



We aim to inspire and work with our communities to enhance, protect and connect with this landscape.

Forest restoration planning and planting guide for landowners in the Halo Project area



A companion document to “A planning guide to native forest restoration for landowners with native forest remnants”



FOREST HABITAT RESTORATION

Integrating biodiversity across this landscape.

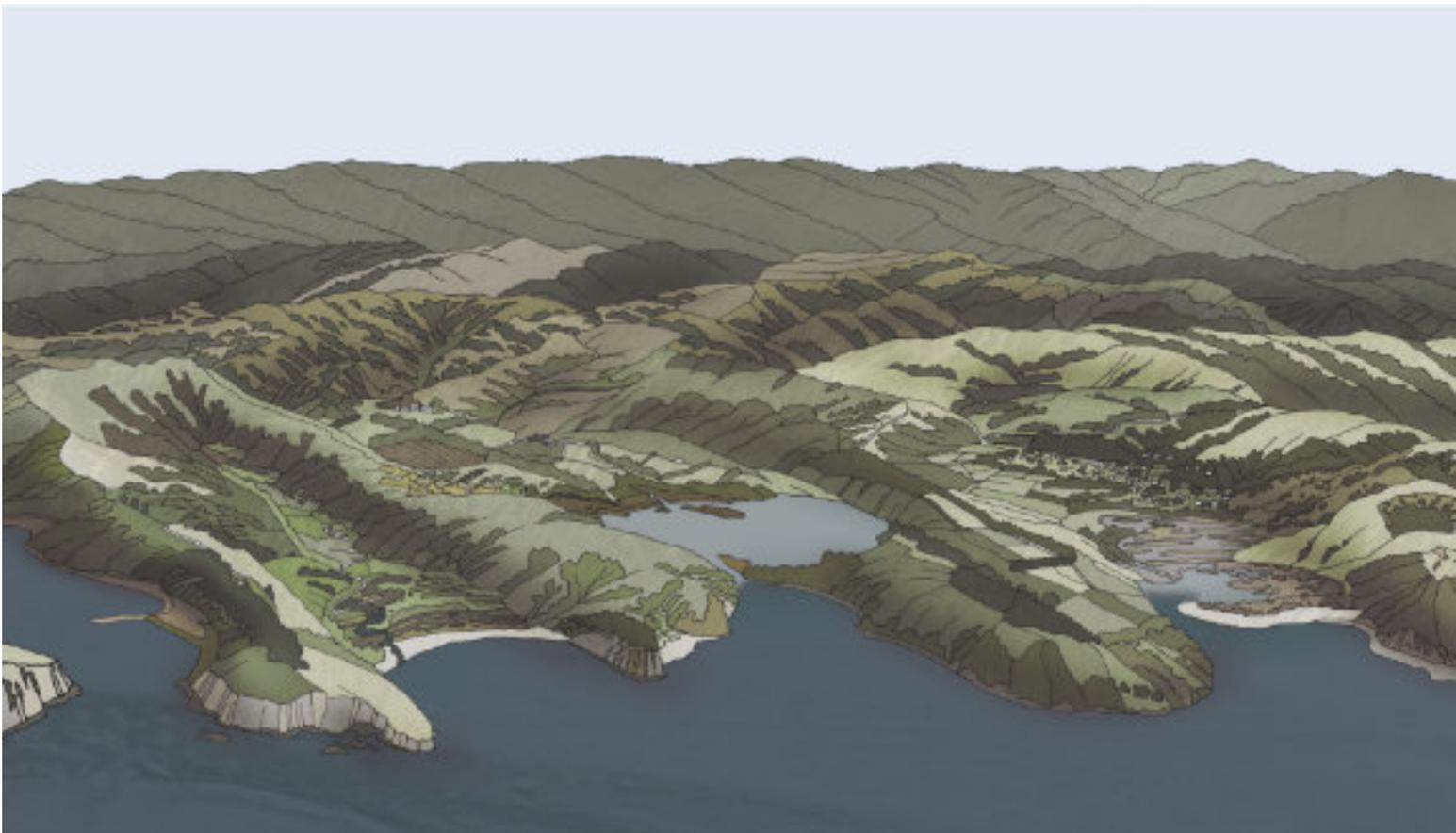
The Halo Project aims to inspire and work with our communities to enhance, protect and connect with this landscape. By working with enthusiastic landowners, we will improve the biodiversity values and ecosystem functioning on both public and private land within the Halo Project area. We work alongside people who are passionate about improving the biodiversity values of their properties by developing site-specific restoration plans; helping them to access restoration funding; coordinating volunteer-driven seed collecting and planting; and overseeing the implementation of restoration projects.

This planning and planting guide has been developed by the Halo Project.

Photo on the front cover: Volunteers at a Halo Project planting day

www.haloproject.org.nz

August 2020



Artistic impression collating the different habitat types and landforms within our project area

Contents

INTRODUCTION

Page 3

1

PLANNING

Page 5

2

**PLANTING AN
OPEN SITE**

Page 17

3

**SUPPLEMENTARY
PLANTING**

Page 29

4

**PLANTING AND
MAINTENANCE**

Page 45

REFERENCES

Page 52

1 PLANNING

- 1.1 Design your planting plan
- 1.2 Source your plants

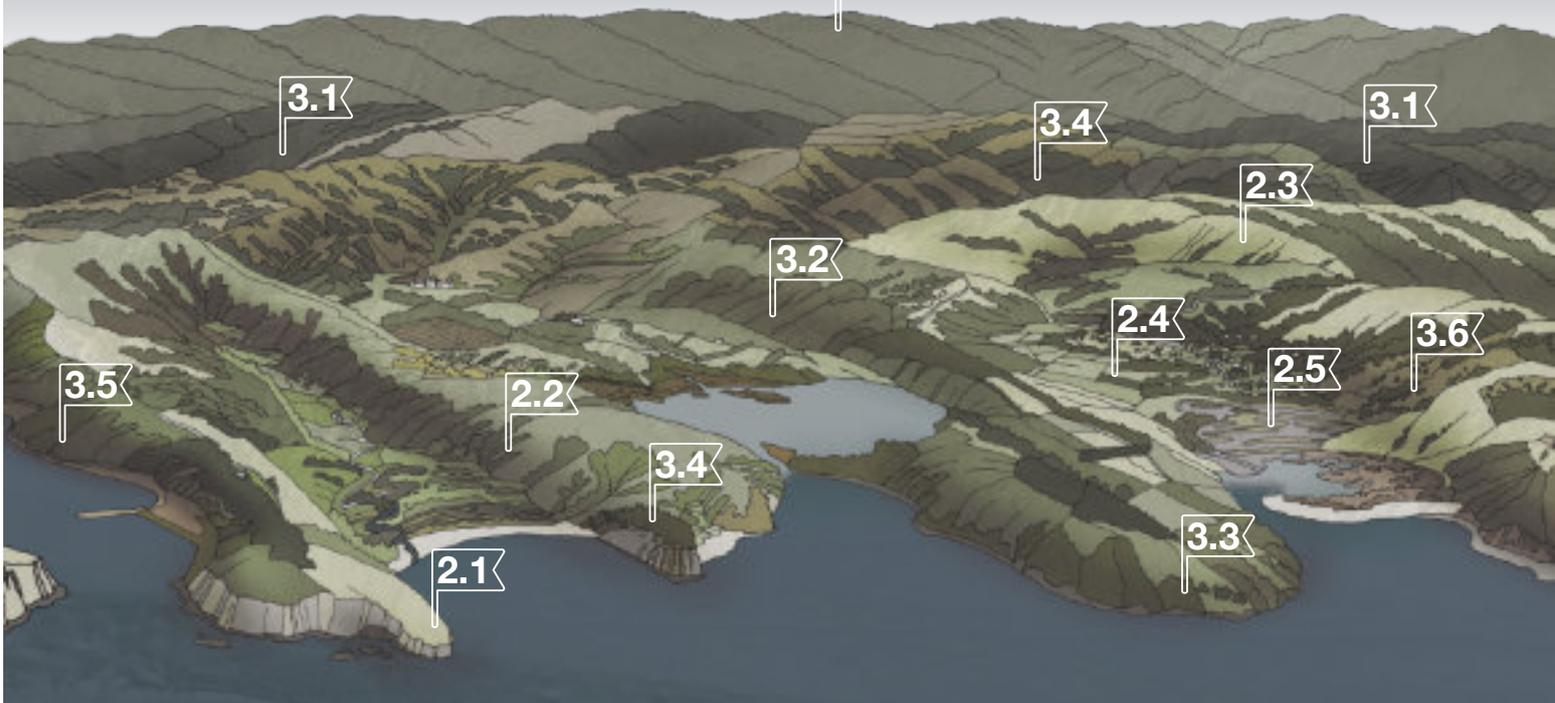
- 1.3 Plan when to plant
- 1.4 Control weeds prior to planting
- 1.5 Protect plantings from animal browsing

2 PLANTING AN OPEN SITE

- 2.1 Exposed coast
- 2.2 Lowland hill country and sheltered coastal slopes
- 2.3 Lowland gullies
- 2.4 Lowland river flats
- 2.5 Flood-disturbed riparian margins

3 SUPPLEMENTARY PLANTING

- 3.1 Podocarp forest
- 3.2 Broadleaved forest
- 3.3 Coastal forest and tree-land
- 3.4 Kōwhai dominated forest and tree-land
- 3.5 Kānuka dominated forest
- 3.6 Regenerating forest
- 3.7 Forest understorey



4 PLANTING AND MAINTENANCE

- 4.1 Planting
- 4.2 Monitoring and maintenance

INTRODUCTION

This guide is designed to help landowners create a planting plan for their own restoration project, based on selecting ecologically appropriate plants for their location and habitat, and compliments *A planning guide to native forest restoration for landowners with native forest remnants*.

The guide is split into four sections.

Section 1: PLANNING outlines planning needed and other useful information to consider before you begin planting.

Generally, two main types of restoration planting occur: those that involve planting in open areas (i.e. sites with no existing vegetation such as retired pasture) and those that aim to supplement existing native vegetation.

We have separated these into two sections: Section 2: PLANTING AN OPEN SITE contains five species lists for planting on different landforms with no neighbouring native vegetation.

Section 3: SUPPLEMENTARY PLANTING contains a further seven lists of species for supplementary planting (i.e. planting in or near patches of existing vegetation) of the forest types typical in eastern Otago. First select Section 1 or 2 depending on your site and then use the landform or habitat descriptions to select the plant list(s) to suit your location. These plant species lists are designed specifically to reflect the habitats within the Halo Project area¹ (Figure 2).

Section 4: PLANTING and MONITORING contains tips and hints to keep your newly planted area thriving over the years.



Figure 1: Riparian restoration plantings at Orokonui Estuary in foreground (harakeke/flax, kōhūhū, mānuka and tī kōuka/cabbage tree) with regenerating kānuka forest behind

¹ Plant lists are based on those produced by Wildland Consultants (2016c, 2016d). Information was also kindly provided by Ribbonwood Nurseries.



Figure 2: The Halo Project area spans 55,000 hectares (ha) from the Silverpeaks in the west to the coastline in the east.



PLANNING



Forward planning for native forest restoration is essential. Firstly, you need to know your site.

Whether you have already worked through our ***Planning guide to native forest restoration for landowners with native forest remnants*** and know which areas of your property you'd like to restore, or simply have an area of your property in mind, you need to know a little bit about the site you want to plant.

If it is a site with no forest remnant vegetation nearby, you will need to decide which landform category it best fits into. Select from: exposed coastal site, lowland hill country and sheltered coastal slopes, lowland gullies, lowland river flats or flood-disturbed riparian margins (as described in Section 2). Then you can be sure you are planting species suited to the site conditions.

If the site is near a forest remnant, what vegetation type is it? Mature trees rather than shrubs are the best indicators of forest type (except in exposed coastal sites). Use the forest type categories described in Section 3: podocarp forest, broadleaved forest, coastal forest & tree-land, kōwhai-dominant forest & tree-land, kānuka-dominant forest or regenerating forest, or perhaps you want to restore the understorey of a forest patch.

We recommend you follow these simple steps:

1. Firstly, you need to design your planting plan, (Figure 3 gives you an idea of what you could do but yours does not need to be this extensive);
2. You need to source your plants;
3. You need to plan when you can plant;
4. You need to control the weeds prior to planting;
5. Then once you have the plants in the ground you need to protect them from any critters that might want to eat them.

This first section walks you through how to do each of these 5 steps.

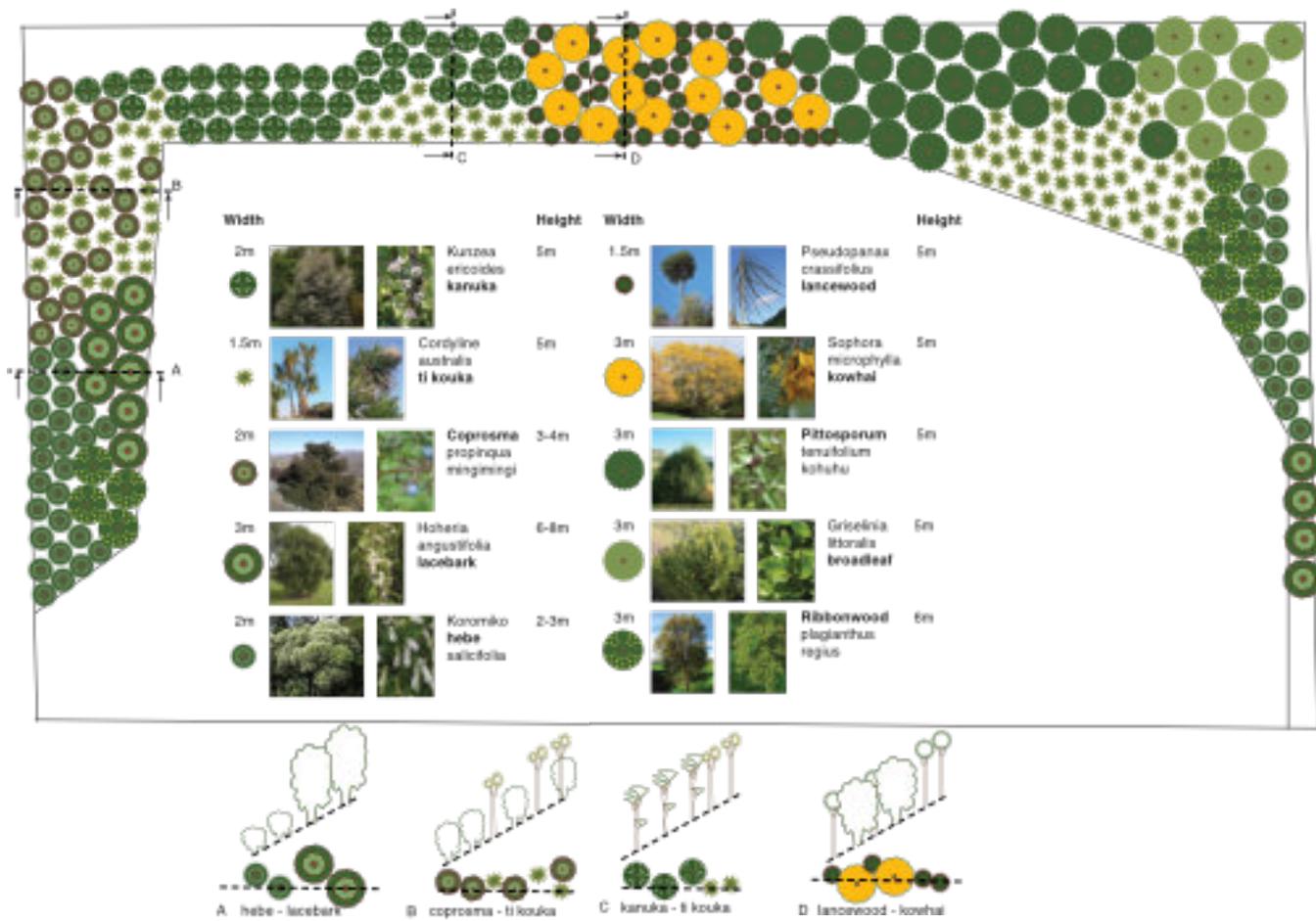


Figure 3: Example of a detailed planting plan

Add your own notes here:

1.1

Design your planting plan

- ✓ Select the species to suit your site.
- ✓ Measure or estimate the size of your planting site.
- ✓ Calculate how many plants you need.
- ✓ Draw a plan of your site with plant positions marked.

See Section 3 for descriptions of vegetation types

Before you begin planting you need to create a plan. The first step is to decide which plant species you're going to plant. Use the plant lists in Section 2 or 3 to select the species most appropriate for your site. When planting forest species, aim to plant trees and shrubs first, giving them time to establish before the understorey species are planted (i.e. herbs, ferns, tree ferns, epiphytes and climbers).

Then you need to calculate approximately how many plants you will need for your project. You should have a rough idea of the area of your site (in hectares or square metres) having calculated it using ***A planning guide to native forest restoration for landowners with native forest remnants***. For forest habitat plantings you should aim to place plants approximately two metres apart (or between 1.5 m to 3 m).

Table 1: Number of plants per ha based on various plant spacings

Plant spacing	Plants per ha
0.5x0.5 m	40,000
1x1 m	10,000
1.5x1.5 m	4,444
2x2 m	2,500
2.5x2.5 m	1,600
3x3 m	1,111
3.5x3.5 m	816
5x5 m	400
10x10 m	100

Wider spacing between plantings can be used where vegetation already exists (e.g. tree-lands or scrub). In these habitats, focus planting in gaps or holes in the canopy (i.e. those areas where existing vegetation is at low densities). Closer spacings can be used for rushes and sedges within riparian margins (0.5 m to 1 m).

The plant lists for open sites (Lists 2.1-2.5) include indications of the relative abundance of species within that habitat type. Use these to help you proportion the number plants of each species.

Table 1 shows you how many plants are required per ha based on different plant spacings. This will help you work out approximately how many plants you need to fully plant your site

Make a plan for your site before you begin.

Using ***A planning guide to native forest restoration for landowners with native forest remnants*** map the location and then create a rough sketch of what species are going to go where. Figure 4 provides a simplified example.

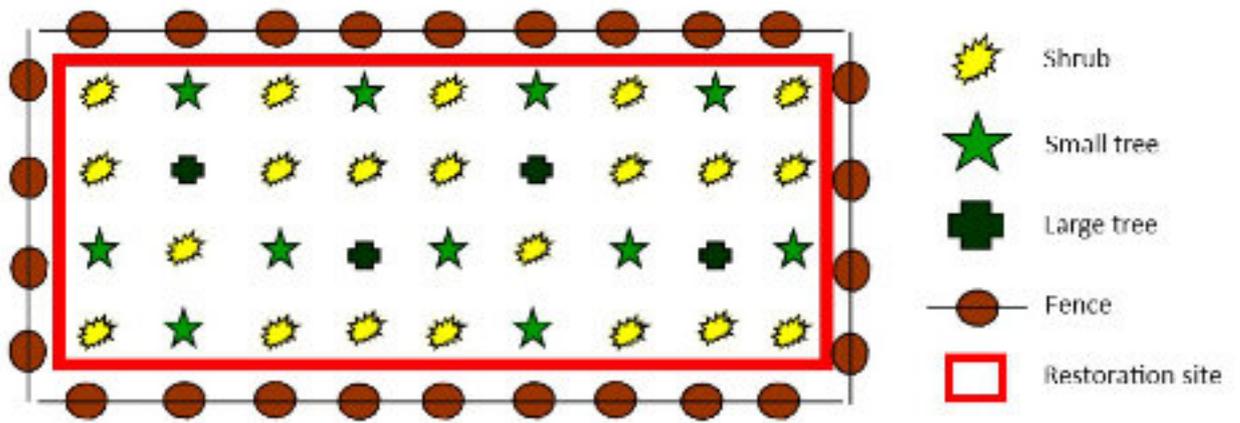


Figure 4: A simplified example of a planting layout for an open site

Draw your planting plan here:

1.2

Source your plants

When undertaking restoration planting, it is best to source plants locally. Locally sourced plants or seeds are generally well-adapted to the local conditions and so survive much better than those sourced from other areas.

In the next section (below) we suggest some nurseries that eco-source their seeds. If you go to other nurseries, they will state on their website whether they practice eco-sourcing. If there is no mention of eco-sourcing, ask them. Taking the time now to ensure you get plants well-suited to local conditions will reduce the likelihood of plants dying, wasting all your hard work.

See the links below for more information on the benefits of eco-sourcing.



Plant sourcing options:

- *Purchase from local native plant nurseries.*
- *Grow plants from local native seeds.*
- *Transplant local native seedlings.*



Figure 5: (Left) rōhutu / New Zealand myrtle at Potato Point and (right) Adult foliage of local kōwhai species *Sophora microphylla*

Useful Resources (information eco-sourcing benefits):



New Zealand Plant Conservation Network

http://www.nzpcn.org.nz/page.aspx?conservation_restoration_ecosourcing

Department of Conservation

<https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/ecosource-seeds/>

The easiest option for sourcing plants is to purchase them from a native plant nursery. Below is a list of plant nurseries found in and around Dunedin, all of which sell eco-sourced native plants. Be sure to check that you purchase the correct species, avoiding any ornamental or garden varieties. Note that not all nurseries will have all the species you wish to plant and so you may have to do some calling around.

Nursery managers and staff are experts in planting native species and so asking any questions you may have about the plants will ensure the best possible outcome for your restoration project.

Alternatively, you could grow your own plants from locally-sourced seeds. This can be time-consuming but it may allow you to plant more than you would if you had to purchase each plant. Perhaps you could approach your local school to help you grow plants, and involve students in planting them?



Local native plant nurseries:

- Blueskin Nurseries (Waitati)
03 482 2828
www.blueskinnurseries.co.nz/
- Ribbonwood Nurseries (Dunedin)
03 453 4673
www.ribbonwoodnurseries.co.nz/

Look to purchase or select healthy plants and, ideally, at least 40 centimetres tall. It can be more cost efficient to purchase fewer larger plants than many smaller plants as the survival rate of larger plants is higher.

Another method for sourcing plants is to collect seedlings from nearby patches of vegetation. However, **it is illegal to collect from areas of public conservation land** (Department of Conservation or council land) without first obtaining a permit. You may be able to collect seedlings from areas of privately-owned remnant native forest, ideally on your property or on other private property nearby (with landowner permission) to ensure you collect local strains.



Figure 6: Transplanted harakeke/flax in riparian planting



Useful Resources (more information on seed collecting):

Collecting on public conservation land (regulations/permit process)

<https://www.doc.govt.nz/get-involved/apply-for-permits/research-and-collection/>

Seed collecting

<https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/ecosource-seeds/collection-and-propagation-guide-trees/>

1.3 Plan when to plant



The climate of eastern Otago means that autumn, winter and early spring are the best times of year to plant.

The biggest constraint is periods of dry weather. Avoid dry Summers and try to ensure the area has received a few decent periods of rain before planting in Autumn.

Similarly, if it looks like Spring and Summer are going to be particularly dry, planting should cease in September or October to ensure plants have time to establish before they face drought stress.

In eastern Otago, the periods of lowest rainfall are from July to November and January to February.

If the weather is particularly dry, some watering of new plantings may be required in the first few weeks to prevent plant death



Volunteers at a Halo Project planting day

Use our handy calendar (overleaf) to plan out when to plant your native trees.

Month:

1.4

Control weeds prior to planting

Perhaps the single biggest issue facing newly planted seedlings is competition with weeds.

A common problem is competition from **fast-growing pasture grasses** that smother seedlings and cause mortality. **Woody weed** species (e.g. gorse, broom, blackberry) can also cause significant damage to native seedlings if not controlled.

Several weeks before planting, the site should be prepared using one of two methods: (1) scrubcutting or (2) spot spraying with herbicide. **Scrubcutting** involves using a scrub cutter or line trimmer (in grass) to create a planting spot by cutting the vegetation down to ground level. **Spot spraying** involves spraying each planting site with herbicide to kill grass and other weeds. Use a non-persistent herbicide such as glyphosate. Planting 'spots' prepared using each method should measure approximately 1 m in diameter. Cardboard, 100% natural fibre carpet or natural fibre coffee sacks can be placed on cut/sprayed planting spots to act as weeds mats.

In the early stages of restoration planting, exotic early-successional species such as gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*) are among the biggest competitors of native plantings. Both grow quickly and if not controlled, will out-compete natives. These species are best controlled by cutting them down and treating the stumps with herbicide to ensure they don't resprout.

It's not just new plantings that are at risk from weeds; established plantings or forest remnants are at risk from species that are able to replace indigenous canopy trees. Around Dunedin, the most significant threats are climbing species such as Chilean flame creeper (*Tropaeolum speciosum*), banana passionfruit (*Passiflora 'Tacsonia'*) and old man's beard (*Clematis vitalba*) and exotic tree species such as sycamore (*Acer pseudoplatanus*), radiata pine



Controlling weeds:

- **Grass swards/rank grass**
Cut with scrub bar, cover with natural fibre material or spray with herbicide.
- **Woody weeds**
Cut and treat stumps, pull out seedlings

(*Pinus radiata*), Douglas fir (*Pseudotsuga menziesii*) and hawthorn (*Crataegus monogyna*)². Other problem weeds include Himalayan honeysuckle, blackberry, jasmine, pampas, periwinkle, cotoneaster, boxthorn, barberry, crack willow, grey willow, elderberry, rowan and white poplar. Riparian weeds include montbretia, yellowflag iris and glyceria³. All these species can overtop and shade both native seedlings and mature plants, ultimately killing them.



Figure 7: A Greggs coffee sack protects tī kōuka/ cabbage tree seedling from grass growth

2 Wildland Consultants, 2016c

3 Otago Conservation Management Strategy 2016, Department of Conservation

Examples of climbing (Figure 8) and exotic weeds (Figure 9).

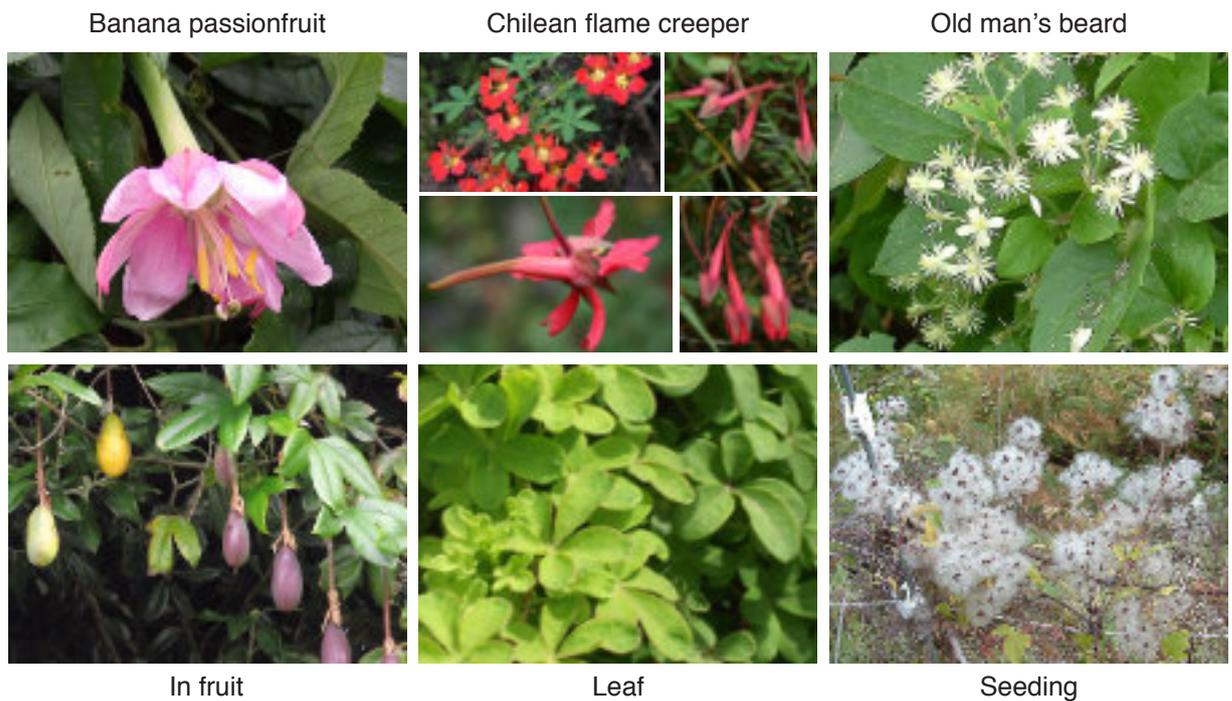


Figure 8: Climbing weeds (Photos: Otago Regional Council and Weedbusters)



Figure 9: Exotic weeds (Photos: Otago Regional Council or Weedbusters)



Useful Resources (information on weeds and control):

Weedbusters NZ (weed identification and control guidelines)
<http://www.weedbusters.org.nz/weed-information/>

Otago Regional Council Pest Hub (weed identification/ control guidelines)
<https://www.orc.govt.nz/managing-our-environment/pest-hub>

1.5

Protect plantings from animal browsing

To survive and thrive, seedlings need to be protected from browsing by stock and animal pests.

Fencing is the simplest way to protect plantings from stock. However, if stock are excluded entirely, weed growth between plantings is likely to increase, requiring further management action.



Options for ongoing protection from animal browse:

- *Fence planting sites from stock*
- *Shield with plant protectors*
- *Hunt, trap or poison pest animals.*



It may be necessary to permit stock access as part of normal farming operations.

Figure 10: Post and netting stock fence

Plant protectors can be used to prevent trees and shrubs from being browsed while still permitting stock access. This may be a good option for plantings in tree-lands. Plant protectors can be any device that prevents animal browse, such as plastic sleeves, netting or a modified 44-gallon drum. In situations where stock have access to the site, drums are a great option as they are sturdy and not easily knocked over.

See Section 3 for descriptions of vegetation types

While plant protectors shield seedlings from pest animals (e.g. deer, pigs, goats, hares, possums, rabbits), the best solution for minimising damage to plants is pest control.

Most pest species can be controlled to relatively low numbers through regular hunting. Possums may require other forms of control as they can be difficult to hunt to low numbers if there are large patches of bush in the landscape. Trapping or poisoning are the most common methods used to control possums.

Note that standard plant protectors (usually 30-50 cm high) are designed to protect browsing by rabbits, hares and possums and will not protect seedlings from stock.

See the useful resources section below for more information on how to control these species.



Figure 11: Fibrous weed mat and CombiGuard protects young manuka from rabbit browse and weedeater damage



Figure 12: Riparian plantings protected by stock fences and plastic sleeves



Figure 13: Possum traps (left to right): Sentinel, Trapinator and Timms

Useful Resources (information on pest control):

The Halo Project (predator control best practice, health & safety)
<https://www.haloproject.org.nz/>

Bionet (pest monitoring and control guidelines)
<https://www.bionet.nz/library/npca-publications/> (best practice guidelines)



Otago Regional Council Pest Hub
<https://www.orc.govt.nz/managing-our-environment/pest-hub>

Trap.NZ (predator management database)
<https://www.trap.nz/>

2

PLANTING AN OPEN SITE

You may be wanting to restore a site where there is little or no native vegetation (e.g. retired pasture).

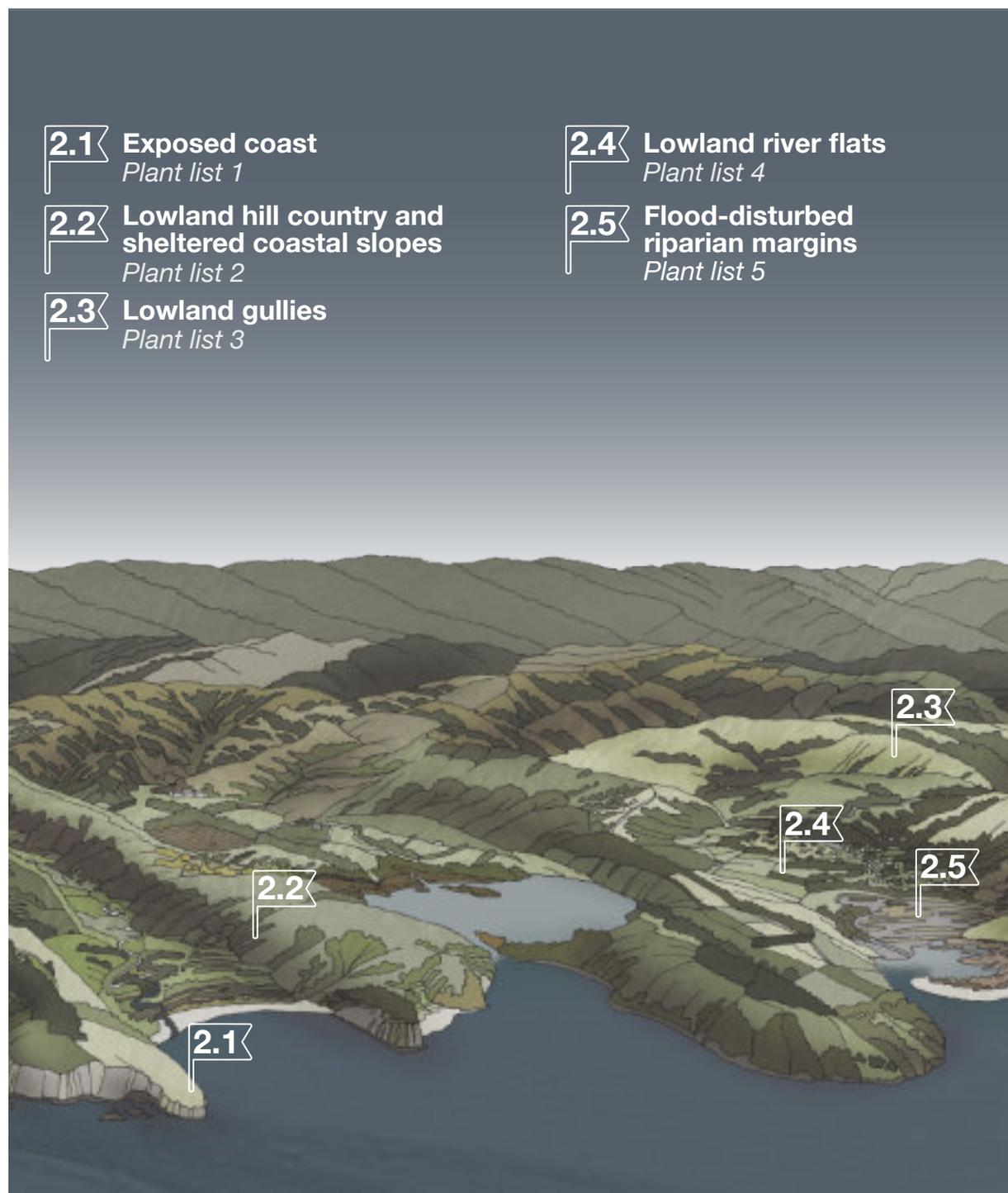
Where there are no native trees providing clues of a past forest type, you need to determine which landform you wish to restore. This section provides a list of plants suitable for each of the main landform types, and their associated environmental conditions, that are common within the Halo Project area.

If you are planting an open site, select the landform description that most closely represents your site and use that to guide your plant choice. Note that you don't have to plant all of the species. Talk to your local native plant nurseries as they may have further suggestions of species suitable for your situation.



Figure 14: Volunteers planting an open site on lowland hill country. Ngaio, broadleaf and harakeke are planted in the foreground

Common landform types in eastern Otago



Use this landform diagram to identify common landform types on your property.



Useful Resources (further information on planting):

Dunedin City Council's (DCCs) Native Planting Guide and Webmap
(<https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>).

2.1 Exposed coastal sites



kōhūhū

Figure 15: Aerial view of an open, exposed coastal site

These sites are characteristically dry and subject to strong winds and salt spray due to their highly exposed nature. They're also typically covered in exotic grass swards, something that needs consideration if the site is to be planted.

Due to the harsh nature of these locations, **staging** of plantings will be critical.

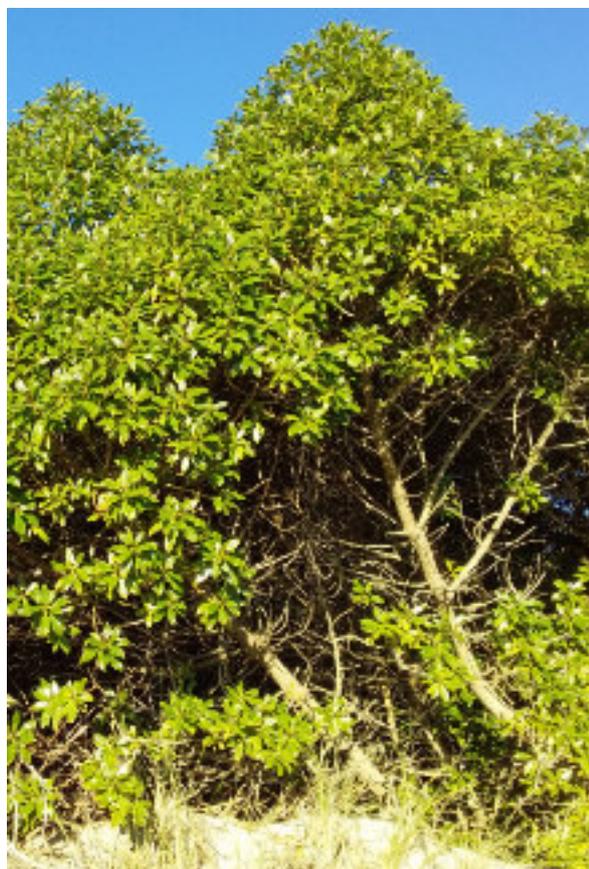


Figure 16: Ngaio (*Myoporum laetum*) on sand dune



Staging is planting hardy species first, allowing them to establish, grow and, in turn, provide shelter for other species which can be planted later.



Plant List 1:

Species recommended for open sites in dry, exposed coastal locations in eastern Otago

The species in shaded boxes should be planted first, with any of the other species planted once those hardy species have established and provide a degree of shelter.

Species	Common name(s)	Plant type	Growth rate	Relative abundance
<i>Carmichaelia petriei</i>	Desert broom	Shrub	Slow	Low
<i>Coprosma crassifolia</i>	Mikimiki, yellow wood	Shrub	Slow	Low
<i>Coprosma propinqua</i>	Mingimingi	Shrub	Moderate	High
<i>Cordyline australis</i>	Cabbage tree, tī kōuka	Tree	High	Moderate
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree	Moderate	Low
<i>Hoheria augustifolia</i>	Narrow-leaved lacebark	Tree	Moderate	Moderate
<i>Meliccytus ramiflorus</i>	Māhoe, whitey-wood	Tree	High	Moderate
<i>Myoporum laetum</i>	Ngaio	Tree	High	High
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree	Slow	Moderate
<i>Olearia fragrantissima</i>	Fragrant tree daisy	Tree	Slow	Low
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree	High	High
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree	High	Moderate
<i>Podocarpus totara</i>	Tōtara	Tree	Slow	Low
<i>Prumnopitys taxifolia</i>	Mataī, black pine	Tree	Slow	Low
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree	Moderate	Low
<i>Pseudopanax ferox</i>	Fierce lancewood	Tree	Slow	Low
<i>Sophora microphylla</i>	Kōwhai	Tree	Slow	Moderate

Additional information on plants for “coastal shrubland and coastal broadleaf forest” is available on Dunedin City Council’s website <https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>.

2.2 Lowland hill country and sheltered coastal slopes



These areas can be planted with a similar selection as exposed coastal sites but do not require the same sort of staging. These areas are generally dominated by broadleaf tree species and will likely establish full forest structure given enough time.

Māhoe (*Melicytus ramiflorus*) is a species that is **not particularly tolerant of exposure** but in these more sheltered locations it can be planted at higher densities than in exposed coastal sites. The high growth rate of this species also means it is capable of forming a canopy relatively quickly, promoting forest development.



houhere



māhoe



Figure 17: Example of planting on lowland hill country and sheltered coastal slopes



Plant List 2:

Plant species recommended for open sites in lowland hill country and sheltered coastal areas in eastern Otago

Species	Common name(s)	Plant type	Growth rate	Relative abundance
<i>Coprosma crassifolia</i>	Mikimiki, yellow wood	Shrub	Slow	Low
<i>Coprosma propinqua</i>	Mingimingi	Shrub	Moderate	Moderate
<i>Cordyline australis</i>	Cabbage tree, tī kōuka	Tree	High	Moderate
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree	Moderate	Moderate
<i>Hoheria augustifolia</i>	Narrow-leaved lacebark, narrow-leaved houhere, houhi puruhi	Tree	Moderate	Moderate
<i>Meliccytus ramiflorus</i>	Māhoe, whiteywood	Tree	High	High
<i>Myoporum laetum</i>	Ngaio	Tree	High	Moderate
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree	Slow	Moderate
<i>Phormium tenax</i>	Harakeke, flax	Herb	Moderate	Moderate
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree	High	High
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree	High	High
<i>Podocarpus totara</i>	Tōtara	Tree	Slow	Low
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree	Moderate	Low
<i>Sophora microphylla</i>	Kōwhai	Tree	Slow	Moderate

Additional information on plants for “coastal broadleaf forest” is available on Dunedin City Council’s website <https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>.

2.3 Lowland gullies

Lowland gullies are not typically affected by harsh coastal conditions, so a greater diversity of forest tree species can be planted; species such as fuchsia/kōtukutuku, wineberry/makomako and marbleleaf/putaputawētā. These sites do not typically contain coastal tree species (e.g. ngaio) that are seen in the coastal habitats.

Given enough time, these sites are likely to succeed into podocarp forest.



putaputawētā



makomako



kōtukutuku



Figure 18: Aerial view of a lowland gully system



Plant List 3:

Plant species recommended for open sites in lowland gullies in eastern Otago.

Species	Common name(s)	Plant type	Growth rate	Relative abundance
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree	High	Moderate
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree	High	Low
<i>Coprosma propinqua</i>	Mingimingi	Shrub	Moderate	Moderate
<i>Cordyline australis</i>	Cabbage tree, tī kōuka	Tree	High	Moderate
<i>Dacrycarpus darcydioides</i>	Kahikatea, white pine	Tree	Moderate	Low
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree	Fast	High
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree	Moderate	Moderate
<i>Hoheria augustifolia</i>	Narrow-leaved lacebark	Tree	Moderate	Moderate
<i>Kunzea ericoides</i>	Kānuka	Tree	High	Moderate
<i>Meliccytus ramiflorus</i>	Māhoe, whitey-wood	Tree	High	High
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree	Slow	Moderate
<i>Pennantia corymbosa</i>	Kaikomako	Shrub	Slow	Low
<i>Phormium tenax</i>	Harakeke, flax	Shrub	Moderate	Moderate
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree	High	Moderate
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree	High	High
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree	High	High
<i>Podocarpus totara</i>	Tōtara	Tree	Slow	Low
<i>Pseudopanax colensoi</i>	Three finger, mountain five-finger	Tree	Moderate	Moderate
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree	Moderate	Low
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree	Moderate	Low
<i>Sophora microphylla</i>	Kōwhai	Tree	Slow	Moderate

Additional information on plants for “coastal broadleaf forest” is available on Dunedin City Council’s website <https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>.

2.4 Lowland river flats



River flats are one of the environments that have had the greatest amount of habitat loss due to their suitability for agriculture. Restoring the natural vegetation of these fertile and productive ecosystems is crucial for conservation.

Lowland alluvial soils can support a wide range of broadleaf (e.g. narrow-leaved lacebark, lowland ribbonwood) and podocarp (e.g. mataī or kahikatea) tree species, with the site eventually becoming podocarp forest.



Figure 19: Natural riparian habitat and podocarp/broadleaved forest (Photo: Allison Beckham, Credit ODT 21 March 2015)



Plant List 4:

Species recommended for open sites in lowland river flats in eastern Otago.

Species	Common name(s)	Plant type	Growth rate	Relative abundance
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree	High	Moderate
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree	High	Moderate
<i>Coprosma propinqua</i>	Mingimingi	Shrub	Moderate	Low
<i>Cordyline australis</i>	Cabbage tree, tī kōuka	Tree	High	Moderate
<i>Dacrydium cupressinum</i>	Rimu, red pine	Tree	Slow	Low
<i>Dacrycarpus darcydioides</i>	Kahikatea, white pine	Tree	Moderate	Low
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree	Fast	High
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree	Moderate	Moderate
<i>Hoheria augustifolia</i>	Narrow-leaved lacebark	Tree	Moderate	Moderate
<i>Kunzea ericoides</i>	Kānuka	Tree	High	Low
<i>Meliccytus ramiflorus</i>	Māhoe, whitey-wood	Tree	High	High
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree	Slow	Low
<i>Pennantia corymbosa</i>	Kaikomako	Shrub	Slow	Low
<i>Phormium tenax</i>	Harakeke, flax	Herb	Moderate	Low
<i>Pittosporum eugenoides</i>	Tarata, lemonwood	Tree	High	Moderate
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree	High	High
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree	High	High
<i>Podocarpus totara</i>	Tōtara	Tree	Slow	Low
<i>Prumnopitys taxifolia</i>	Mataī, black pine	Tree	Slow	Low
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree	Moderate	Moderate
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree	Moderate	Moderate
<i>Sophora microphylla</i>	Kōwhai	Tree	Slow	Moderate

Additional information on plants for “alluvial and swamp forest” is available on Dunedin City Council’s website <https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>.

2.5 Flood-disturbed riparian margins

Planting stream or river margins will create new habitat for wildlife, protect banks from erosion, and increase filtering of runoff before it enters waterways.

Frequent flooding at these sites can make it difficult for forest plant species to establish. Planting flood-tolerant species at the right time helps reduce the risk of having your hard work destroyed when flooding damages or washes away seedlings.

Moderately flood tolerant trees can be planted further from the regularly-flooded zone to recreate a natural riparian margin sequence. Lowland ribbonwood/ mānatu, fuchsia/ kōtukutuku, seven-finger/ patete and wineberry/ makomako all grow well in relatively damp locations and are moderately tolerant of flooding. The plant species recommended for river flats and lowland gullies are suitable for planting further away from the stream margins.

Plant during periods of relatively fine



Figure 20: Aerial view of riparian planting, Waitati Stream

weather. This will ensure plants have time to establish before any major flood events. In eastern Otago, the periods of lowest rainfall are from July to November and January to February.

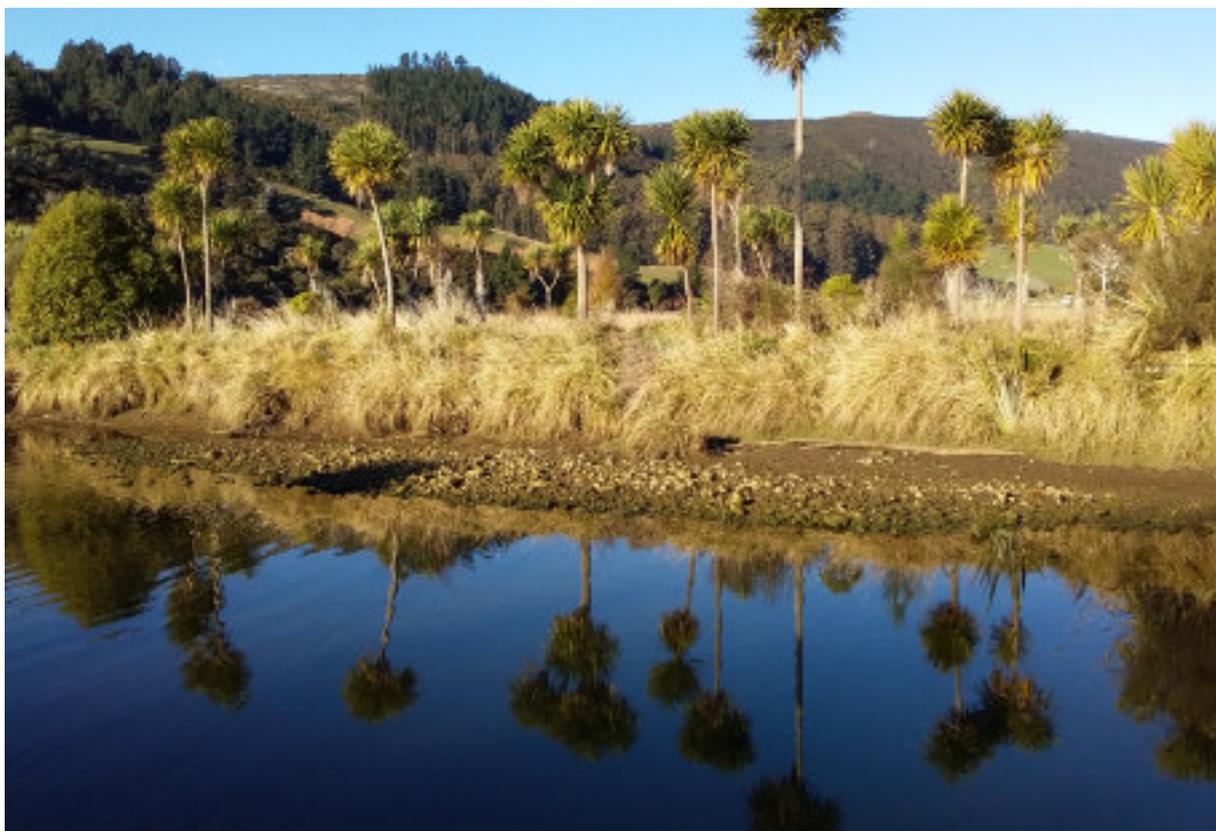


Figure 21: Riparian restoration along the banks of Waitati Stream



Plant List 5:

Species recommended for open sites of flood-disturbed stream/river margins in eastern Otago

Plant grasses, sedges, rushes and herbs closest to the water channel.

Plant trees just above or back from regularly flooded banks.

Moderately flood tolerant trees are shaded in the list.

Species	Common name(s)	Plant type	Growth rate	Relative abundance
<i>Austroderia richardii</i>	Toetoe	Grass	Moderate	Moderate
<i>Carex geminata</i>	Rautahi, cutty grass	Sedge	Moderate	High
<i>Juncus edgariae</i>	Hard rush	Rush	Moderate	High
<i>Microlaena avenacea</i>	Bush rice grass	Grass	Moderate	High
<i>Phormium tenax</i>	Harakeke, flax	Herb	Moderate	Moderate
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree	High	Moderate
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree	Fast	High
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree	High	High
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree	Moderate	Moderate

Additional information on plants for “alluvial and swamp forest” is available on Dunedin City Council’s website <https://www.dunedin.govt.nz/dunedin-city/maps-and-photos/native-planting-in-dunedin>.

3

SUPPLEMENTARY PLANTING

Supplementary planting in and around remnant or regenerating vegetation will increase the size and connectivity of native habitat within the landscape.

A large number of remnant and regenerating forest patches already exist within the Halo Project area. Opting to restore these sites, as opposed to planting entirely new ones, is likely to be

the more common approach. In these situations, you already have an indication of the vegetation that naturally grows at the site, allowing you to plan your plantings to reflect the natural species composition.

Select the habitat type that most closely reflects the site you wish to restore, using the accompanying species list to guide your restoration planting. You don't have to plant all the species on the list. Talk to your local native plant nurseries as they may have further suggestions of species suitable for your situation.



Figure 22: An example of an area of regenerating broadleaf forest which could be enhanced with supplementary planting around the edge and in gaps



Figure 23: Supplementary planting of lowland podocarp forest at Woodhaugh Gardens (Photo: Lions Club of Dunedin)

Forest remnant habitat types of eastern Otago

3.1 Podocarp forest
Plant list 6

3.2 Broadleaved forest
Plant list 7

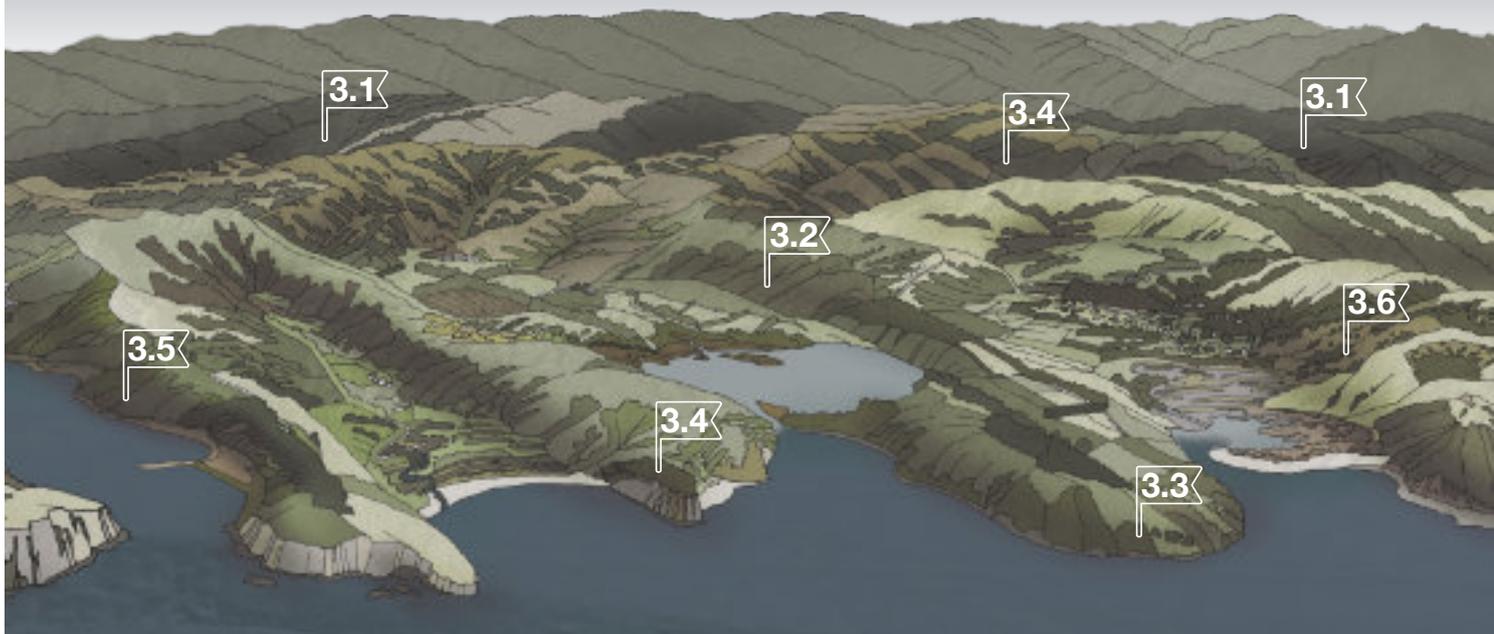
3.3 Coastal forest and tree-land
Plant list 8

3.4 Kōwhai dominated forest and tree-land
Plant list 9

3.5 Kānuka dominated forest
Plant list 10

3.6 Regenerating forest
Plant list 11

3.7 Forest understorey
Plant list 12



Use this landform diagram to identify your forest remnant habitat types.

3.1 Podocarp forest

Podocarp forests in the Halo Project area are typically dominated by large, emergent rimu, miro and mataī trees with a sub-canopy of broadleaf species such as broadleaf, marbleleaf and fuchsia. The understorey is dominated by small-leaved shrubs and tree ferns with ferns and herbs dominating the ground layer.

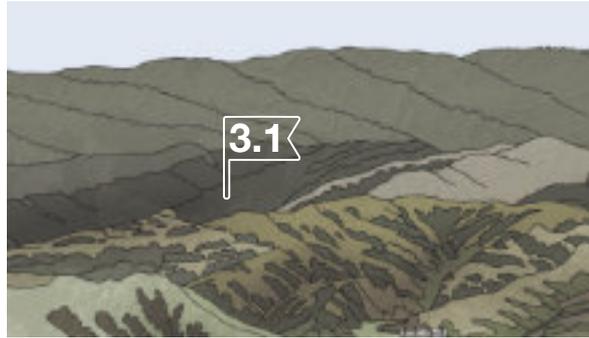


Figure 24: Aerial view of podocarp forest at Sullivan's Dam, Leith Saddle

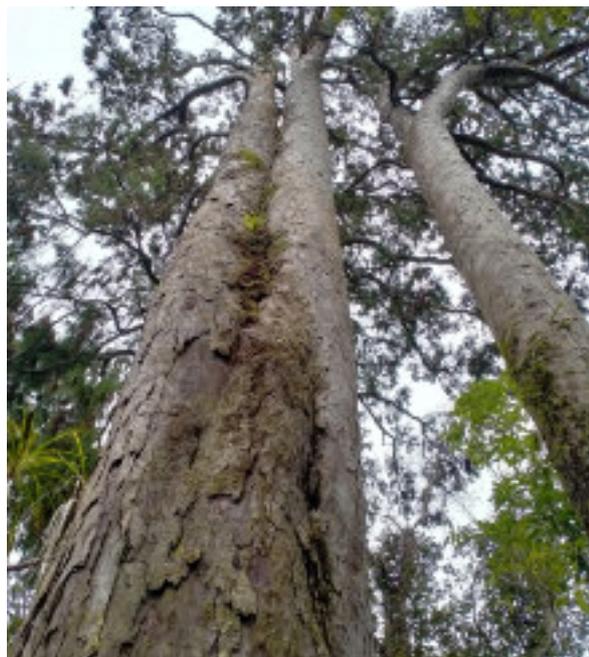


Figure 25: Mataī on left (Photo: Mataī in Takaka_Katie J_Used under license CC-BY-NC) and rimu on right are common in established podocarp forests (Photo: Rimu at Punakaiki_John Barkla CC-BY)



Plant List 6:

Plant species recommended for supplementary planting in or near podocarp forest remnants in eastern Otago.

Species	Common name(s)	Plant type
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Blechnum chambersii</i>	Lance fern, nini, rereti	Fern
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree
<i>Coprosma linariifolia</i>	Mikimiki, yellow wood	Tree
<i>Cyathea smithii</i>	Soft tree fern	Tree fern
<i>Dicksonia squarrosa</i>	Whekī, rough tree fern	Tree fern
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Leptopteris hymenophylloides</i>	Crape fern, heruheru	Fern
<i>Melicytus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree
<i>Polystichum vestitum</i>	Pūnui, prickly shield fern	Fern
<i>Pseudopanax colensoi</i>	Three finger, mountain five-finger	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Pseudowintera colorata</i>	Horopito, pepper tree	Shrub
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree

3.2 Broadleaved forest

Broadleaved forest lacks the large, emergent trees that dominate areas of podocarp forest. Except for those large trees, broadleaved forest has similar plant composition to podocarp forest and should be planted in a similar manner (i.e. plant shrub and tree species before understorey species like ferns and tree ferns).

Broadleaved forest is dominated by fleshy-fruited tree species making these habitats particularly popular with frugivorous bird species such as kererū (wood pigeon), tūi and korimako/bellbird.

Broadleaved forest is one of the most extensive forest types in the Halo Project area.



Figure 26: Broadleaf-forested gully flanked by regenerating areas of gorse scrub (Photo: Wildland Consultants)



Plant List 7:

Plant species recommended for supplementary planting in or near broadleaved forest in eastern Otago.

Species	Common name(s)	Plant type
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Blechnum chambersii</i>	Lance fern, nini, rereti	Fern
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree
<i>Coprosma linariifolia</i>	Mikimiki, yellow wood	Tree
<i>Cyathea smithii</i>	Soft tree fern	Tree fern
<i>Dicksonia squarrosa</i>	Whekī, rough tree fern	Tree fern
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Leptopteris hymenophylloides</i>	Crape fern, heruheru	Fern
<i>Melicytus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree
<i>Polystichum vestitum</i>	Pūnui, prickly shield fern	Fern
<i>Pseudopanax colensoi</i>	Three finger, mountain five-finger	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Pseudowintera colorata</i>	Horopito, pepper tree	Shrub
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree

3.3 Coastal forest and tree-land

Coastal forest is one of the least common habitat types in eastern Otago. The plant species that compose this forest type are typically hardy and somewhat resistant to the harsh coastal conditions. Any supplementary planting should try to match the plant composition of the nearest remnant as closely as possible.

Tree-lands are groups of mature trees or shrubs that may or *may* not form a canopy and generally have pasture or bare ground beneath. These habitats lack any other features typical of forest ecosystems (e.g. understorey vegetation)



and so do not provide particularly good habitat for native species.

The threatened shrub, *Olearia fragrantissima* is found in coastal forest in eastern Otago. Protecting coastal forest and increasing its size is important for conserving this endangered species.

As well as being habitat for forest birds, coastal forest may also be vital to seabirds which nest along our coast, such as tītī or muttonbirds, blue penguins and hoiho or yellow-eyed penguins.



Figure 27: Kōwhai tree-land with only old trees, a common native tree-land type within Halo Project's coastal areas



Plant List 8:

Plant species recommended for supplementary planting in or near coastal forest and tree-land in eastern Otago.

Species	Common name(s)	Plant type
<i>Acaena juvenca</i>	Bidibid, piripiri	Herb
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Carex forsteri</i>	Forster's sedge	Sedge
<i>Dacrydium cupressinum</i>	Rimu, red pine	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Hoheria angustifolia</i>	Narrow-leaved lacebark	Tree
<i>Melicetyus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Microsorium pustulatum</i>	Hound's tounge fern	Epiphyte
<i>Muehlenbeckia australis</i>	Pohuehue, large-leaved muehlenbeckia	Climber
<i>Myoporum laetum</i>	Ngaio	Tree
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree
<i>Olearia fragrantissima</i>	Fragrant tree daisy	Shrub
<i>Pittosporum eugenoides</i>	Tarata, lemonwood	Tree
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree
<i>Podocarpus tōtara</i>	Tōtara	Tree
<i>Polystichum neozelandicum</i>	Shield fern	Fern
<i>Polystichum vestitum</i>	Pūnui, prickly shield fern	Fern
<i>Prumnopitys taxifolia</i>	Mataī, black pine	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Pseudopanax ferox</i>	Fierce lancewood	Tree
<i>Rytidosperma gracile</i>	Dainty bristle grass	Grass

3.4 Kōwhai-dominant forest and tree-land

Kōwhai-dominant forests and tree-lands typically occur in warm, productive locations. Tree-lands are groups of mature trees or shrubs that may or may not form a canopy and generally have pasture or bare ground beneath.

Given these sites are also highly suitable for agriculture, kōwhai forests have been replaced by pasture. The flowers of the plants are important for nectar-feeding birds such as kākā, korimako/bellbirds and tūi, for kererū that eat the flowers, and for birds that eat the insects associated with kōwhai, such as shining cuckoo and grey warbler.

Although kōwhai is the most notable species, many other trees and shrubs are associated with this habitat type. Many species common in broadleaved forest and coastal forest are also commonly found in kōwhai-dominated forest (e.g. broadleaf, māhoe, lemonwood).

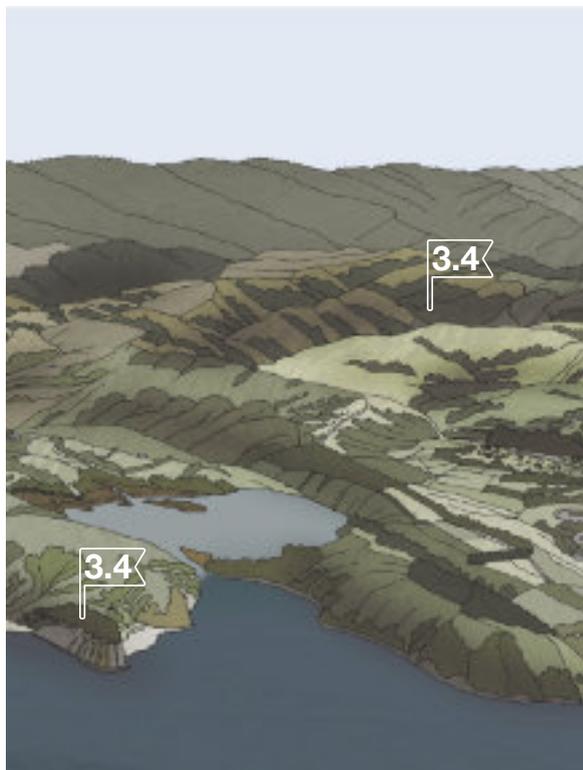


Figure 28: A senescing (declining) kōwhai tree-land (foreground) (Photo: Wildland Consultants)



Plant List 9:

Species recommended for supplementary planting in or near kōwhai forest and tree-land in eastern Otago.

Species	Common name(s)	Plant type
<i>Acaena juvenca</i>	Bidibid, piripiri	Herb
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Brachyglottis sciadophila</i>	Climbing groundsel	Herb
<i>Coprosma</i> spp.	Any of the small-leaved coprosmas	Shrub/Tree
<i>Corokia cotoneaster</i>	Korokio, wire-netting bush	Shrub
<i>Dacrycarpus dacrydioides</i>	Kahikatea, white pine	Tree
<i>Dacrydium cupressinum</i>	Rimu, red pine	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Helichrysum lanceolatum</i>		Shrub
<i>Hoheria angustifolia</i>	Narrow-leaved lacebark	Tree
<i>Lophomyrtus obcordata</i>	Rohutu, New Zealand myrtle	Shrub
<i>Melicope simplex</i>	Poataniwha	Shrub
<i>Melicytus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Muehlenbeckia australis</i>	Pohuehue, large-leaved muehlenbeckia	Climber
<i>Myrsine australis</i>	Red māpou, red matipo, māpau, red maple	Tree
<i>Pellaea rotundifolia</i>	Round-leaved fern, New Zealand cliff brake	Fern
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree
<i>Plagianthus regius</i>	Ribbonwood, lowland ribbonwood, mānatu	Tree
<i>Poa matthewsii</i>		Grass
<i>Podocarpus tōtara</i>	Tōtara	Tree
<i>Polystichum neozelandicum</i>	Shield fern	Fern
<i>Polystichum vestitum</i>	Pūnui, prickly shield fern	Fern
<i>Prumnopitys taxifolia</i>	Mataī, black pine	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Rubus</i> spp.	Bush lawyer	Climber
<i>Sophora microphylla</i>	Kōwhai	Tree
<i>Urtica ferox</i>	Ongaonga, tree nettle	Shrub

3.5 Kānuka-dominant forest

Kānuka is an early-successional species meaning that when land is retired it is one of the first plant species to colonise, particularly if the site is cleared by fire.

The history of forest clearance for agriculture in the Halo Project area has resulted in kānuka-dominant forest becoming the most common type of indigenous vegetation. This forest type is often highly diverse with the kānuka canopy typically providing shelter for numerous broadleaf tree species which will eventually replace the kānuka canopy.



These habitats are favoured by many species of native birds, particularly brown creeper, fantail, robin and rifleman.

Given the scarcity of robins and rifleman in eastern Otago, conserving and enhancing kānuka-forest may prove vital to their conservation, as well as benefitting all of the other native bird species that frequent this habitat.



Figure 29: Kānuka dominant forest (dark green) and regenerating broadleaf forest (bright green in foreground) on the eastern flanks of Mopanui (Photo: Flyover Media)



Figure 30: Mature kānuka forest with regenerating broadleaved trees emerging through canopy gaps in Waitati



Plant List 10:

Plant species recommended for supplementary planting in or near kānuka-dominant forest in eastern Otago.

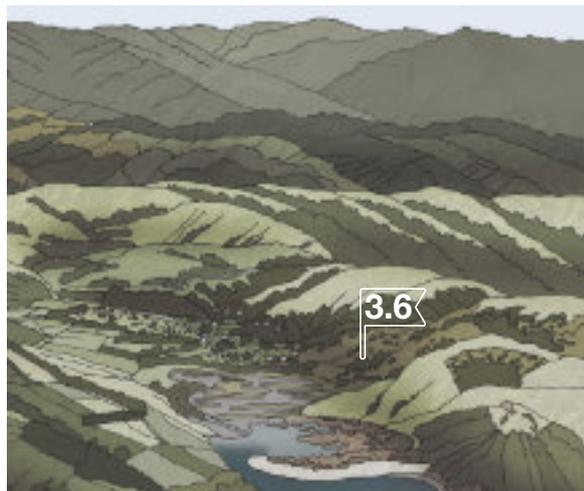
Species	Common name(s)	Plant type
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Blechnum chambersii</i>	Lance fern, nini, rereti	Fern
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree
<i>Coprosma linariifolia</i>	Mikimiki, yellow wood	Tree
<i>Cyathea smithii</i>	Soft tree fern	Tree fern
<i>Dicksonia squarrosa</i>	Whekī, rough tree fern	Tree fern
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Kunzea robusta</i>	Kānuka	Tree
<i>Leptopteris hymenophylloides</i>	Crape fern, heruheru	Fern
<i>Melicytus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree
<i>Polystichum vestitum</i>	Pūnui, prickly shield fern	Fern
<i>Pseudopanax colensoi</i>	Three finger, mountain five-finger	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Pseudowintera colorata</i>	Horopito, pepper tree	Shrub
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree

3.6 Regenerating forest

Here, the term ‘regenerating forest’ refers to areas of exotic scrub (e.g. gorse and broom) that are in the process of returning to native forest. If given enough time, native seedlings are likely to grow through the scrub, forming a canopy which will shade and kill the scrub, eventually forming a new forest.

If you are planning to plant in or around these areas, choose mainly broadleaf tree species because they are more effective at shading-out scrub. Once the canopy of native trees has established, understorey species can be planted under the newly-formed canopy to enhance forest development.

The best method for planting in areas of gorse and broom is to clear ‘wells’ in the scrub to plant in. A ‘well’ is simply a cleared patch of whatever size is most



practical for your situation. Wells can be created with hand tools, a scrub bar, or for big jobs – an excavator mulcher. Wells provide an area with enough light for native seedlings to grow. Once large enough, native plantings will act as a seed source for further forest regeneration. Some initial maintenance of plantings will be required in these wells, but once plants have grown above scrub height, little or no input is required.



Figure 31: Gorse scrub adjacent to kānuka-dominant forest (Photo: Wildland Consultants)



Plant List 11:

Plant species recommended for supplementary planting in or near regenerating forest in eastern Otago.

Species	Common name(s)	Plant type
<i>Aristotelia serrata</i>	Wineberry, makomako	Tree
<i>Carpodetus serratus</i>	Marbleleaf, putaputawētā	Tree
<i>Coprosma linariifolia</i>	Mikimiki, yellow wood	Tree
<i>Fuchsia excorticata</i>	Kōtukutuku, tree fuchsia	Tree
<i>Griselinia littoralis</i>	Broadleaf, kāpuka, pāpāuma	Tree
<i>Melicytus ramiflorus</i>	Māhoe, whitey-wood	Tree
<i>Pittosporum eugenioides</i>	Tarata, lemonwood	Tree
<i>Pittosporum tenuifolium</i>	Kōhūhū, black matipo	Tree
<i>Pseudopanax colensoi</i>	Three finger, mountain five-finger	Tree
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood	Tree
<i>Pseudowintera colorata</i>	Horopito, pepper tree	Shrub
<i>Schefflera digitata</i>	Patete, patē, seven-finger	Tree
<i>Podocarpus tōtara</i>	Tōtara	Tree
<i>Prumnopitys taxifolia</i>	Mataī, black pine	Tree

3.7

Forest understorey

If you have native forest remnants or tree-lands on your property that have been grazed by stock, then chances are the understorey is relatively bare. These remnants can be significantly enhanced and their future assured by re-establishing typical forest structure.

Ferns, tree ferns, herbs and climbers dominate the understorey of eastern Otago forests. The species below are suitable for most understorey restoration planting, particularly bush flax, whekī, crown fern, and hen and chicken fern.

With the exclusion of stock and appropriate pest control, canopy species will once again be able to regenerate through the understorey.



Figure 32: Kakaha/bush flax (Astelia fragrans)



Figure 33: Healthy forest understorey with kakahah/ bush flax

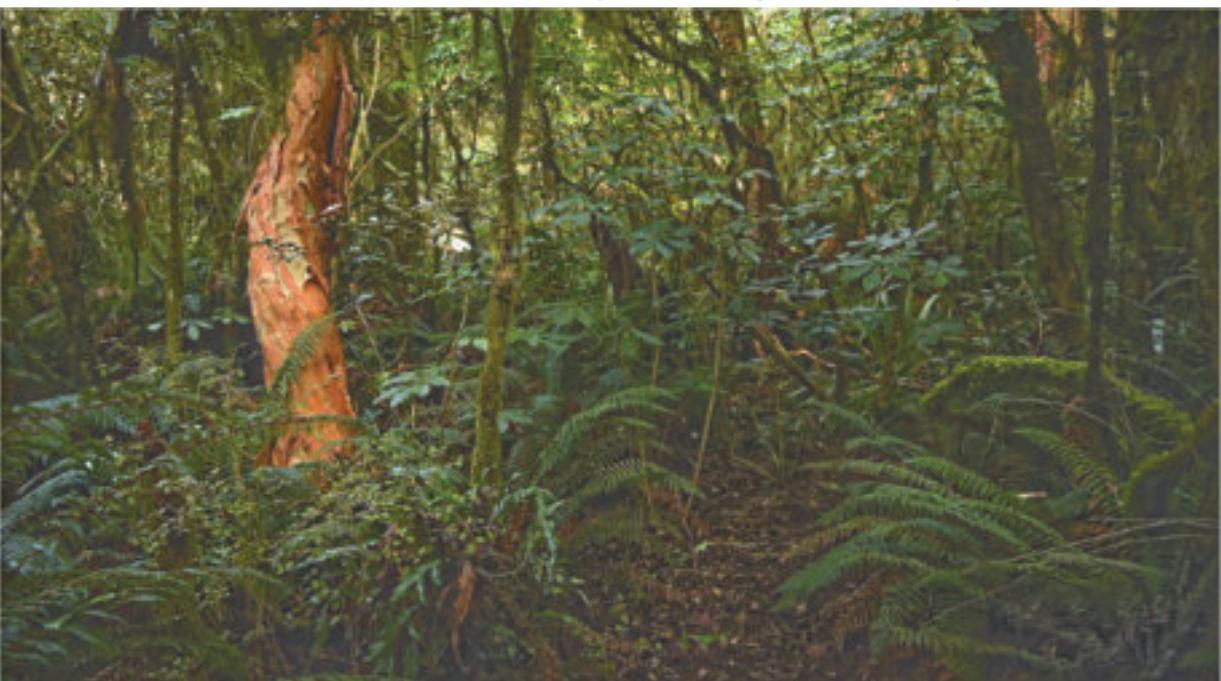


Figure 34: Moore's Bush - podocarp forest understorey (Photo: Forest and Bird)



Plant List 12:

Species recommended for supplementary planting in forest understorey in eastern Otago.

Species	Common name(s)	Plant type
<i>Acaena juvenca</i>	Bidibid, piripiri	Herb
<i>Asplenium bulbiferum</i>	Hen and chicken fern, pikopiko, mother spleenwort	Fern
<i>Asplenium flabellifolium</i>	Butterfly fern, walking fern, necklace fern	Fern
<i>Asplenium hookerianum</i>	Hooker's spleenwort	Fern
<i>Asplenium obtusatum</i>	Shore spleenwort	Fern
<i>Astelia fragrans</i>	Bush flax, kakaha	Herb
<i>Blechnum discolor</i>	Crown fern	Fern
<i>Blechnum minus</i>	Swamp kiokio	Fern
<i>Blechnum novaezelandiae</i>	Kiokio	Fern
<i>Brachyglottis sciadophila</i>	Climbing groundsel	Climber
<i>Carex forsteri</i>	Forster's sedge	Sedge
<i>Clematis paniculata</i>	Clematis, puawānanga	Climber
<i>Coprosma areolata</i>	Thin-leaved coprosma	Tree
<i>Cyathea smithii</i>	Soft tree fern	Tree fern
<i>Dianella nigra</i>	Tūrutu, New Zealand blueberry	Herb
<i>Dicksonia squarrosa</i>	Whekī, rough tree fern	Tree fern
<i>Lophomyrtus obcordata</i>	Rohutu, New Zealand myrtle	Tree
<i>Melicope simplex</i>	Poataniwha	Shrub
<i>Microlaena avenacea</i>	Bush rice grass	Grass
<i>Pellaea rotundifolia</i>	Round-leaved fern, New Zealand cliff brake	Fern
<i>Polystichum neozelandicum</i>	Shield fern	Fern
<i>Streblus heterophyllus</i>	Tūrepo, small-leaved milk tree	Tree
<i>Uncinia glabra</i>	Hooked sedge	Sedge
<i>Urtica ferox</i>	Tree nettle, ongaonga	Shrub

4

PLANTING AND MAINTENANCE



Correct planting and ongoing maintenance for your new native species will give them the best chance of survival.

This fourth section of the planting guide outlines best practice for planting as well as monitoring and maintenance.



Figure 35: Grass scrub cut prior to planting and plastic plant protectors used to protect plants from pests.



Figure 36: Planting into holes cut with scrub cutter



Figure 37: A selection of healthy plants ready for planting



Figure 38: Planting into holes cut with scrub cutter



Figure 39: Fenced off section of ex-pasture, maintenance is needed in order to keep grass from smothering planted seedlings

4.1 Planting

Taking the time to plant healthy seedlings carefully and correctly will save you losing plants to drought, flood or animal browse.



Figure 40: Harakeke seedling planted, staked and coffee sack weedmat applied



Figure 41: Newly planted māhoe with square weedmat

Our planting method is for sites already cleared of weeds and rank grass.

PLANTING METHOD:

1. Use a spade to remove the vegetation and dense root layer from the top of the planting site.
2. Dig a hole twice the size of the seedling's container.
3. Place the seedling and loosened soil in the hole so that the stem of the plant remains at the same level as it is in the container.
4. Carefully firm the soil around the seedling with your foot.
5. Water if possible.
6. Apply mulch/weed mat if present.
7. Bamboo stakes can be used to mark plants so they are not lost in rank grass.



Figure 42: Volunteers gathering mulch



Figure 43: Volunteers spread mulch around newly planted seedlings

4.2

Monitoring and maintenance

Some plant mortality is inevitable, but with ongoing monitoring of plant health, you may pick up on issues early enough to rectify problems and reduce plant mortality.

Build in time and budget to maintain plantings for three to five years, until plants are established and no longer threatened by weeds.

- ✓ Record observations
- ✓ Check fences and protectors
- ✓ Control weeds
- ✓ Water and mulch
- ✓ Replace dead plants

CHECKLIST:

- Record your observations and diagnose any problem: there may be a pattern.
- Regularly check that fences and plant protectors are intact and effective. Replace or mend where necessary. If evidence of browsing occurs, consider undertaking pest control.
- Control weeds so they don't smother young plants.
- Water and place mulch around seedlings during prolonged dry periods.
- Replace dead plants to avoid gaps.



Figure 44: Narrow leaved māhoe seedling with two out of three tips browsed (likely by a possum)



Figure 45: Gorse and grass are no longer a problem for this harakeke/flax planted 9 years ago



Figure 46: This 9 year old lowland ribbwood/mānatu is now well above the grasp of dense grass swards



Useful Resources (information on monitoring):

Department of Conservation (guide to monitoring / maintaining plantings)
<https://www.doc.govt.nz/about-us/science-publications/conservation-publications/protecting-and-restoring-our-natural-heritage-a-practical-guide/maintaining-a-restoration-project/>

Write your own notes here:

REFERENCES

Otago Conservation Management Strategy 2016, published by the Department of Conservation <https://www.doc.govt.nz/about-us/our-policies-and-plans/statutory-plans/statutory-plan-publications/conservation-management-strategies/otago/>

The following reports are available on our website: www.haloproject.org.nz see the Resources page:

Wildland Consultants (2016a) *Habitat relationships of forest birds in a mixed production landscape in east Otago*. Wildland Consultants Ltd Contract Report No.3412a. Prepared for Landscape Connections Trust, Dunedin. 65pp.

Wildland Consultants (2016b) *Beyond Orokonui Volume 1: indigenous biodiversity*. Wildland Consultants Ltd Contract Report No. 3412b. Prepared for Landscape Connections Trust, Dunedin. 43pp.

Wildland Consultants (2016c) *Beyond Orokonui Volume 2: management priorities and guidelines*. Wildland Consultants Ltd Contract Report No. 3412c. Prepared for Landscape Connections Trust, Dunedin. 25pp.

Wildland Consultants (2016d) *Descriptions of habitats mapped across the 'Beyond Orokonui' project area*. Wildland Consultants Ltd Contract Report No.3412d. Prepared for Landscape Connections Trust, Dunedin. 11pp.

This resource has been made possible with the generous support of the Department of Conservation and the Dunedin City Council.



The Halo Project
is brought to
you by the

