Te whakatō tipu whakapaipai ngahere
Forest enrichment planting

Diverse and abundant plants and animals once cloaked the Wellington landscape from hilltops to sea. Northern rātā was a common sight emerging through the canopy along with rimu, mataī, kahikatea, pukatea and tōtara. Below them stood a dense cover of tawa, kohekohe, kāmahi, titoki, hīnau and kōwhai. The forest interiors were thick with climbers like kiekie and supplejack, and the forest floor carpeted with ferns. Tieke, piopio, robin, kokako, stitchbird, banded rail, kiwi, weka, kererū, kākā and huia would have called through the trees and tuatara would have scurried in and out of sea bird burrows feasting on eggs.

A history of logging, burn-off, clearance for farming and development, and planting of macrocarpa and pines has resulted in a substantial loss of Wellington's forests over time.

Today only 5% of Wellington's original lowland broadleaf-podocarp forest and 1% of original coastal forest remains. These remnants provide sanctuary for the surviving native birds and insects and are an important seed source for forest restoration and planting.

In the remaining old forest remnants, like Otari-Wilton's Bush and the Botanic Garden, the range of native plants and animals present is much diminished from what it once was.

Council, community groups and landowners throughout the city are working hard to re-establish a wider range of species in the regenerating forests to bring back some of the rarer species that are special to Wellington. Planting a wider range of species in regenerating forests is known as 'enrichment planting'. Enrichment planting can both increase biodiversity as well as start to provide for more complex ecological relationships between plants and animals.

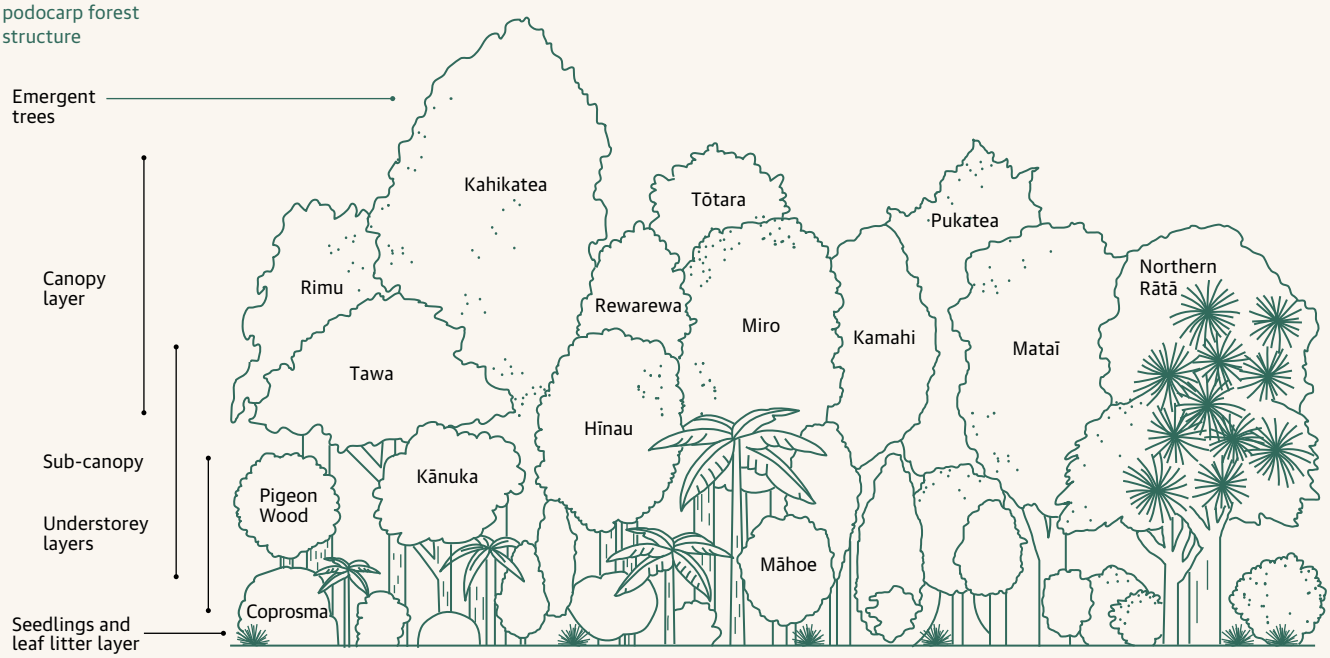
Nōhanga
Habitat

Typically, the structure of Wellington forests would have looked similar to the diagram below. Otari-Wilton's Bush is one of the few areas where this structure remains, including a rich abundance of ferns and grasses covering the ground.

The composition of the species changes depending on aspect, whether it is a valley floor or hillside, elevation, and whether the canopy is dominated by māhoe, tawa or kohekohe as well as proximity to the sea.

Tawa dominated canopy with typical gully species

Broadleaf-podocarp forest structure



Te whakatō tipu
Planting

The aim of enrichment planting is to re-establish a more natural composition of native plants by reintroducing absent species and increasing the number of species through a site or local area.

Your site should already have shelter from existing native shrubs and trees, and weeds and animal pests should be well managed so that young planted and regenerating seedlings can survive. There will likely be seedlings already naturally regenerating on the forest floor and a range of microclimates throughout the site. If your site does not have adequate shelter, check out other sections for earlier stage planting, eg Restoration planting on inland hillsides, valleys and basins.

Usually, enrichment planting does not require close spacing of plants - in fact, it is better to distribute the plants more widely within existing plantings. Look for suitable microsites and think about the conditions that the plants naturally prefer.

It is necessary to plant species where there is no, or limited, seed source close by. For species where seed source exists, you can help the natural process of bird and wind seed dispersal by controlling weeds to reduce competition for space, light and nutrients. Dropping seed into suitable locations may be all that is required to establish some species.

As plants establish and start to produce seed and the conditions for natural seed germination and seedling establishment improve, the natural forest structure will gradually redevelop. Seed dispersers, like tūī, kererū and kākā, will move from area to area feeding and introducing other native species.

(Above) Bush rice grass, establishing well on the forest floor.

"Get to know and understand the whole ecosystem you are working in. It's not just about getting plants in the ground, it's about looking at ecological relationships, mix of species, pollination, habitat for rare species - all the things that mean a forest can sustain itself.

Check out old photos, visit the old remnant forests, talk to or join other planting groups, or look for books and science papers that describe what the forests used to look like. Make a plan and stage your planting over several years to get the right mix of shelter and species."

Joakim, Miramar

Te papa ngahere me ngā momo tipu kei raro iho i te kāuru o te ngahere
Forest floor, understorey and sub-canopy species

The forest floor includes a wide range of mosses, ferns, grasses, ground covers and leaf litter dropped from taller canopy plants. It is generally a shady and moist environment that provides the conditions needed for native seeds to germinate and grow. A wider range of forest floor, understorey and sub-canopy shrubs can be planted once there is a canopy of taller trees providing shelter and lower light levels.

(Above, right) Ferns and seedlings colonising the damp understorey on the valley floor

(Right) Microsorum scandens with ripe spores - try pinning spore-laden fern fronds spore side down, on the forest floor. Check first to make sure the spore is ripe

Tips for planting and restoring forest floor, understorey and sub-canopy species

Control weeds such as Wandering willie so that native seeds and fern spore can germinate and grow without being smothered. Weed around young naturally regenerating seedlings as well as planted seedlings.

Plant in between naturally regenerating seedlings. Plant in groups of about 3 plants in a triangular pattern so they shelter can each other. Mix species up so you don't have a monoculture.

Plant ground covers, herbs and ferns at around 0.5 metre spacings. Plant shrubs and smaller plants at around 0.1 metre spacings.

Ferns are notoriously hard to grow but will naturally colonise bank and rock faces in damp shady situations. Try making small vertical cuts into sloping ground in suitably damp, shady places on your site to encourage fern development. Lay fertile fronds from fern and tree ferns onto damp surfaces; hold them in place with something heavy.

Once the canopy has reached a height that can be walked under, try establishing some of the wind and frost tender species such as kawakawa or hangehange.

Ferns often colonise banks and rock faces in damp, shady situations; spores are blown onto these faces. Try making small vertical cuts into sloping ground in suitably damp, shady places on your site to encourage fern development.

Plant list for forest floor, understorey and sub-canopy species

Enhancement forest planting – forest floor, understorey and subcanopy		**Planting site**			**Life form**	**Plant preferences & tolerances**				**Abundance**
Māori/ Common name	Botanical name	Forest floor	Under-storey	Sub canopy	Life form	Soil moisture needs	Light levels	Frost tolerant	Wind tolerant	
Bush rice grass	*Microlaena avenacea*	•			Grass, 0.4m	Semi-moist	Shade	✓	Exposed	++
Fine-leaved hook sedge	*Carex banksiana*	•			Sedge, 0.5m	Semi-moist	Semi-shade	✓	Exposed	+
Forest sedge	*Carex dissita*	•			Sedge, 0.5m	Semi-moist	Semi shade	✓	Exposed	++
Trip-me-up	*Carex flagellifera*	•			Sedge, 0.4m	Semi-moist	Semi-shade	✓	✓	++
Hangehange	*Geniostoma ligustrifolium var. ligustrifolium*		•		Shrub to 2 m	Semi-moist	Semi-shade	Frost tender	✓	++
Kamu / Hook grass	*Carex uncinata*	•			Sedge, 0.4m	Semi-moist	Semi-shade	✓	Exposed	++
Kakaha / Bush flax	*Astelia fragrans*	•			Flax-like herb, 1m	Semi-moist	Semi-shade	✓	Exposed	+
Kanono	*Coprosma grandifolia*		•	•	Shrub	Semi moist	Semi shade to sun	✓	Exposed	+++
Kawakawa	*Piper excelsum*		•		Shrub/ small tree	Semi-moist	Semi-shade	Frost tender	Exposed	+++
Lowland horopito	*Pseudowintera axillaris*			•	Small tree, 7m	Semi moist	Semi shade	✓ When mature	Exposed	+
Māhoe / Whitey wood	*Melicytus ramiflorus*			•	Tree to 5m	Semi moist to dry	Semi shade	✓ When mature	Moderate	++
Māpere / Razor sedge	*Gahnia setifolia*	•			Sedge, flowers to 3m	Dry	Sun	✓	Moderate	+
Mīkoikoi / New Zealand iris	*Libertia grandifolia*	•			Flax-like shrub, 0.7m	Semi-moist	Semi-shade	✓	✓	++
Mīkoikoi/ New Zealand iris	*Libertia ixioides*	•			Flax-like shrub, 0.7m	Semi-moist	Semi-shade	✓	✓	+

+ use sparingly ++ use commonly +++ use plentifully ✓ yes • categorised

Plant list for forest floor, understorey and sub-canopy species (cont.)

Enhancement forest planting – forest floor, understorey and subcanopy		**Planting site**			**Life form**	**Plant preferences & tolerances**				**Abundance**
Māori/ Common name	Botanical name	Forest floor	Under-storey	Sub canopy	Life form	Soil moisture needs	Light levels	Frost tolerant	Wind tolerant	
Porokaiwhiri, pigeonwood	*Hedycarya arborea*			•	Tree to 8m	Semi moist	Semi shade to sun	✓ When mature	Moderate	+++
Putaputawētā	*Carpodetus serratus*			•	Tree to 5m	Moist to semi moist	Shade	✓ When mature	Moderate	++
Ramarama	*Lophomrytus bullata*		•		Tree to 5m	Moist to semi moist	Shade	✓ When mature	Moderate	++
Round-leaved coprosma	*Coprosma rotundifolia*		•		Shrub 2 – 4m	Semi moist	Semi shade	✓ When mature	Moderate	++
Speckled sedge	*Carex testacea*	•			Sedge, 0.4m	Semi-moist	Semi-shade	✓	✓	++
Thin-leaved coprosma	*Coprosma areolata*		•		Shrub to 3m	Semi moist	Semi shade to sun	✓	✓	++
Tūrutu / NZ blueberry	*Dianella nigra*	•			Tussock-like herb, up to 0.5m	Semi-moist	Semi-shade	✓	Moderate	+++

\+ use sparingly ++ use commonly +++ use plentifully ✓ yes • categorised

Te kāuru o te ngahere me ngā rākau teitei e tipu tonu ana
Canopy and emergent tall trees

The forest floor includes a wide range of mosses, ferns, grasses, ground covers and leaf litter dropped from taller canopy plants. It is generally a shady and moist environment that provides the conditions needed for native seeds to germinate and grow. A wider range of forest floor, understorey and sub-canopy shrubs can be planted once there is a canopy of taller trees providing shelter and lower light levels.

Rimu growing in small light well.

Tips for planting and restoring forest floor, understorey and sub-canopy species

Rimu naturally comes up through light pockets in the forest created when large trees fall over and tawa favours moist sites under a established canopy. Consequently, both these species struggle in an open environment. They need shelter and grow better on the edge of a stand of trees where they are protected from frost and strong drying winds. They also need reasonable soil that holds enough moisture over the summer season.

Tōtara and Northern rātā can be planted in open situations alongside the early-stage restoration plant species and tolerate more exposed, north-facing sites.

Kahikatea can be planted in open situations but needs a reasonable amount of soil moisture.

Pukatea needs a moist environment, shelter and protection from frosts.

If you have a closed canopy and a very shady environment, cut small light wells for emergent trees that need light, eg rimu. Make sure to maintain the light wells and do regular weed control in the area until the new seedling is well established and starting to emerge through the surrounding growth.

Emergent trees take up a lot of space in a forest, so can be planted at wider spacings, around 5 metres, depending on the site and the mix of species present.

Plant list for canopy and emergent trees

Enhancement planting – Canopy and emergent trees		Life form	Plant preferences & tolerances				Habitat	Comments
Māori/ Common name	Botanical name	Life form	Soil moisture needs	Light levels	Frost tolerant	Wind tolerant		
Heketara	*Olearia rani var. colorata*	Small tree, up to 6m	Dry to Semi-moist	Semi-shade	✓ When mature	✓	Coastal to inland forests, dry hillsides	White flowers Aug to Nov attract bees.
Hīnau	*Elaeocarpus dentatus*	Canopy tree, 20m	Semi-moist	Semi-shade	✓ When mature		Hillsides in established canopy, fertile soil	Fleshy fruits attracts kererū, tūī, tītapu. Flowers attract bees.
Horoeka/ lancewood	*Pseudopanax crassifolius*	Small tree to 8m	Semi moist	Semi shade to sun	✓	✓	Coastal to inland forest, hillsides	Two stages of growth, juvenile lance leaves to a round topped tree, attractive to birds.
Kahikatea / White pine	*Dacrycarpus dacrydioides*	Emergent, up to 50m	Moist to wet	Semi-shade	✓ When mature	✓	Valley floors and lower hillslopes	Fleshy fruit attracts and is dispersed by birds.
Kaikōmako	*Pennantia corymbosa*	Small tree, up to 8m	Semi-moist	Sun to semi-shade	✓ When mature	✓	Coastal to inland forests	Black fruit Jan to Apr attracts Korimako.
Kāmahi	*Weinmannia racemosa*	Canopy tree up to 25m	Semi-moist	Semi-shade	✓ When mature	✓	Well drained steep hillsides, sea level to montane	Flowers Dec to Jan attract birds and bees. Easily grown from seed.
Kohekohe	*Dysoxylum spectabile*	Canopy tree, 15m	Semi-moist	Semi-shade	✓ When mature	Sheltered	Coastal to inland hillsides	Large glossy leaves. Flowers and fruit attract birds in winter.
Maire/ Black maire	*Nestegis cunninghamii*	Canopy tree up to 20m	Moist to Semi moist	Semi shade	✓ When mature	Sheltered	Gully, plant within established canopy	Locally rare species. Fruit Dec to May attracts kererū.
Maire rauiki / White maire	*Nestegis lanceolata*	Canopy tree up to 20m	Semi-moist to dry	Semi-shade	✓ When mature	Sheltered	Hillsides among existing canopy	Red fruit attractive to birds, especially kererū. Easily grown from seed.
Maire tawake	*Szygium maire*	Canopy tree up to 16m	Moist-wet	Sun to shade	✓ When mature	Sheltered	Swamp to very wet valley floors	Nationally threatened species. Susceptible to myrtle rust.
Mataī	*Prumnopytis taxifolia*	Emergent tree up to 20m	Semi-moist	Semi-shade	✓ When mature	Sheltered	Lowland valleys and hillslopes	Black fruit, attractive to birds.
Miro	*Prumnopytis ferruginea*	Emergent tree up to 25m	Semi-moist	Semi-shade	✓ When mature	Sheltered	Grow in a wide range of sites, valley floor to hilltops	Red plum-like fruit Nov to Apr, attractive to kererū.

\+ use sparingly ++ use commonly +++ use plentifully ✓ yes • categorised

Plant list for canopy and emergent trees (cont.)

Enhancement planting – Canopy and emergent trees		Life form	Plant preferences & tolerances				Habitat	Comments
Māori/ Common name	Botanical name	Life form	Soil moisture needs	Light levels	Frost tolerant	Wind tolerant		
Nīkau	*Rhopalostylis sapida*	Palm-like tree up to 15m	Semi-moist	Semi-shade	✓ When mature	Sheltered	Lowland valleys and gullies	Attracts birds and bees.
Pōkākā	*Elaeocarpus hookerianus*	Canopy tree to 15m	Dry to moist	Sun to semi shade	✓ When mature		Tolerates a wide range of conditions, dry hillsides	Unusual divaricating phase, flowers only occasionally, can be up to 8 years apart, locally rare.
Pukatea	*Laurelia novae – zealandiae*	Canopy tree up to 30m	Moist to wet	Semi-shade	✓ When mature	Sheltered	Valley floor and shaded gullies, deep moist soil	Prefers damp sites. Has buttress trunk.
Rātā/ Northern rātā	*Metrosideros robusta*	Emergent 25-40m	Dry to Semi-moist	Sun to semi-shade	✓ When mature		Hillsides, coastal to inland. Epiphytic as well as terrestrial	Attractive to possums, nationally threatened. Attracts bees Nov to Jan. Grows from fresh seed.
Rewarewa / NZ honeysuckle	*Knightia excelsa*	Emergent, up to 30m	Dry to Semi-moist	Semi-shade	✓ When mature	Sheltered	Dry well drained hillslopes	Fruits Oct to Jan, attracts nectar feeders and bees. Grown from fresh seed.
Raukawa	*Raukaua edgerleyi*	Tree up to 12m	Moist to Semi moist	Semi shade	✓ When mature	Sheltered	Inland hillslopes	Locally rare species. Susceptible to possum, goat, rat browsing.
Rimu	*Dacrydium cupressinum*	Emergent, 35-50m	Semi-moist to moist	Semi-shade	✓ When mature	Sheltered	Tolerates a range of conditions, preference for deep fertile soil, sheltered position	Fleshy fruit Mar to May attracts birds and bees.
Tawa	*Beilschmiedia tawa*	Canopy tree, up to 24m	Semi-moist	Shade	✓ When mature	Sheltered	Coastal to inland forest, hillsides and valleys	Purple plum-like fruit attracts kererū. Easily grown from fresh seed.
Titoki	*Alectryon excelsus*	Tree, up to 15m	Dry to semi-moist	Semi-shade	✓ When mature	Moderate	Coastal to lowland forest, valley floor to hillsides	Red fleshy fruit attracts birds and bees. Grown from fresh seed.
Toro	*Myrsine salicina*	Tree to 10m	Moist to semi moist	shade	✓ When mature	Sheltered	Lowland forests	Locally rare species, valley floors and moist hillsides.
Tōtara	*Podocarpus totara var. totara*	Emergent, 15-30m	Semi-moist to dry	Sun to semi-shade	✓ When mature	✓	Tolerates dry conditions, prefers fertile soil, lowland to hillslopes	Fruit takes a year to ripen, attract birds Apr/ May. Grown from fresh seed.
Tūrepo/ Milk tree	*Streblus heterophyllus*	Tree up to 12m	Dry to semi-moist	Sun to semi shade	✓ When mature	Sheltered	Coastal forest to inland	Rare species. Susceptible to possum, goat, rat browsing.

\+ use sparingly ++ use commonly +++ use plentifully ✓ yes • categorised

Ngā tipu kaipiki me ngā tipu pipiri
Climbers and epiphytes

Kaihua and kōhia are commonly found throughout established and regenerating forest areas around Wellington but intervention is needed to broaden the distribution of some of the lesser known climbers. Most climbers like to be planted with their roots in the cool shade and require something to scramble on or climb up so they can grow into the canopy and get their tops into the sun. A small light well can be cut to encourage initial growth.

Epiphytes or perching plants are found growing on another plant but aren't parasitic. Epiphytes rely on the surrounding environment for moisture and nutrients, high up in a canopy tree they receive more light than on the forest floor.

Epiphytes provide habitat for insects, bats, frogs, geckos and birds and some epiphytes rely on the large nesting clumps of Astelias to grow such as tāwhiri karo.

Many species of epiphytic plants are difficult to grow and will arrive naturally over time. Hīnau, rimu and many of the larger emergent trees all host epiphytes and climbers. Finding hollows in trees, rotting logs or rock crevices can provide places for these plants to grow but some species will also successfully grow on the forest floor.

Puawhānanga are often seen in early spring, flowering in the canopy

Tāwhiri karo "planted" into a tree hollow.

Plant list for climbers and epiphytes

Enhancement forest planting – climbers and epiphytes		Planting site		Life form	Plant preferences & tolerances				Abundance
Māori/ Common name	Botanical name	Climber	Epiptyte	Life form	Soil moisture needs	Light levels	Frost tolerant	Wind tolerant	
Akapuka	*Griselinia lucida*		•	Epiphytic shrub or small tree	Dry to semi moist	Semi shade to sun	Frost tender	Exposed	++
Kahakaha	*Astelia hastata*		•	Nest epiphyte	Dry to semi-moist	Semi shade	Frost tender	Moderate	+
Kaihua / NZ jasmine	*Parsonsia heterophylla*	•		Dense climber	Semi-moist	Semi-shade	✓	Moderate	+++
Kareao / Supplejack	*Ripogonum scandens*	•		Woody vine	Semi-moist	Shade	Frost tender	✓	++
Kiekie	*Freycinetia banksii*	•		Vigorous climber	Semi moist to moist	Semi shade	✓	✓	++
Kōhia / NZ passionfruit	*Passiflora tetranda*	•		Dense bushy climber	Semi-moist	Sun	✓	Moderate	+++
Kōwharawhara	*Astelia solandri*		•	Nest epiphyte	Dry to semi-moist	Semi shade	Frost tender	Moderate	+
Puawhānanga / Small white clematis	*Clematis forsteri*	•		Scrambling climber	Semi-moist	Sun	✓	Moderate	+
Puawhānanga / White clematis	*Clematis paniculata*	•		Woody vine up to 12m	Semi-moist	Semi-shade	✓	Moderate	+
Tātarāmoa / Bush lawyer	*Rubus cissoides*	•		Prickly, scrambling vine	Semi-moist	Semi-shade	✓	✓	+
Tāwhiri karo	*Pittosporum cornifolium*		•	Epiphytic shrub 2.5m	Semi moist	Semi shade	✓	Moderate	+

\+ use sparingly ++ use commonly +++ use plentifully ✓ yes • categorised