*Macherina*
Rimu	Mahoe	Mingimingi	*Haloragis*
Totara	Putaputaweta	Five-finger	NZ jasmine
Rewarewa	Lancewood	Bush snowberry	NZ clematis
Miro	Kanuka	Tauhinu	Toetoe (*Cortaderia fulvida*)
Northern rata	Kohuhu	Manuka	Pinatoro
Red beech			Kakaha
Hinau			Silver fern
			Parahebe

Zone 3 – montane zone

Mountain ranges and high ridge tops (> 800 metres).

This zone is largely confined to the high elevation areas above 800 metres on the Hauhungaroa and Kaimanawa ranges, dropping to lower elevations in frosty gullies. It also includes the tops of the Horohoro and Paeroa ranges in Atiamuri ecological district. The cooler temperatures and steeper slopes favour beech species over podocarps, which are prominent mainly on the broad ridge tops where Hall's totara and miro occur.

Because this zone is almost all in reserves and fully covered in native vegetation, there are no planting hints, but typical species are included in the plant list on pages 24-29.

Forest types that characterise this zone are as follows.

- Montane conifer-broadleaf forest on the broad high ridges on the Hauhungaroa Range west of Lake Taupo and the Paeroa Range and Horohoro Bluffs in Atiamuri. The vegetation consists of a dense low forest of kamahi, tawheowheo, kapuka (*Griselinia littoralis*) and other hardwood shrubs with scattered emergent Hall's totara, mountain toatoa and stunted miro.
- Rimu-broadleaved-beech forest at the lower elevations, comprising scattered rimu, miro, matai and/or Hall's totara emergent over a canopy of red and/or silver beech with abundant kamahi. Mainly occurs on the foothills of the Kaimanawa Ranges, with lesser amounts on the Hauhungaroa Range.
- Conifer-broadleaved-beech forest comprising scattered emergent miro and Hall's totara over a canopy of either pure red beech, or red and silver beech, with kapuka and kamahi on the lower steep slopes of the Kaimanawa Ranges, at about 800 metres, above the altitudinal limits of rimu.
- Beech forest at higher elevations on the Kaimanawa Ranges dominated by either pure or mixed stands of red and silver beech with occasional Hall's totara, kamahi and kapuka at the lower elevations, and mountain beech at higher altitudes. Kaikawaka and mountain toatoa occur in boggy areas.

Plant list for Taupo and Atiamuri ecological districts

Use the ecological district and planting zone maps (on page 12) and descriptions to find out which colour zone your property is in. Look for plants with your zone colour and check they are in your ecological district. Plant in proportions indicated on your zone band for each species. For example, plant mostly species with 'most', use species labelled 'common' generously, use 'few' plants sparingly and only plant a few scattered plants with 'least'.

This is a detailed, but not comprehensive, list of species that grow naturally in the area, and some may be difficult to source.

The harsh climate of the Taupo and Atiamuri districts, with heavy spring frosts and summer droughts (particularly in areas of pumice soil), can make establishment of native plant material difficult. Because of this we recommend a three stage planting as outlined below.

Are you planting into a bare area exposed to frost, wind, or sun?	➔	Go to list 1 page 25	Plant dense clumps of trees, shrubs and grasses to provide shelter and shade out weeds.
Are you planting in a sheltered, frost-free area, or among existing plants, including trees you might have planted more than three years ago?	➔	Go to list 2 page 27	You can also plant species from list 1 in this situation, although they may grow more slowly in the shade.
Are you planting underneath an existing area of forest, or under trees you planted 10 or more years ago that now form an overhead canopy?	➔	Go to list 3 page 29	You can also plant most of the species in list 1 and 2 under existing canopy (except plants like manuka and kanuka that need high light levels). Plants in lists 1 and 2 will probably grow better where the light levels are higher, for example, near bush edges and in canopy gaps. This list includes plants that are epiphytes that should be grown on existing trees. Note that many ferns may turn up on their own.

First stage planting usually involves short-lived species that can handle high light situations and form a 'nurse cover', such as manuka, kohuhu, *Pittosporum colensoi*, koromiko, kowhai, kanuka, cabbage tree and toetoe (*Cortaderia fulvida*). As shelter and a thin canopy cover is achieved (3-10 years) planting of longer term and some future canopy species such as kamahi, mahoe and putaputaweta can be undertaken.

Third stage is often after 10 or more years, when a semi-established tree cover is achieved. Sensitive species that can tolerate higher levels of shade can then be introduced, such as pate, toropapa, hinau and many fern species. This zone also includes epiphytes, including some like climbing rata that require high light levels and should be attached to existing tree limbs in light wells.

It is important that second and third stage planting is carried out for the long-term success of your project. Failure to do so could result in establishment of dominant weed species as first stage planting matures and collapses. If enough tall canopy species are included in the first stage plantings, for example kahikatea, totara, rimu, kanuka, kowhai, collapse can be avoided.

Symbols used in species lists

Zones

L - Least
F - Few
C - Common
M - Most

Topographic position

Crest or ridge
Slope
Gully or foot of slope

Drainage

Tolerates poor drainage

Frost

Tolerates frost

Growth rate

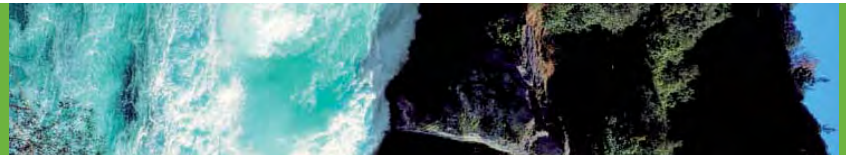
▲▲▲ Fast
▲▲ Medium
▲ Slow

Notes

Potentially difficult to source
Essential to source locally (eco-source)
All parts are poisonous
T Threatened plant
Attracts wildlife/birds

1. Plant in the open (Years 1-3)

Maori/common name	Botanical name	Atiamuri ecological district	Taupo ecological district	Zones			Plant type	Topo position	Drainage	Frost	Growth rate	Notes
				Lowland	Submontane	Montane						
Akeake	*Dodonea viscosa*		✓	L	L		Small tree				▲▲▲	
Bush snowberry	*Gaultheria antipoda*	✓	✓		L	L	Shrub			❄	▲	
Creeping pohuehue	*Muehlenbeckia axillaris*	✓	✓	L	L	L	Shrub				▲▲	
Dainty daisy	*Celmisia gracilenta*	✓	✓		L	L	Herb				▲	
Hall's totara	*Podocarpus hallii*	✓	✓		F	C	Tree			❄	▲	
Harakeke/NZ flax	*Phormium tenax*	✓	✓	F	F	F	Mono herb			❄	▲▲	
Holy grass/kaaretu	*Hierochloe redolens*	✓	✓		L		Grass			❄	▲▲	
Horoeka/lancewood	*Pseudopanax crassifolius*	✓	✓		F	F	Small tree				▲	
Kahikatea/white pine	*Dacrycarpus dacrydioides*	✓	✓	L	L		Tree				▲▲	
Kanuka	*Kunzea ericoides*	✓	✓	M	M	C	Tree			❄	▲▲▲	
Kiokio	*Blechnum novae-zelandiae*	✓	✓	L	L		Fern				▲▲	
Kohuhu	*Pittosporum tenuifolium*	✓	✓	C	C	F	Small tree				▲▲▲	
Korokio	*Corokia cotoneaster*	✓	✓		F		Shrub			❄	▲▲	
Koromiko	*Hebe stricta*	✓	✓	C	C	F	Shrub				▲▲▲	
Kowhai	*Sophora tetraptera*	✓	✓	M	F		Tree			❄	▲▲	
Manatu/ribbonwood	*Plagianthus regius*	✓	✓		F		Tree			❄	▲▲▲	
Manuka	*Leptospermum scoparium*	✓	✓	M	M	C	Small tree			❄	▲▲▲	
Mapou	*Myrsine australis*	✓	✓	C	C	F	Small tree				▲▲▲	
Marble leaf/putaputaweta	*Carpodetus serratus*	✓	✓	C	C	F	Small tree				▲▲	



Matai	*Prumnopitys taxifolia*	✓	✓	F	C	L	Tree			❄	▲	
Maukoro	*Carmichaelia australis*	✓	✓	L	L		Shrub			❄	▲▲	
Mikimiki	*Coprosma propinqua*	✓	✓	F	F	F	Shrub		≈	❄	▲▲	
Mingimingi	*Leucopogon fasciculatus*	✓	✓	L	L	C	Shrub				▲▲	
Miro	*Prumnopitys ferruginea*	✓	✓	L	F	F	Tree				▲	
Monoao	*Dracophyllum subulatum*	✓	✓		L	L	Shrub			❄	▲	
Mountain toatoa	*Phyllocladus alpinus*	✓	✓			L	Small tree			❄	▲▲	
Mountain tutu	*Coriaria pteridoides*		✓		F	F	Shrub			❄	▲▲▲	
Nehenehe	*Epacris alpina*	✓	✓			L	Shrub			❄	▲	
Nihinihi/shore bindweed	*Calystegia soldanella*		✓	F			Scrambler				▲▲▲	
Niniao/everlasting daisy	*Helichrysum filicaule*	✓	✓		L	L	Low ground cover			❄	▲▲	
Pinatoro	*Pimelea prostrata*	✓	✓			F	Shrub				▲▲▲	
Pohuehue	Muehlenbeckia complexa	✓			L		Liane			❄	▲▲▲	
Pohutukawa	*Metrosideros excelsa*		✓	F			Tree				▲▲▲	
Prickly shield fern	*Polystichum vestitum*	✓	✓			L	Fern			❄	▲▲▲	
Prostrate snowberry	*Gaultheria macrostigma*		✓			L	Shrub			❄	▲	
Rimu	*Dacrydium cupressinum*	✓	✓	C	C	F	Tree				▲▲	
Sedge	*Morelotia affinis*	✓	✓		L		Sedge				▲▲	
Silver tussock	*Poa cita*	✓	✓		L	L	Grass			❄	▲▲▲	
Small-leaved tutu	*Coriaria kingiana*		✓			C	Shrub			❄	▲▲▲	
Snowberry	*Gaultheria depressa*		✓			L	Shrub			❄	▲	
Snowberry	*Gaultheria oppositifolia*	✓	✓			L	Shrub			❄	▲	
Snowberry	*Gaultheria paniculata*	✓	✓			L	Shrub			❄	▲	
Tanekaha/celery pine	*Phyllocladus trichomanoides*	✓	✓		C	F	Tree				▲▲	
Tarata/lemonwood	*Pittosporum eugenioides*	✓	✓	F	F	L	Tree				▲▲▲	
Tauhinu	*Pomaderris ericifolia*	✓	✓		L		Shrub			❄	▲▲	T
Ti kouka/cabbage tree	*Cordyline australis*	✓	✓	C	F	L	Tree		≈		▲▲▲	
Toetoe	*Cortaderia fulvida*	✓	✓	C	C	F	Grass		≈	❄	▲▲▲	
Toi/mountain cabbage tree	*Cordyline indivisa*	✓	✓			L	Sm tree			❄	▲	
Totara	*Podocarpus totara*	✓	✓	L	F	L	Tree			❄	▲▲	T
Tree daisy	*Olearia virgata*	✓	✓	F	C		Tree		≈	❄	▲▲▲	
Turner's kohuhu	*Pittosporum turnerii*		✓		L	L	Small tree			❄	▲	T

Tutu	*Coriaria arborea*	✓	✓	C	M	C	Shrub			❄	▲	
Weeping mapou	*Myrsine divaricata*		✓		L	F	Shrub			❄	▲	
Whararikí/mountain flax	*Phormium cookianum*	✓	✓	F	F		Mono herb			❄	▲▲	
Wheki ponga	*Dicksonia fibrosa*	✓	✓	L	F	L	Tree fern		≈	❄	▲	
	Coprosma tayloriae	✓	✓		L	L	Shrub		≈	❄	▲▲	
	Pittosporum colensoi	✓	✓	C	C	F	Small tree				▲▲▲	

Symbols used in species lists

Zones

L - Least
F - Few
C - Common
M - Most

Topographic position

Crest or ridge
Slope
Gully or foot of slope

Drainage

≈ Tolerates poor drainage

Frost

❄ Tolerates frost

Growth rate

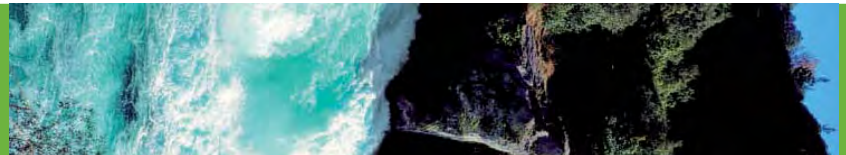
▲▲▲ Fast
▲▲ Medium
▲ Slow

Notes

Potentially difficult to source
Essential to source locally (eco-source)
All parts are poisonous
T Threatened plant
Attracts wildlife/birds

2. Plant in sheltered areas or among existing plants (years 3 – 10)

Maori/common name	*Botanical name*	Atiamuri ecological district	Taupo ecological district	Zones			Plant type	Topo position	Drainage	Frost	Growth rate	Notes
				Lowland	Submontane	Montane						
Black beech	*Nothofagus solandri*		✓	F	F	F	Tree			❄	▲▲▲	
Black maire	*Nestegis cunninghamii*	✓	✓	F	L	F	Tree				▲	
Bog mingimingi	*Androstoma empetrifolia*	✓	✓		L	L	Shrub		≈	❄	▲▲	
Clematis	*Clematis forsteri*	✓	✓	L	L	L	Liane				▲	
Clematis	*Clematis quadribracteolata*	✓	✓			L	Liane				▲	
Clematis/puawananga	*Clematis paniculata*	✓	✓	L	L	L	Liane				▲	
Forest cabbage tree	*Cordyline banksii*	✓	✓		F	L	Small tree				▲▲	
Glossy tree daisy	*Olearia arborescens*	✓	✓		L	L	Shrub				▲▲	
Haumakoroa	*Raukaua simplex*	✓	✓		L	L	Shrub				▲▲	
Kaikomako	*Pennantia corymbosa*	✓	✓	L	F		Tree		≈		▲▲▲	
Kamahi	*Weinmannia racemosa*	✓	✓	F	F	F	Tree				▲	
Kanono	*Coprosma grandifolia*	✓	✓	F	F	L	Shrub				▲▲▲	



Kapuka/broadleaf	*Griselinia littoralis*	✓	✓	F	C	M	Tree				▲▲▲	
Karamu	*Coprosma lucida*	✓	✓	F	F	F	Small tree				▲▲	
Karamu	*Coprosma robusta*	✓	✓	C	C	F	Shrub				▲▲▲	
Katote/soft tree fern	*Cyathea smithii*	✓	✓	F	C	F	Tree fern				▲	
Kotukutuku/tree fuchsia	*Fuchsia excorticata*	✓	✓	F	F	F	Small tree				▲▲▲	
Leatherwood	*Brachyglottis elaeagnifolia*		✓			L	Shrub			❄	▲	
Lowland horopito	*Pseudowintera axillaris*	✓			F		Shrub				▲▲	
Mahoe/whiteywood	*Melicytus ramiflorus*	✓	✓	C	C	F	Small tree				▲▲▲	
Mountain beech	*Nothofagus solandri var. cliffortioides*		✓			C	Tree			❄	▲▲▲	
Mountain five finger	*Pseudopanax colensoi*	✓	✓		L	F	Small tree				▲▲	
Mountain holly	*Olearia ilicifolia*	✓	✓		F	F	Small tree				▲	
Mountain horopito	*Pseudowintera colorata*	✓	✓		F	F	Shrub				▲▲	
Mountain wineberry	*Aristotelia fruticosa*	✓	✓		L	L	Shrub			❄	▲▲	
Narrow-leaved mahoe	*Melicytus lanceolatus*	✓	✓		F	C	Small tree				▲▲	
Northern rata	*Metrosideros robusta*	✓			F		Tree				▲	
Ongaonga/tree nettle	*Urtica ferox*	✓			L		Shrub				▲▲▲	
Pokaka	*Elaeocarpus hookerianus*	✓	✓	F	L	F	Tree		≈		▲	
Ponga/silver tree fern	*Cyathea dealbata*	✓	✓		F	F	Tree fern				▲▲	
Porokaiwhiri/pigeonwood	*Hedycarya arborea*	✓	✓		F	L	Small tree				▲▲	
Poroporo	*Solanum aviculare*	✓	✓	F	F		Shrub				▲▲▲	
Poroporo	*Solanum laciniatum*	✓	✓	F	F		Shrub				▲▲▲	
Prickly mingimingi	*Leptecophylla juniperina*	✓	✓	L	L	F	Shrub				▲	
Rangiora	*Brachyglottis repanda*	✓	✓	F	F	L	Shrub				▲▲▲	
Red beech	*Nothofagus fusca*	✓	✓	F	F	C	Tree				▲▲▲	
Red fruited karamu	*Coprosma rhamnoides*	✓	✓	L	L	L	Shrub				▲▲	
Rewarewa	*Knightia excelsa*	✓	✓	C	C	F	Tree				▲▲▲	
Rohutu	*Neomyrtus pedunculata*	✓	✓		F	L	Shrub		≈		▲	
Silver beech	*Nothofagus menziesii*		✓	F	F	C	Tree				▲▲▲	
Stinkwood	*Coprosma foetidissima*	✓	✓		L	L	Shrub				▲▲	
Tawheowheo	*Quintinia serrata*	✓	✓		F	F	Small tree				▲▲	
Toro	*Myrsine salicina*	✓	✓	F	L	L	Tree				▲	
Toru	*Toronia toru*	✓	✓		F	L	Tree				▲▲	
Turepo/milk tree	*Streblus heterophyllus*	✓			F		Tree				▲▲	

Turutu/blueberry	*Dianella nigra*	✓	✓	L	L	L	Mono herb				▲▲	
Wavy leaved coprosma	*Coprosma tenuifolia*	✓	✓			F	Shrub				▲▲	
Whauwhaupaku/five finger	*Pseudopanax arboreus*	✓	✓	C	C		Small tree				▲▲▲	
Wheki/rough tree fern	*Dicksonia squarrosa*	✓	✓	L	F	L	Tree fern				▲▲	
Wineberry/makomako	*Aristotelia serrata*	✓	✓	F	C	L	Small tree				▲▲▲	
	Coprosma colensoi	✓			L	L	Shrub				▲▲	
	Coprosma rigida	✓	✓	L	L		Shrub		≈		▲▲	
	Dracophyllum strictum	✓	✓		L	L	Shrub			❄	▲	
	Pentachondra pumila		✓		L	L	Shrub		≈	❄	▲	
	Raukaua anomalus	✓	✓		L	L	Shrub				▲	

Symbols used in species lists

Zones

L - Least
F - Few
C - Common
M - Most

Topographic position

Crest or ridge
Slope
Gully or foot of slope

Drainage

≈ Tolerates poor drainage

Frost

❄ Tolerates frost

Growth rate

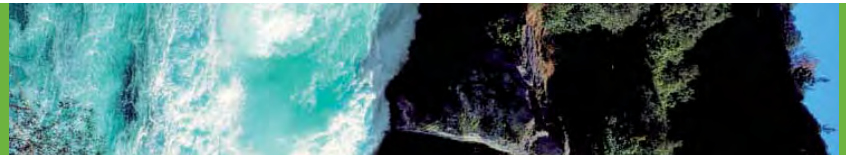
▲▲▲ Fast
▲▲ Medium
▲ Slow

Notes

Potentially difficult to source
Essential to source locally (eco-source)
All parts are poisonous
T Threatened plant
Attracts wildlife/birds

3. Plant in existing bush areas or under dense canopy (years 10+)

Maori/common name	*Botanical name*	Atiamuri ecological district	Taupo ecological district	Zones			Plant type	Topo position	Drainage	Frost	Growth rate	Notes
				Lowland	Submontane	Montane						
Akatea/small leaved white rata	*Metrosideros perforata*	✓			L	L	Liane/Shrub				▲	
Akepiro	*Olearia furfuracea*	✓			L	L	Small tree				▲▲	
Bush lawyer	*Rubus cissoides*	✓	✓	L	L	L	Liane				▲▲	
Bush lawyer	*Rubus schmidelioides*	✓	✓		L		Liane			❄	▲▲	
Crown fern/petipeti	*Blechnum discolor*	✓	✓		L	L	Fern				▲▲	
Dwarf mingimingi, Patotara	*Leucopogon fraseri*	✓	✓		L	L	Shrub				▲	
Hangehange	*Geniostoma rupestre*	✓	✓	L	L	L	Shrub				▲▲	
Heketara/forest tree daisy	*Olearia rani*	✓	✓	F	F	L	Small tree				▲▲	



Heruheru/single crape fern	*Leptopteris hymenophylloides*	✓	✓		L	L	Fern				▲▲	
Hinau	*Elaeocarpus dentatus*	✓	✓		L	L	Tree				▲▲	
Huruhuru whenua	*Asplenium oblongifolium*	✓	✓	L	L		Fern				▲▲	
Kahakaha/perching lily	*Collospermum hastatum*	✓	✓	L	L	L	Mono herb				▲	
Kaiwhiria	*Parsonsia heterophylla*	✓			L	L	Liane				▲	
Kakaha/fragrant lily	*Astelia fragrans*	✓	✓	L	L	L	Mono herb				▲	
Kiwakiwa/creek fern	*Blechnum fluviatile*	✓	✓	L	L		Fern				▲▲	
Kohia/New Zealand passionfruit	*Passiflora tetrandra*	✓		L	L		Liane				▲▲	
Kohurangi	*Brachyglottis kirkii var. kirkii*	✓			F		Shrub/Epiphyte				▲	T
Korokio/mountain hard fern	*Blechnum vulcanicum*	✓	✓	L	L	L	Fern				▲▲	
Kowharawhara/perching lily	*Astelia solandri*	✓	✓	L	L	L	Mono herb				▲	
Mamaku/black ponga	*Cyathea medullaris*	✓	✓		F		Tree fern				▲▲	
Manamana/hen and chicken fern	*Asplenium bulbiferum*	✓	✓	L	L		Fern				▲▲	
Mangeao	*Litsea calicaris*	✓			L		Tree				▲▲	
Mida/willow leaved maire	*Mida salicifolia*	✓	✓		L		Small tree				▲	
Mistletoe	*Ileostylus micranthus*	✓	✓		L		Hemi-parasite					
New Zealand jasmine	*Parsonsia capsularis*	✓	✓	L	L	L	Liane				▲	
Panako/thread fern	*Blechnum filiforme*	✓	✓	L	L		Fern/Liane				▲	
Pate	*Schefflera digitata*	✓	✓	F	F	L	Small tree				▲▲	
Poataniwha	*Melicope simplex*	✓	✓	L	L		Shrub				▲▲	
Puka	*Griselinia lucida*	✓		F	F	L	Small tree (Epi)				▲▲	
Raukatauri/drooping spleenwort	*Asplenium flaccidum*	✓	✓	L	L	L	Fern				▲▲	
Raukawa	*Raukaua edgerleyi*	✓	✓		L	L	Small tree				▲▲	T
Supplejack	*Ripogonum scandens*	✓			L	L	Liane				▲	
Tawa	*Beilschmiedia tawa*	✓	✓	F	F		Tree				▲	
Tawari	*Ixerba brexioides*	✓				C	Tree				▲	
Toropapa	*Alseuosmia macrophylla*	✓			F	L	Shrub				▲▲	
Toropapa	*Alseuosmia pusilla*		✓		L	L	Shrub				▲	
White climbing rata	*Metrosideros diffusa*	✓	✓	L	L	L	Liane				▲	
White maire	*Nestegis lanceolata*	✓	✓		L		Tree				▲	
White mistletoe	*Tupeia antarctica*	✓	✓		L	L	Shrub (Epi)					T
Wood rose	*Dactylanthus taylorii*	✓	✓		L		Parasite					T
Dwarf mistletoe	*Korthalsella salicornioides*	✓	✓		L	L	Shrub (Epi)					T

Your notes