

KAHIKATEA FOREST FRAGMENTS: MANAGING A WAIKATO ICON



KAHIKATEA IN THE WAIKATO

Before humans arrived in the Waikato, pure kahikatea forests grew in the wet areas beside our lakes and swamps, and formed extensive areas of the great floodplains of the Waikato, Waipā, Piako and Waihou rivers. The river channels often changed their course, destroying the vegetation cover and exposing new areas for kahikatea to colonise. As sites naturally became drier, other trees such as tōtara, mataī, rimu and hardwoods like tawa replaced the pure kahikatea forests.

With Maori settlement, the forested landscape was transformed by fires and cultivation. When European settlers arrived in the 1860s, the lowlands were mostly covered by bracken and mānuka, between large expanses of swamp and bog. However, even back then there were still tens of thousands of hectares of kahikatea forest in the Waikato lowlands. The settlers cleared much of it, felling the trees to make butter boxes and converting the land to fertile pasture. Today about 1 per cent of the original extent remains in the Waikato region.

There are still a few old-growth remnants left in the Waikato (for example, at Mangapu and Mokau). However, most existing kahikatea stands in the Waikato lowlands are relatively young forest fragments that have grown up around a few old trees left standing after most of the original forest was cleared for farming.

These young stands are characterised by their cone-shaped trees, which are only about 100-120 years old. Some stands still have their original seed trees around which the new forest grew. These massive trees, with trunks occasionally over 2 metres across, are about 400-500 years old.

About 5433 kahikatea fragments, totalling 3965 hectares, occur in the Waikato region today. They are typically small, between 0.01 and 35 hectares, with half of them less than 0.28 hectares. Most of them grow on the river floodplains of the Waikato Basin, Hauraki Plains and Mōkau River.

Because they grow on flat, fertile sites ideal for farmland, kahikatea forests are often at risk of being cleared. Half of the kahikatea fragments in the Waikato Region are not fully fenced off from stock, and only 10 per cent are legally protected.

Without management, these stands are destined to degrade and eventually die. In the almost totally deforested Waikato lowlands, even these small patches are a distinctive and iconic feature, and it's important that we look after them.



When Captain Cook's ship, the Endeavour, drifted up the Waihou River, his botanist Joseph Banks saw "the finest timber my eyes ever beheld of a tree ... as straight as a pine and of immense size; still higher we came the more numerous they were".

Kahikatea, the white pine, is our tallest native tree. It usually grows up to 60 metres although some have been measured at 90 metres!

Kahikatea stands are the characteristic forests of fertile floodplains, lake margins and riverbanks throughout the Waikato and elsewhere in New Zealand.

They are a classic landscape feature in the Waikato lowlands, standing like small islands in a vast 'sea' of pasture. They are special places with special needs.

This factsheet tells you why kahikatea fragments are special and how to look after them for many generations to come.

KAHIKATEA (*DACRYCARPUS DACRYDIOIDES*)

- One of the 10 tall native conifers (includes kauri, tānekaha, rimu and mataī).
- Grows rapidly on fertile, damp soil, but more tolerant of waterlogged, swampy soils than most native trees.
- On wet ground, develops large buttresses at the base of the trunk to support them.
- Leaves of young plants are long, narrow and slightly curved, with pointed tips. Adult trees have leaves that are shorter and overlap like fish scales.
- Separate male and female trees – males produce pollen in cones, females produce purple/black seeds on a bright red fruit-like base eaten by birds (and other animals).
- In a good year, a large tree can produce several million viable seeds.
- Seedlings are shade intolerant. They grow best in well-lit situations but are prone to drying out.
- Trees can live for over 500 years and grow trunks up to 2 metres across. Young trees are shaped like Christmas trees, while mature trees have tall bare trunks ending with massive, shaggy ‘stag’s-head’ canopies.

LIFE AND TIMES OF A KAHIKATEA TREE

When a kahikatea tree topples in a healthy (damp!) kahikatea forest, there is often a seedling on a patch of bare, fertile silt, waiting for the opportunity to flourish in the sunlight. With light-loving seedlings, dense kahikatea forests normally develop through open, swampy flax areas or shrublands, where damp conditions keep other species at bay.

This happens where previous forest has been destroyed by fire, flood or cyclone. As rivers changed course, or forests were destroyed by severe floods, new areas were colonised. Kahikatea forests moved with the rivers in their meanders over the centuries. Today, this dynamic change in forest types can only be seen in the forests of south Westland.

Kahikatea are quite capable of growing on drier sites, but so can other tree species. Where kahikatea stands have been drained, hardwood trees such as tawa, titoki, māhoe and pukatea become more abundant. These trees grow well in the shade and get a head start on kahikatea seedlings, beating them in the light gaps formed by fallen trees. Over time, drained kahikatea forests will change into broadleaf forest as the older kahikatea topple over and the more shade tolerant tree species replace them, although this may take many hundreds of years.

Because we now control flood events and resow flood-damaged pastures, we are unlikely to see many new areas of kahikatea forest developing in the Waikato. Scientists estimate that more than 98 per cent of pre-European kahikatea forests have been lost nationwide. If kahikatea stands are to continue to be a feature of the Waikato landscape, we will have to either periodically plant new stands, plant kahikatea trees in gaps where large trees come down in older stands, or block drains running through them. We must also maintain and protect remaining stands in our region, using the tips in this factsheet.



ANIMALS

Kahikatea fragments are permanent or seasonal homes for a wide range of native and introduced animal species. They are also important feeding areas for mobile species like tūi or kererū that use the larger landscape.

Most birds found in small stands are introduced species, such as blackbird, chaffinch, eastern rosella, house sparrow, mynah and magpie. However, native fantail, grey warbler, silvereye, morepork, kingfisher and shining cuckoo are also common. Kererū and tūi are occasionally seen, particularly in fragments near large blocks of native forest. The best time to see birds like kererū and tūi is when the kahikatea are fruiting in autumn.

Native long-tailed bats have been recorded at a few of the kahikatea stands in the Waikato. These bats roost in hollow trees or under bark, and eat flying insects. We don't know much about geckos or skinks in kahikatea fragments, but they may be there.

Waikato kahikatea forests have a remarkable diversity of native insects and other invertebrate species that don't occur in the surrounding pastures. These stands are important refuges for such species.



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PLANTS

The plants found in kahikatea fragments vary, depending on how well drained they are. True 'swamp forest' grows where the ground is almost permanently flooded, with pools of water surrounding the buttresses of the trees. Kahikatea and cabbage trees grow on 'islands' of matted roots and silt, with swamp maire, swamp lily, sedges and herbs in the wet hollows. These forests are rare now because introduced willows have mostly taken their place, but small patches can still be found near Lake Whangape and Kopuatai peat dome.

Kahikatea forests in drier sites, or areas drained by human activities, may have abundant tōtara and mataī, along with rimu, tītoki, pukatea and kōwhai. Hardwood trees like pukatea, tawa and tītoki establish in the shade of the young kahikatea canopy. Healthy (ungrazed) kahikatea fragments have a scattering of māhoe, patē and māpou shrubs, but many stands are open to farm stock and quite bare underneath. There are often a few pōkākā and cabbage trees around the edges. Kahikatea forests on drier sites are also rare because the well-drained, fertile soils they grow on are ideal for farmland.

Healthy, swampy kahikatea forest is well known for its distinctive understorey of small-leaved trees and shrubs, including tūrepo (milk tree), small-leaved māhoe, poataniwha, *Coprosma areolata* and round-leaved coprosma – and its abundance of lianes like supplejack, kiekie and our native passionfruit and native jasmine. Where there are no weeds, ferns cover the ground. The perching orchid, *Drymoanthus adversus*, grows on kahikatea trunks and can be spotted by its white thread-like roots that spread over the trunk.

Unfortunately, many areas of kahikatea are disturbed by livestock, resulting in a mass of weeds under an open canopy. Weeds like thorny barberry and hawthorn, and poisonous plants like Jerusalem cherry and privet, are generally ignored by stock. Birds bring in the seeds of these fleshy-fruited plants when they arrive in autumn to feed on kahikatea fruit.

Kahikatea forests normally develop through open swampy flax areas or shrublands.



MANAGING A KAHIKATEA FRAGMENT

Kahikatea fragments mainly need:

- fencing from stock
- protection from 'edge effects'
- retaining or restoring water levels
- legal protection.
- plant and animal pest control

Follow the steps below to keep your kahikatea forest healthy.

1. FENCING

Stock, especially cattle, trample seedlings (wiping out the next generation) and eat many native plants. Kahikatea fragments are particularly vulnerable because they are generally on flat land, so stock can easily move through. Often, where stock regularly visit kahikatea fragments, the only understorey plants are weeds, such as the poisonous Jerusalem cherry.

Fencing to exclude stock is essential if fragments are to have any hope of persisting. Even a single hotwire will deter most stock, but it is best to complete a full wire fence to protect the forest. Leave a gap of 3-5 metres between the fence and the forest edge to provide space to plant a protective buffer. Some councils and the QEII National Trust may help with fencing costs. See Factsheet 3 in this series for tips on fencing native forest fragments. Be ready to tackle weeds as soon as the last stock are out. You may find the weeds 'take off' when grazing stops.

2. WEED CONTROL

Perennial plants like privet, ornamental cherry, hawthorn, arum lily, wild ginger, ivy and wandering dew pose a serious threat unless they are removed. Plants that are spread by birds will continue to establish unless seed sources in nearby gardens are removed. Kahikatea fragments should not be used as dumping grounds for garden or domestic rubbish, even lawn clippings, because these often contain weeds. Contact your local plant pest officer for information on how to control problem weeds.

Some common weeds of grazed kahikatea fragments, such as Jerusalem cherry or inkweed, are less of a problem. They are only there because of the degraded condition of the remnant and will eventually disappear once the natural understorey recovers after fencing. However, Jerusalem cherry may persist for 15 or so years, particularly in light gaps and near the forest edge, or if stock get into the fragment.

Very wet kahikatea stands may also be invaded by reed sweet grass (*Glyceria maxima*) which forms dense mats and smothers native plants.

3. ANIMAL PESTS

Animal pests can also be a problem for native plants and animals. Possums, stoats, ship rats and wild cats are everywhere in the Waikato. They have a disastrous effect on wildlife. Eight out of every 10 eggs laid, or chicks hatched by a native bird, are killed by possums, rats or stoats. Possums can also severely damage plant species like lowland ribbonwood, māhoe and tītoki. Contact Waikato Regional Council for information and support with animal pest control.

4. PROTECTION FROM 'EDGE EFFECTS'

Exposure to prevailing winds can damage sensitive species on the edges of fragments and dry out the forest interior. This is a particular problem with kahikatea fragments because they usually occur on flat ground, well away from the shelter of hills. Planting a 'hedge' of fast-growing, exposure tolerant species like karamū, mānuka, flax, kawakawa, māpou or round-leaved coprosma around the edges, or erecting a shadecloth barrier along a fenceline, will reduce this problem.

5. KEEPING THEIR FEET WET

Kahikatea are often thought of as swamp trees, but they can live in a range of sites, out-competing other species in wetter sites rather than preferring them. In fact, laboratory research has shown they survive best in moderately wet soil. However, species commonly found with kahikatea in wetter sites may not survive drainage (e.g. swamp lily, swamp maire and swamp coprosma). Wetter kahikatea stands are less likely to become weedy, and less likely to be replaced by broadleaf trees.

Most of the kahikatea fragments in the Waikato are on land that was drained for farming. In rare cases, it may be possible to restore the water table to its original state, e.g. by blocking drains that run through or around the fragment. However, any change in water table should be gradual or all of the plants could die. Seek expert advice.

PROJECT KAHIKATEA was established in 2006 to help document the current condition of kahikatea stands in the Waikato lowlands, and identify options to help landowners protect and enhance the remaining stands. They've held several farmer field days, helped fund fencing, and developed a package of resource information.

Member organisations include the Waikato Branch of NZ Farm Forestry Association, Waikato Regional Council, NZ Landcare Trust, Waikato Biodiversity Forum, Department of Conservation, QEII National Trust, Federated Farmers and individuals.

projectkahikatea.weebly.com

See more kahikatea projects landcare.org.nz/completed-project-item/kahikatea-fragment-enhancement-project



6. LEGAL PROTECTION

Many kahikatea forests are located on flat land, so they are generally not covered by regional council rules that are designed to maintain soil and water quality by protecting hill-country vegetation.

Local council rules may not protect kahikatea forests, either. Local rules vary from district to district, and may change when councils review their plans. To protect kahikatea fragments from clearance by future landowners, consider placing a private covenant over them. Contact the QEII National Trust, Ngā Whenua Rāhui, Department of Conservation or your local council for more information (see Factsheet 4 in this series for contact details).

7. ADJACENT LAND USE

Activities on land next to a kahikatea stand may affect the health of the forest. Take care with fires (for example stubble burning) and spray drift (especially of broadcast herbicide). Fertiliser drift or enriched run off may encourage weeds or change the mix of native species in a block. For the same reason, kahikatea stands should not be used for effluent disposal. Adjacent woodlots, organic orchards or shelterbelts may help reduce the effects of adjacent land use.

8. UNDERPLANTING AND INTERPLANTING

Dense young kahikatea stands are often bare underneath and it may be tempting to underplant them. This may be a waste of time because fierce root competition from overtopping trees and lack of light may kill planted seedlings. However, if native seeds don't pop up on their own within a year or so after you have fenced your stand, you may wish to plant some native species. Some of the small-leaved plants like *Coprosma areolata*, and shade-tolerant native grasses such as the hook sedge (*Uncinia*), can cope with shade and root competition.

It is also worthwhile planting a 'hedge' around the edges or to plant grassy areas and large gaps included within fenced areas. First, clear weeds and spot spray any pasture grasses with herbicide, then plant with a selection of the species listed in the plant list at the end of this factsheet, based on how damp or sheltered the site is.

Perennial plants like ivy pose a serious threat unless they are removed.

CREATING A KAHIKATEA FRAGMENT

Flood damage once enabled new kahikatea stands to establish in the Waikato lowlands. This doesn't happen now because we manage floods to protect life and property. If kahikatea stands are to continue to be a feature of the landscape, we will have to periodically plant new stands.

Kahikatea grow well in the open, so are one of the quickest types of native forest to establish from scratch. After 25 years, kahikatea trees can reach 10 metres in height with trunks nearly 20 centimetres across. After 50 years, they should have formed a 20 metre tall forest stand.

Follow these steps if you wish to create a kahikatea forest for the future.

1. SELECT YOUR SITE

The worst grazing areas – the low-lying, boggy paddocks on your property – are ideal for a kahikatea forest. Existing trees or small groves of kahikatea in the middle of a paddock tell you it's the right site. They can also provide an ideal nucleus for a new forest. Mixed forests can be planted on better drained land. Ideally, a new forest should be adjacent to an existing wetland or to other patches of forest. If you can, join up several stands of kahikatea trees into a single block.

2. SELECT YOUR PLANTS

The species you plant will depend on drainage and exposure. A poorly-drained site is ideal for a 'pure' kahikatea forest. A better-drained site can support a mixture of native trees, such as mātai and tōtara with the kahikatea.

In pasture sites, rushes, Yorkshire fog and creeping buttercup will often indicate a wet or damp area. You can also look at the soil type. Dig a soil pit to one spade depth. If the subsoil is white with bluish or reddish colours on the sides, your soil is seasonally wet and therefore poorly drained. If not, it is probably moderately or even well-drained. In very wet areas, plant trees and shrubs (even those tolerant of poor drainage) on a small mound of soil (about 20 centimetres high) to allow the plant to get used to its new conditions.

Use the species list to select appropriate plants for your site based on drainage and whether you will be planting in the open or among existing trees. Look at nearby kahikatea stands to see what is growing there. Waikato Regional Council's website has a map of existing stands and of the kahikatea forest types that once would have been in your area (see waikatoregion.govt.nz/vegetation-biodiversity-map). This can also help you to select the best plants for your restoration project.

Talk to your nursery to ensure your plants are locally sourced and grown from seed, not cuttings. You can also collect seed from nearby natural areas to grow your own plants, but always get permission from the landowner and avoid areas near gardens where non-local plants may have cross-pollinated with local plants.

On very exposed sites, plant a 'nurse crop' of fast-growing, short-lived shrubs like mānuka, koromiko or karamū. On more sheltered sites, light-tolerant trees like kahikatea, pukatea, kōwhai, lowland ribbonwood and tītoki can be planted in the open.

Shade-tolerant species like tawa and māhoe benefit from shelter and should be planted some five years or more after the first trees are planted.

3. PREPARE YOUR SITE

When planting a new site in retired pasture, clear grass or weeds by screening (chipping off the surface vegetation with a spade to expose the soil) or spraying with glyphosate herbicide (spot spray 1 square metre patches of grass at planting sites). Fence the site, if needed, to protect plantings from stock damage.

4. PLANTING

Planting should be done in late autumn, winter or early spring to ensure the roots become established before the dry season. If the site is very wet, plant in late spring to allow plants to adjust to the wetter conditions. Plant in clusters (not unnatural-looking straight lines), with shrubs and small trees planted about 2 metres apart. Larger trees like kahikatea and tōtara should be planted further apart (5 metres or so). Plant closer together if you can afford the extra plants – you will have a more natural look and probably fewer weed problems.

Existing forests or small groves of kahikatea in the middle of a paddock tell you it's the right site.



5. RELEASING

'Releasing' seedlings from competition from grass and other pasture plants over the first two to three years is often necessary. Use a slasher or herbicide (protect seedlings from spray damage with cones or upturned buckets). Releasing may need to occur up to three times a year over this period. Old woollen carpet squares placed around the plant can help to keep weeds down.

6. AFTERCARE

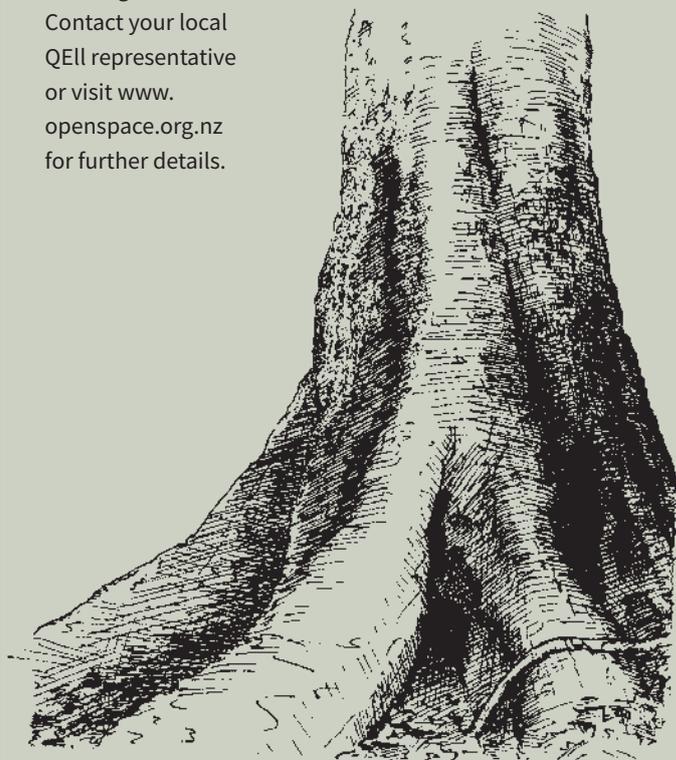
- Maintain fences to exclude stock. Pay particular attention after storms, when trees may have fallen down and damaged the fence.
- Weed invasion will be an ongoing problem, so regularly check for and control weeds.
- Animal pests will also require regular control. Hares are particularly tough on newly planted saplings.



KAHIKATEA FORESTS YOU CAN VISIT

- Claudelands Bush, a kahikatea fragment in the heart of Hamilton, off Boundary Road.
- Barrett Bush scenic reserve, south of Hamilton. Take Barrett Road off Koromatua Road. Ask the adjacent landowners for access permission.
- Kāniwhaniwha Stream, Mt Pirongia, Limeworks Road.
- Gordon Gow scenic reserve, north of Matamata, on the corner of Walton Road and SH27.
- Yarndley's Bush scenic reserve, off Ngāroto Road, between Hamilton and Te Awamutu.
- Lake Serpentine (Rotopiko) wildlife management refuge, SH3, between Ohaupo and Te Awamutu – see planted kahikatea trees inside a pest proof fence.
- Pehitawa Kahikatea QEII National Trust open space covenant, Te Kuiti.
- Hodges QEII National Trust open space covenant, Te Kowhai, Ngaruawahia.

Please note that all QEII National Trust covenants are on private land and prior permission from the landowner is required before entering these areas. Contact your local QEII representative or visit www.openspace.org.nz for further details.



For more information on planting forest and wetland sites contact Waikato Regional Council for your free copy of the factsheet series: Forest Fragment Management and Wetland Management.

PLANT LIST FOR KAHIKATEA FOREST FRAGMENTS

DRAINAGE

Plants listed in order from wetter sites to drier sites

SCIENTIFIC NAME	COMMON NAME	PLANT TYPE	DRAINAGE
'Nurse' plants - full sun in exposed sites			
<i>Carex virgata</i>	Purei	Sedge	Poor
<i>Carex secta</i>	Purei	Sedge	Poor
<i>Coprosma propinqua</i>	Swamp coprosma	Shrub	Poor
<i>Coprosma tenuicaulis</i>	Swamp coprosma	Shrub	Moderate/poor
<i>Austroderia fulvida</i>	Toetoe	Sedge	Moderate
<i>Carpodetus serratus</i>	Putaputawētā	Tree	Moderate
<i>Coprosma rigida</i>		Shrub	Good/moderate/poor
<i>Cordyline australis</i>	Cabbage tree/tī	Tree	Good/moderate/poor
<i>Leptospermum scoparium</i>	Mānuka	Tree	Good/moderate/poor
<i>Phormium tenax</i>	Flax/ harakeke		Good/moderate/poor
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Tree	Good/moderate/poor
<i>Coprosma robusta</i>	Karamū	Shrub	Good/moderate
<i>Myrsine australis</i>	Māpou	Tree	Good/moderate
<i>Podocarpus totara</i>	Tōtara	Tree	Good
<i>Kunzea ericoides</i>	Kānuka	Tree	Good
<i>Sophora microphylla</i>	Kōwhai	Tree	Good
Planting in sheltered sites or canopy gaps			
<i>Syzygium maire</i>	Swamp maire	Tree	Poor
<i>Astelia grandis</i>	Swamp lily	Flax-like herb	Moderate/poor
<i>Coprosma tenuicaulis</i>	Swamp coprosma	Shrub	Moderate/poor
<i>Gahnia xanthocarpa</i>	Giant sedge	Sedge	Moderate/poor
<i>Laurelia novae-zelandiae</i>	Pukatea	Tree	Moderate/poor
<i>Melicope simplex</i>	Poataniwha	Tree	Moderate/poor
<i>Streblus heterophyllus</i>	Tūrepo	Tree	Moderate/poor
<i>Carex dissita</i>	Purei	Sedge	Moderate
<i>Pennantia corymbosa</i>	Kaikōmako	Tree	Moderate
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Tree	Good/moderate/poor
<i>Alectryon excelsus</i>	Tītoki	Tree	Good/moderate
<i>Coprosma rhamnoides</i>		Shrub	Good/moderate
<i>Coprosma areolata</i>	Thin-leaved coprosma	Shrub	Good/moderate
<i>Coprosma rotundifolia</i>	Round-leaved coprosma	Shrub	Good/moderate
<i>Dacrydium cupressinum</i>	Rimu	Tree	Good/moderate
<i>Eleocarpus hookerianus</i>	Pōkākā	Tree	Good/moderate
<i>Hedycarya arobreia</i>	Pigeonwood	Tree	Good/moderate
<i>Melicytus micranthus</i>	Small-leaved māhoe	Shrub	Good/moderate
<i>Melicytus ramiflorus</i>	Māhoe	Tree	Good/moderate
<i>Nestegis cunninghamii</i>	Black maire	Tree	Good/moderate
<i>Prumnopitys taxifolia</i>	Mataī	Tree	Good/moderate
<i>Sophora microphylla</i>	Kōwhai	Tree	Good

Later planting under nurse plants in shaded areas

<i>Astelia grandis</i>	Swamp lily	Flax-like herb	Moderate/poor
<i>Schefflera digitata</i>	Patē	Shrub	Good/moderate
<i>Coprosma grandifolia</i>	Raurēkau, kanono	Shrub	Good/moderate
<i>Hedycarya arobreia</i>	Pigeonwood	Tree	Good/moderate
<i>Melicytus ramiflorus</i>	Māhoe	Tree	Good/moderate
<i>Alectryon excelsus</i>	Titoki	Tree	Good/moderate
<i>Geniostoma rupestre</i>	Hangehange	Shrub	Good
<i>Beilschmiedia tawa</i>	Tawa	Tree	Good

Note: ferns are widely dispersed and will likely turn up on their own

