



groundtruth

TURITEA WEST FOREST

Native Forest Restoration after Harvest

June 2017



A report for

Palmerston North City Council.

PO Box 52, Paekakariki
Kapiti Coast, New Zealand
Ph 04 904 0876
www.groundtruth.co.nz



1. BACKGROUND	1
2. FORESTS, SOIL STABILITY AND REGENERATION	1
2.1 Overview	1
2.2 Assessment of Turitea West Block	2
3. RESULTS	5
4.1 Site and vegetation types	5
4.2 Revegetation approaches	5
5. DISCUSSION	7
6. RECOMMENDATIONS	7
REFERENCES	8
APPENDIX 1	9
APPENDIX 2: PLANT SPECIES LIST FROM SITE ASSESSMENT	10

1. BACKGROUND

Harvesting of a mature radiata pine plantation in the west of the Turitea Reserve, close to the water supply reservoirs is planned for the summer of 2017-18 (see map in Appendix 1). This harvest has been approved by Council.

At the Finance and Performance Committee meeting where harvest was considered, additional information was sought about the regeneration of the land into native forest following harvest of pine forest. The area will not be replanted in pines and will instead be regenerated into native forest. This supports the long-term reserve management objectives of water supply and biodiversity restoration in line with the Turitea Reserve Management Plan.

Groundtruth were engaged to provide an overview of the best approach to achieving rapid native forest regeneration and the risks and advantages of different methods.

The objectives of regeneration into native forest can be identified as including:

- Soil stability following harvest and tree removal – and subsequent long term soil protection
- Biodiversity values: Increasing areas of native vegetation and habitat.
- Weed management: Rapid establishment of native vegetation to suppress problem weeds.
- Ensuring regeneration of forest cover and avoiding deforestation in the terms of the Emissions Trading Scheme

This report provides information on native forest revegetation methods, identifies different types of site across the harvest area and recommends a practical and cost-effective approach.

Site visits were undertaken in March and June 2017 to identify native species already present and broadly assess the site.

2. FORESTS, SOIL STABILITY AND REGENERATION

2.1 Overview

Harvest of pine forest has occurred previously in this area in the 1970s. This involved ground based harvest machinery and significantly less sensitive harvest techniques than are used today. Assessment of the sedimentation risks to the water supply from harvest of this area was commented on in a harvest planning report by Forme Consulting Group in 1998. The small area of harvest relative to the catchment of the reservoirs means that erosion impact from this area is very small. This is combined with the fact that almost all areas of the forest are separated from the edge of the reservoir by a native forest buffer.

Forests protect soils and reduce erosion by two main processes. Firstly they keep soils drier because the forest canopy intercepts some rainfall that evaporates back into the atmosphere and the tree takes up moisture through its roots and transpires this into the atmosphere. Secondly tree roots physically bind the soil together. When a forest is harvested the drying effect is immediately removed. This begins to return as forest cover is re-established. The mechanical strength of roots is not immediately removed – as it takes some years for stumps and roots to rot and lose their strength. Radiata pine roots lose about half their strength after 18 months. As it always takes some time to re-establish a forest (whether it is pine or native forest) there is a period where roots from the previous forest have lost their strength, and the stabilising effect of the new forest has not replaced it because trees are still growing in size and forming a canopy cover.

Promoting rapid forest establishment keeps this “window of vulnerability” as narrow as possible. Restoring this area into permanent native forest will avoid future periods of erosion risk following harvest and also increase biodiversity value.

Groundtruth have significant experience assessing and managing areas of pine forest into permanent native forest following harvest. This includes local experience with PNCC forests on South Range Road and at Arapuke Forest Park. Some key findings from this work include:

- Plantation pine forests near to native forest will have major existing regeneration of native species in the understorey prior to harvest. This is particularly the case if pine stands have been pruned and thinned or have a greater proportion of gaps and edges.
- At harvest native species within the stand are crushed and damaged. However, most of the common species such as Mahoe (*Melcytus ramiflorus*), Pate (*Schlefera digitata*) and Pigeonwood (*Hedecarya arborea*) are able to re-sprout and grow rapidly following harvest. The combination of disturbance and the presence of existing native seed and seedlings means that a range of colonising native species regenerate rapidly.
- Gully areas, where crop trees are wherever possible pulled away from these areas to prevent damage, generally have more advanced regeneration and are less damaged during harvest – so provide rapid regeneration.
- Regeneration of pine seedlings will also occur. This is particularly a problem on warmer, drier northern faces. An annual programme of removing pine regeneration, mainly by hand pulling, is required.

Our work on these areas has shown that planting of native species is generally not warranted. In most cases it would be a waste of money as planted seedlings would soon be lost amongst large numbers of naturally regenerated seedlings.

2.2 Assessment of Turitea West Block

Existing native forest regeneration

The Turitea West Block is close to, and often surrounded by, native forest. Consequently it has abundant regeneration in the understorey as shown in the photos below. A wide range of species are present in the pine forest as seedlings and saplings – both understorey species and long-lived canopy species such as tawa (see Appendix 2).

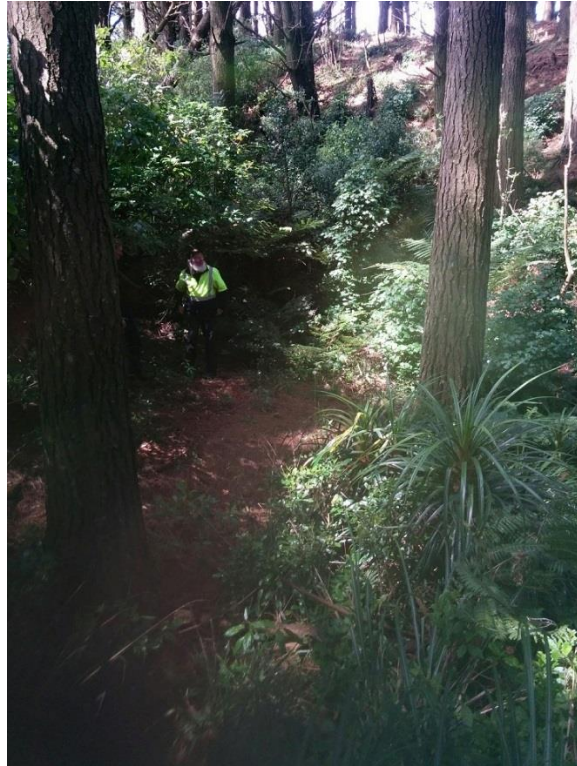


Advanced regeneration of native species amongst pine forest.

The main Tutaewhare Stream that leads into the lower reservoir has a gully area with some larger native trees and open canopy that has resulted in abundant native forest regeneration.



Larger native forest vegetation in Tutaewhare stream



More native regeneration in gully areas in forest.

Other moist small gully areas within the pine forest have greater and more developed native species regeneration (see photo above).

Overall, the forest area has a good level of native regeneration, particularly in areas that are wetter and have more open canopy.

Weeds

Areas of gorse and also Himalayan honeysuckle are present. Native species can regenerate through these weeds over time. However, they slow the speed of regeneration as they rapidly form a dense canopy that suppresses native species for a number of years until natives overtop these weed species. A sensible approach is to keep an eye on the establishment of these weed species. If they occur as scattered small patches only, following harvest, they can potentially be ignored as native species will overtop and shade them out. If large dense areas of these weeds develop, localised spraying of them to encourage native regeneration could be considered.

Pine regeneration hotspots

Following harvest there will be regeneration of pine seedlings. If these are not removed they will potentially dominate in some areas and result in the pine forest re-establishing. Bursting of pine cones and subsequent spread of seed is driven by temperature. Consequently, harvesting on warm north facing slopes over summer results in the greatest likelihood of large amounts of pine regeneration. The Turitea West block has a broadly southerly aspect so pine regeneration may not be as bad, as for example, has been experienced on the north faces of Arapuke Forest Park.

The greatest pine regeneration is likely to occur on the upper warm ridges, though scattered regeneration could occur throughout. Removal of regeneration will be required from approximately six months after harvest. Regenerating pines need to be big enough to easily hold to pull out, but not big enough to be hard to pull out (generally around 300 mm in height).

If very dense areas of pine regeneration occur, these can be sprayed out to reduce effort. A small number of stems that are missed in hand pulling can be cut. Generally a control program over approximately 3 years will be required with some final checks up to year 5. The first 1-2 years may require two visits per year to hand pull regen. By year 5 it will be an annual check to fell any small trees missed earlier.

Erosion risk areas

The most significant erosion area is likely to be a slip that is already present adjacent to the road above Tutaewhare Stream. This existing slip is shown on the map in Appendix 1.

It may be worth identifying if practical steps can be taken to drain water away from this slip area once the site is opened up at harvesting. This could help avoid any further de-stabilisation of the area due to wetter soils.

Careful harvesting to avoid new tracking in steep areas. Some small amounts of tracking proposed – but have been kept away from waterway areas.

Rapid regeneration is expected and should be monitored to confirm it is occurring. Simple photopoints are likely to be sufficient.

Areas where native regeneration may be less rapid

The key aspects that could affect regeneration include those covered above – weeds and pine regeneration. Management of those issues is discussed above and will need to occur to ensure rapid native forest regeneration.

One other area where regeneration may be slower is on some small areas of dry ridges. These occur on a number of small spurs on the northern farmland boundary. These areas may naturally establish in a cover of exotic grasses. This can slow regeneration as it is more difficult for seeds from native species to germinate and establish amongst dense grass cover. Depending on whether this establishment in grass does occur, simple management can be undertaken to promote regeneration in these areas. This would involve spot spraying grass regrowth and planting seedlings through these areas.

3. RESULTS

4.1 Site and vegetation types

The site assessment and review of native regeneration suggests that there are large amounts of established native regeneration. This regeneration will be damaged at harvest, but a large portion will recover and result in fairly rapid regeneration of the site back into native species. The following broad vegetation / management sites can be identified:

- **Moist gully areas:** These have large amounts of regeneration and are also sensitive in terms of impact of the harvesting operation on water quality. Harvesting away from any gully areas, in line with normal forestry practice will reduce the damage on these sites and mean that these areas regenerate particularly rapidly. Crossing of these gully areas will be minimised and located on established tracks.
- **Warm north faces:** These areas have some existing native regeneration, but may be likely to see more pine regeneration following harvest, so will require particular attention for pine regeneration control.
- **Dry ridges:** There are a small number of dry ridge areas, particularly close to the northern edge of the forest. These areas may be colonised by grass following harvest and be slower to regenerate into native species. These areas should be examined a year after harvesting to see if grass control and possibly some localised planting is required to enhance native regeneration.

4.2 Revegetation approaches

Expected outcome following harvest

From our experience and examination of this site we would expect the following to occur:

- Damage to small native trees, saplings and seedlings in harvest area during harvest
- Re-sprouting from broken stems of many damaged native tree species
- Growth of native seedlings once overhead pine canopy is removed.
- Germination and growth of pine seedlings, particularly in warmer dryer areas
- Growth of gorse and other weeds in localised areas where they were previously present
- Provided there is adequate control of pine regeneration and targeted other weed control, native species will rapidly dominate. Once they form a dense canopy over the site most weed species will be effectively suppressed and the native forest will continue to grow and mature with minimal management.

Given these expected outcomes, we do not consider that widespread planting of native species is warranted. Supporting natural regeneration from existing seedlings and subsequent bird spread seed appears to be the best pathway to restoring native forest.

Management requirements

We expect the following active management to be required:

- **Control of radiata pine regeneration:** Within 6 months of harvest pine seeds will germinate and seedlings begin to grow. An ongoing control programme is required to remove this regeneration over the first approximately 3 years following harvest. The most effective way to control pine regeneration is using the following mix of approaches:
 1. Leave regeneration to grow to around 30cm in height so it can be easily grasped in one hand and will pull out of the ground easily. This is likely to require around 6 months – until the first spring following harvest.
 2. Walk through areas of scattered regeneration hand pulling all the pine seedlings.
 3. Where there are very dense patches of pine seedlings use a knapsack sprayer to spot control

these areas of regeneration

4. Repeat hand pulling walking through the area twice a year. After the first two years this work will significantly reduce and may only require a check once a year.
 5. Do a final check through five years after harvest and fell any occasional individual pines that have missed earlier control.
- *Spot weed control:* During control of pine seedlings, identify any areas of dense patches of gorse, blackberry or other weeds. If these occur, undertake spray control. These areas can be controlled with a knapsack spray unit unless particularly large.
 - *Possible planting areas:* Inspect the whole area 3 years following harvest and identify if there are areas that are not regenerating into native species due to, for example, establishment of a dense grass cover. Develop a management approach for these areas potentially involving spot spraying and planting, if necessary.

Budget for native regeneration management

The suggested budget for supporting management back into native forest is as follows:

Task	Year1 (\$)	Year 2 (\$)	Year 3 (\$)	Year 4 (\$)	Year 5 (\$)
Control of pine regeneration	\$10,000	\$10,000	\$5,000	\$2,000	\$1,000
Spot weed control	\$2,000	\$2,000	\$1,000		
Localised planting (if needed)			\$3,000		
TOTAL	\$12,000	\$12,000	\$9,000	\$2,000	\$1,000

Replanting in native species as an alternative

The total harvest area at Turitea West is approximately 21 hectares. Usual planting approaches with native species can cost around \$3.50 per plant and if a re-vegetation stocking of 3500 plants per hectare was assumed this would amount to \$12,250 per hectare. This would give a total cost of \$257,250 for the whole area.

These planted native species are likely to be quickly overtopped and replaced by naturally regenerated seedlings and regrowth from broken native saplings. It seems clear that replanting across the whole area is not a sensible alternative.

5. DISCUSSION

Native species are well established in the understorey of pine plantation areas to be harvested in Turitea West. Experience on a range of similar sites around the Manawatu suggests this area will regenerate very successfully into mature native forest. Fast growing colonising native species such as mahoe, pate, rangiora, tree fuchsia and kanono will grow rapidly and dominate the site. There are also seedlings of fast growing canopy species such as rewarewa, which will likely follow quickly. Important canopy species such as Tawa, miro, totara, black maire and pigeonwood are also already present and likely to establish relatively quickly, along with a range of tree ferns. Because of the large numbers of native seedling and sapling natives present a quick regeneration of native species is expected to occur.

Replanting of native species is unlikely to be warranted, except possibly in some small areas on dry ridges, particularly on the northern boundary.

Good management of the harvesting operation and active control of pine regeneration and other weeds following harvest will be required to ensure high quality native forest establishment as quickly as possible.

Re-establishment of the area into native forest in this way is aligned with the Turitea Reserve Management Plan and will ensure that the area has increased benefit for water supply and biodiversity protection in the long term.

6. RECOMMENDATIONS

The following recommendations are made to ensure cost effective and rapid restoration of native forest cover on this site.

1. Ensure high quality harvest operations in line with good forestry practice. Wherever possible this should include:
 - Minimise soil disturbance
 - Sensible planning and placement of slash at landings: Slash should not be placed in problem areas where it will inhibit native regeneration. The maximum amount of merchantable wood should be removed. Wherever possible short “billet wood” should be removed.
2. Begin control of pine regeneration 6 months following completion of harvesting and undertake control approximately six monthly until the issue is removed.
3. Identify any dense weed patches that are likely to inhibit regeneration and apply control.
4. Identify any areas, particularly drier ridges where regeneration has not occurred and undertake localised grass control and planting if required.
5. Inspect and undertake pine regeneration control and other weed control as required until native regeneration has achieved a closed canopy and is suppressing weeds. This should be achieved by 3-5 years following harvest.

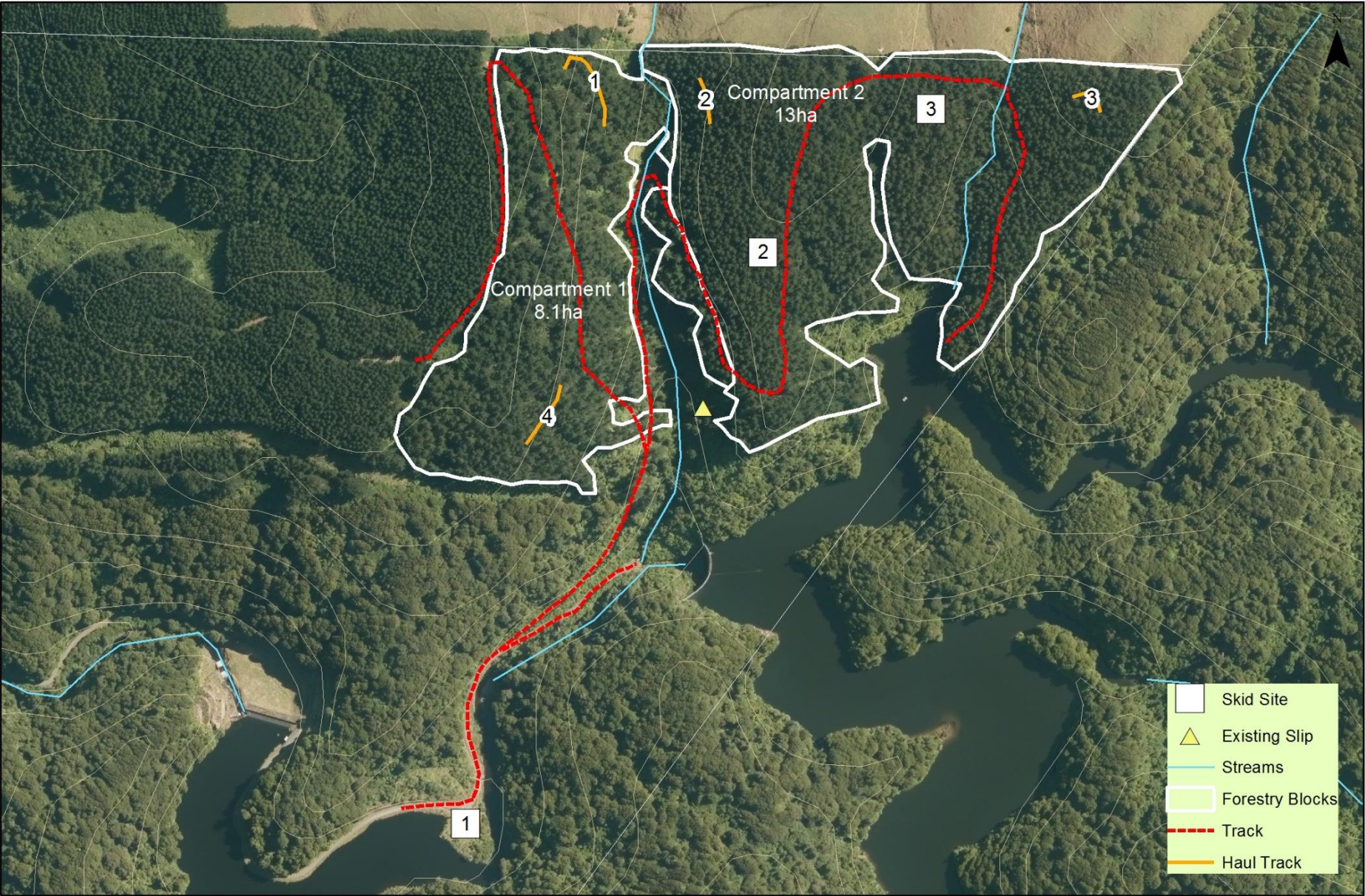
Widespread planting of native species is not considered necessary and is not recommended.

REFERENCES

Forme Consulting Group (1998) "Turitea Forest Tactical Harvest Plan"

Wallis, G & McMahon, S (1994) "The Impacts of Forest Management on Erosion and Sedimentation: A New Zealand Review". LIRO Report Vol 198, No 2, 1994.

O'Loughlin, Colin (2005) "The protective role of trees in soil conservation". NZ Journal of Forestry, February 2005.



Date: 12/12/2016

Turitea Harveting

APPENDIX 2: PLANT SPECIES LIST FROM SITE ASSESSMENT

Native species

Common Name	Scientific Name
Kiokio	<i>Blechnum novae-zelandiae</i>
Mahoe	<i>Melicytus ramiflorus</i>
Kanono	<i>Coprosma grandifolia</i>
mamaku	<i>Cyathea medularis</i>
Rangiora	<i>Brachyglottis repanda</i>
Hangehange	<i>Geniostoma ligustrifolium</i>
Lancewood	<i>Pseudopanax crassifolius</i>
Bush lawyer Rubcis	<i>Rubus cissoides</i>
Koromiko	<i>Veronica stricta</i>
Toetoe	<i>Austroderia toetoe</i>
Kawakawa	<i>Piper excelsum</i> subsp <i>excelsum</i>
mapou	<i>Mysine australis</i>
Cyperus spp	Exotic cyperus
Heketara	<i>Olearia rani</i>
Marbleleaf	<i>Carpodetus serratus</i>
Wineberry	<i>Aristotelia serrata</i>
Pate	<i>Schefflera digitata</i>
Piupiu	<i>Pneumatopteris pennigera</i>
Pikopiko, Hen & Chicken fern	<i>Asplenium bulbiferum</i>
Rangiora	<i>Brachyglottis repanda</i>
Tree fuchsia	<i>Fuchsia excorticata</i>
Lemonwood	<i>Pittosporum eugenioides</i>
Poroporo	<i>Solanum aviculare</i>
Tasmanian Blackwood	<i>Acacia melanoxylon</i>
Rewarewa	<i>Knightia excelsa</i>
Ponga, silver fern	<i>Cyathea dealbata</i>
Hinau	<i>Elaeocarpus dentatus</i>
Wheki, rough tree fern	<i>Dicksonia squarrosa</i>
tawa	<i>Beilschmiedia tawa</i>
Pigeonwood, Porokaiwhiri	<i>Hedocarya arborea</i>
Kiwikiwi, creek fern	<i>Blechnum fluviatile</i>
Miro	<i>Prumnopitys ferruginea</i>
Rimu	<i>Dacrydium cupressinum</i>
Supplejack	<i>Ripogonum scandens</i>
<i>Coprosma rhamnoides</i>	<i>Coprosma rhamnoides</i>
Black maire	<i>Nestegis cunninghamii</i>
Red bidibid	<i>Acaena novae-zelandiae</i>
Bush rice grass	<i>Microlaena avenacea</i>
Hook grass	<i>Carex uncinata</i>
Kaikomako	<i>Pennantia corymbosa</i>
Kamahi	<i>Weinmannia racemosa</i>
Totara	<i>Podocarpus totara</i>
Kiekie	<i>Freycinetia banksia</i>
Mountain astelia	<i>Astelia nervosa</i>

Exotic species

Common Name	Scientific Name
Gorse	Ulex europaeus
Himalayan honeysuckle	Leycesteria formosa
Monterey pine	Pinus radiata
Tutsan	Hypericum androsaemum
Blackberry	Rubus fruticosus
Tasmanian Blackwood	Acacia melanoxylon
Foxglove	Digitalis purpurea
Monterey pine	Pinus radiata