

Appendix One: Draft Plant Pest Management Plan

(Prepared by Conservation Consultancy Ltd. for Milford Dart Ltd. 2007)

1. Introduction

Milford Dart Limited have applied to construct a tunnel under the Humbolt Mountains connecting the Routeburn Road end in the Mt. Aspiring National Park (MANP) with the Hollyford Valley in the Fiordland National Park (FNP).

The construction phase of the project will cause disturbance to roadsides within the two National Parks as well as at the tunnel portal areas and spoil disposal site. This disturbance is likely to allow access to plant pests or weeds. Additionally, plant pests/weeds can be brought to the construction zones by machinery and by human activity.

The Department of Conservation (DoC) has the role of protecting the natural values in National Parks and other protected land and is required under the National Parks Act 1980 to, as far as possible and practical, remove all introduced plants from these areas. This role will pass to Milford Dart during the construction of the tunnel, for all areas within both National Parks that are being used for the construction including road edges, spoil sites and tunnel portal areas. Plant pest management will be necessary in these areas for a period after the completion of the tunnel construction as well.

2. What is a weed or plant pest?

A weed is any plant that is growing where it is not wanted. In natural areas such as National Parks, the indigenous vegetation is to be protected and, as far as possible, exotic or introduced plants are to be removed – especially where they threaten native plants or native communities.

Many introduced plants are now so widespread and integrated with native plant communities that they are generally accepted as part of the ‘natural’ community although they can also be considered weeds. These plants include various herbs, grasses, rushes and sedges that although they may affect the integrity of the natural community they do not change it significantly or pose a threat to it. In the National Park situation, where an exotic species is a recent arrival or where exotic species occur in small numbers and it is practical to remove them, then they should be removed.

Plant pests are generally weeds that can adversely affect the structure of natural plant communities. These are the plants that are of most concern in Conservation areas (including in National Parks). They are also termed “invasive” weeds or ecological weeds. “Invasive weeds are plants that can significantly and adversely affect the long-term survival of native species, the integrity or sustainability of natural communities, or the genetic variation within indigenous species” (Owen, 1998a). These plants tend to be woody species, often large and some are climbers but once established are hard to eradicate. They can be spread by birds, the wind, by water and by human activity. Several have seeds that last for fifty years or more in the soil.

2.1 Ecological Weeds

Ecological weeds or environmental weeds have been defined as “any foreign plant species that threaten local native species or ecosystem processes” (Reid 1998). The term invasive weeds, defined earlier, is synonymous with ecological and environmental weeds. Ecological weeds have been scored according to their Biological Success Rating (BSR), the biological capacity of the weed (fast establishment and growth rate, high number of seeds, asexual spread) and the Effect On System (EOS) rating, the behaviour of the weed in the community type and geographical location (major disturbance to structure, composition and natural processes) with a maximum score of 36, the higher the score the more weedy (Owen 1997). The community type potentially affected is also noted.

Scores for weeds that occur in the Wakatipu and that could be introduced to the Mt. Aspiring and Fiordland National Parks by human activity or by natural means (taking advantage of disturbed sites) during the tunnel construction, are listed below:-

| | | |
|----------------------------------|-----------------------|----|
| <i>Acer pseudoplatanus</i> | sycamore | 27 |
| # <i>Agrostis capillaris</i> | browntop | 25 |
| <i>Buddleia davidii</i> | buddleia | 26 |
| <i>Clematis vitalba</i> | old man’s Beard | 33 |
| <i>Cotoneaster glaucophyllus</i> | cotoneaster | 25 |
| <i>Crataegus monogyna</i> | hawthorn | 31 |
| <i>Cytisus scoparius</i> | broom | 25 |
| # <i>Dactylis glomerata</i> | cocksfoot | 22 |
| <i>Erica lusitanica</i> | Spanish heath | 23 |
| # <i>Hypericum perforatum</i> | St. John’s wort | 17 |
| <i>Lycesteria formosa</i> | Himalayan honeysuckle | 22 |
| <i>Lupinus arboreus</i> | tree lupin | 27 |
| <i>Lupinus polyphyllus</i> | Russell lupin | 27 |
| <i>Pinus contorta</i> | lodgepole pine | 28 |
| <i>Pinus</i> species | wilding pine | 27 |
| <i>Pseudotsuga menziesii</i> | Douglas fir | 27 |
| <i>Rubus fruticosus</i> | blackberry | 31 |

| | | |
|-----------------------------|-------------------|----|
| <i>Rosa rubiginosa</i> | sweet brier | 28 |
| <i>Salix cinerea</i> | grey willow | 32 |
| <i>Salix fragilis</i> | crack willow | 28 |
| <i>Sambucus nigra</i> | elder/elderberry | 22 |
| <i>Senecio jacobeus</i> | ragwort | 23 |
| <i>Teline monspessulana</i> | Montpellier broom | 25 |
| <i>Ulex europaeus</i> | gorse | 28 |

These species already occur along road edges and are widespread in the National Parks in open areas and along river edges and are not considered an ecological weed here in that they do not change the native community or the ecological processes.

Control of Invasive weeds by the Department of Conservation is set out in a Strategic Plan (Owen 1998b) and regionally in the Otago Conservancy Plant Pest Strategy (Simpson 1995). The Department of Conservation also has a responsibility under the Biosecurity Act 1993 to effectively manage or eradicate pest plants.

As mentioned above this responsibility will pass to Milford Dart and its contractors during the construction phase of the tunnel for the areas affected by the construction. The plant pest control will also need to be continued for a specified time after the completion of construction.

2.2 Existing Weeds

A number of weeds are already found in the proposed construction zones of the Routeburn Valley and Hollyford Valley and along relevant the road edges. These are listed in Table A1.1. There are likely to be other small weeds that have been overlooked but these are unlikely to be significant. Tree lupin, sweet brier and ragwort are the plants of most concern on this list with oxeye daisy, blackberry and bitter sweet a lesser problem.

Table A1.1

Introduced Plants and Pest plants presently found (2007) at the Routeburn Road End and at the Lower Hollyford Valley in the Vicinity of the Airstrip

| Plant Name - Scientific name | Maori/common names | Routeburn area | Hollyford area |
|------------------------------|---------------------|----------------|----------------|
| <i>Lupinus arboreus</i> | tree lupin | | * |
| <i>Achillea millefolium</i> | yarrow | | * |
| <i>Agrostis capillaris</i> | brown top | * | * |
| <i>Anthoxanthum odoratum</i> | sweet vernal | * | * |
| <i>Cerastium fontanum</i> | chickweed | * | * |
| <i>Cirsium arvense</i> | Californian thistle | * | * |
| <i>Cirsium vulgare</i> | Scotch thistle | * | * |
| <i>Digitalis purpurea</i> | foxglove | * | * |
| <i>Holcus lanatus</i> | Yorkshire fog | * | * |
| <i>Hypochaeris radicata</i> | cats ear | * | * |
| <i>Juncus articulatus</i> | a rush | * | * |
| <i>Juncus effusus</i> | a rush | * | * |
| <i>Leucanthemum vulgare</i> | oxeye daisy | * | * |
| <i>Lotus pedunculata</i> | lotus | * | * |
| <i>Mimulus moschatus</i> | monkey musk | * | * |
| <i>Prunella vulgaris</i> | selfheal | * | * |
| <i>Ranunculus acris</i> | buttercup | * | * |
| <i>Ranunculus repens</i> | buttercup | * | * |
| <i>Rosa rubiginosa</i> | sweet brier | * | * |
| <i>Rubus fruticosus</i> | blackberry | * | * |
| <i>Rumex acetosella</i> | sheep's sorrel | * | * |
| <i>Senecio jacobaeus</i> | ragwort | * | * |
| <i>Solanum dulcamara</i> | bitter sweet | * | * |

2.3 Likely Plant Pest Introductions

The most likely plant pest introductions will be tree lupin, broom and gorse, all with long-lived seeds and usually arriving on earth moving vehicles and in gravel brought on site. Buddleia, Spanish heath, cotoneaster and hawthorn are other species that could be blown in or be brought in by birds. Weed species that are already present can be expected to increase, taking over any bare or disturbed sites.

Providing all the Biosecurity measures listed in the Milford Dart EIA are carried out diligently then any plant pest or weed problem should be only minor.

3. Biosecurity in the Milford Dart EIA

55. *An area shall be provided immediately outside the National Parks for steam cleaning and washing of plant and equipment that is to enter the National Parks. All plant and machinery will be thoroughly washed down to ensure that dirt, vegetation and any organic matter is removed prior to entry into the National Parks.*

Note: The Wildlands audit report suggests that there is the potential for weed seeds to germinate at the washing down site, to grow and seed into the parks. They suggest that this area should be at some distance from the park entrances to ensure that any weeds that grow do not threaten the National Parks.

Alternatively, the wash down areas shall be included in the plant pest management plan as areas that require weed and plant pest control.

56. *All equipment and plant will be inspected prior to entry into the National Parks and following cleaning. This shall be undertaken by a person who is independent of the Concessionaire. A written quality check shall be issued and must be kept with the equipment/plant at all times during operation within the National Parks.*
57. *Plant/equipment leaving National Parks shall return its quality check record and if re-entering, go through the same process.*
58. *Materials imported into National Parks shall be checked to minimise the potential for weed and exotic plant species to enter the Parks. This check shall be undertaken by an independent inspector and an inspection certificate issued. For bulk materials that are imported and used, containment or sterilisation shall be used to ensure that weed seeds cannot enter the material or are killed prior to entry to the National Parks.*
59. *Plant and equipment on site shall be routinely checked for possible alien seeds etc, and to check the written quality check. Plant and equipment that has not been checked or shows signs of inadequate cleaning shall be removed from the site.*
60. *Inspections shall be undertaken in and around the areas of operation on a routine basis to assess weed growth and weed/spraying carried out to kill weeds. This approach will ensure that any weeds that inadvertently enter the area and germinate will be rapidly killed, minimising the potential for weeds to become established in the area.*

3.1 Additional Plant Pest Control

As well as the above actions regular inspections will be carried out and weed control undertaken along the road edges as required, taking particular care of areas where road widening or other disturbance has occurred.

It is important that no new weeds or plant pests be allowed to flower and set seed.

4. Weed and Plant Pest Control Methods

Two methods of weed control shall be undertaken. The use of herbicide from a knapsack sprayer and hand weeding, by hand pulling or by the use of an appropriate hand tool.

Initially a knapsack sprayer will be used to kill weeds with especial care taken along edges where intact native plant communities exist. After about six months native seedlings will germinate on many of the previously disturbed sites and especially along forested road edges. The further use of herbicide in these situations will jeopardise the natural regeneration and hand methods of weed control shall be undertaken.

Large areas where disturbance is continuous such as the Hollyford spoil dump area and around buildings (likely to be weed prone sites) herbicide will be used to control weeds using a knapsack sprayer.

If vehicles have been cleaned satisfactorily before entering the National Parks and a good initial kill of all weeds made on disturbed sites then only hand methods of weed control should be necessary at all but the larger sites.

5. Cessation of Weed Control by Milford Dart

Routine inspections of all construction zones and roadsides will be carried out for two years after the completion of the tunnel and other site works. Routine inspections shall be carried out during April, September and December.

At the rehabilitated spoil deposit site weed control shall continue for up to five years or until the plantings cover the bare ground and are of sufficient height and coverage to shade the ground and eliminate competition from grasses and weeds.

Signing off will occur after a joint inspection by DoC and Milford Dart and/or their representatives.

6. References

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Appendix Two: Draft Routeburn Road End Predator Control Plan

(Prepared by Lucy Hardy on behalf of Milford Dart Ltd. July 2007)

1. Introduction

This predator control plan has been developed on behalf of Milford Dart Ltd, who propose to upgrade and extend the Routeburn Road from its entry point into the Mount Aspiring National Park through to the vicinity of the Double Barrel Falls track. The Department of Conservation already has an extensive predator control plan in the Routeburn, Caples and Dart catchments as part of Operation Ark, a national initiative to minimise the effects of periodic predator plagues in South Island beech forests. The development of any further predator control needs to have the capacity to be fully integrated into the Department's existing programmes in order for it to function efficiently and cohesively. Recommendations have therefore been made which are compatible with the objectives and techniques of the Operation Ark programme. Information regarding Operation Ark has been provided by Wakatipu Area Department of Conservation staff and contractors involved in the existing control programmes. Operation Ark will develop over time, using alternative methods, as knowledge improves on how to best manage the predator irruptions, which periodically take place. Therefore this predator control plan is not prescriptive, but rather provides an indication of the likely predator control measures, which should to be implemented and an estimate of the costs incurred.

1.1 Operational Area

The area under which predator control is recommended to be undertaken encompasses the lower forest-clad terraces and slopes below 600 metres on the true right of the Routeburn, from the entry point into the National Park (at the Lake Sylvan turn-off) to approximately 2km past the Double Barrel Falls track, where the ground starts to rise sharply (Figure A).

1.2 Ecology

The indigenous fauna and habitats of the Routeburn Road end are described to some degree by Southey, I. (date unknown). Of note the area supports a significant mohua population, a nationally endangered threatened species (Hitchmough, Bull and Cromarty 2005)

In addition, falcon (gradual decline), kaka (nationally endangered), yellow crowned parakeet (gradual decline), kereru (gradual decline) and long tailed bats (nationally endangered) are present. The low beech forest areas to the west of Weka Flat are a mixture of red and mountain beech, with some large areas of mature red beech forest and a (relatively) dense and diverse understorey component. These forest areas

provide good mohua habitat and a significant breeding population is found here. To the east of Weka Flat the vegetation consists of predominantly mountain beech, with little understorey and obvious signs of considerable deer browse. This area does not appear to provide good mohua habitat, although birds were observed here (Southey, I.).

Figure A. *Proposed operational area for Routeburn portal.*

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TIFF (LZW) decompressor
are needed to see this picture.

The population dynamics of fauna (both native species and introduced predators) in the beech (*Nothofagus*) forests of the South Island of New Zealand are affected by the huge, synchronous production of beech seed, or “mast” which occurs at intervals of three to eleven years (Wardle 1984). In the Dart Valley, mast years have occurred in the late summer of 2006, late summer of 2000, with a partial mast in 1995 (Barry Lawrence, pers. comm). The production of mast provides food resources for rodents, birds and insects, and triggers a rapid increase in the mouse and rat population, or a “plague”. This has a knock on effect, with huge increases in mice and rats supporting an increased stoat population. The rodent numbers can suddenly drop when food resources diminish, with stoats switching prey to native birds. This periodic pulse to the beech forest ecosystem and associated rodent and stoat irruption has been implicated in the decline of several species in southern beech forests (e.g. Elliot 1996, O’Donnell 1996). The mohua population was lost from the lower Caples valley following the 2000 beech mast. Hole nesting birds, such as kaka, mohua, parakeets and roosting long tailed bats are particularly vulnerable.

Any predator control programme that may be implemented needs to be able to respond to the periodic nature of the beech mast and its associated predator irruptions. Rodents increase late winter and early spring, often crashing in late summer when food resources are exhausted. Stoats are most noticeable from December onwards when young stoats become independent. Predators and pests known to be present in the area include rodents (mice and rats), stoats, possums (in low numbers), and also probably include ferrets and cats. Although possum numbers are likely to be low, possum browse selectively on mistletoe and other palatable shrubs, such as fuchsia. The flowers and fruit of these plants are particularly important as food resources for nectar feeding birds such as kaka, tui and bellbird. Kaka, in particular, have a wide range of food sources including fruits, nectar and invertebrates, all of which they compete for with possum.

2. Existing predator control in the area

An extensive predator control programme already exists in the area . A range of methods are used to target stoat and rodent populations, with some possum control taking place periodically.

2.1 Stoat control

Permanently located stoat traps are spaced along the bush margin and the road every 200m. These traps are a mixture of old fenn traps and new DoC 150's They are baited using a single egg. They are checked approximately once every two weeks during the summer of an irruptive phase, and much less frequently during the winter and inter-mast periods, as funding allows. These traps also catch rats. During a rat irruption the traps become filled with rats and can fail to catch their intended target, stoats. They therefore need to be checked as regularly as possible during the early spring and summer following a mast. Stoats are also affected by secondary poisoning, if they prey on rodents or scavenge on the poisoned carcasses of possums or rodents following Brodifacoum or 1080 poison operations.

2.2 Rodent control

60 rat bait stations ("Rat cafe" – Pestoff product) are placed in a grid at 100 metre spacing in an area of red beech forest which is known to support good mohua populations, near to the Routeburn car-park. The bait stations are filled with brodifacoum baits during an irruptive phase (approximately once every 5 years). They need to be refilled approximately every week until the rat population subsides below

an acceptable, defined tracking level of 5%, however refilling has depended upon funding and staff availability. If the rat population remains high (above a 5% tracking level) then an aerial 1080 operation is used to control rats.

Brodifacoum is a second generation anti-coagulant poison widely used in New Zealand for the control and eradication of vertebrate pests, particularly possums and rats. It is insoluble in water and is only broken down slowly by microbial action. It persists in the environment and its half life in the soil varies from 12 – 25 weeks. It accumulates in vertebrate tissues, particularly the liver, with residues still detectable for at least eight months in possums. When poisoned animals (alive or dead) are eaten by carnivores or scavengers, secondary poisoning may occur. The risk of secondary poisoning using second-generation anticoagulants, such as Brodifacoum, is particularly high because these compounds are not substantially metabolised before the vector dies. Deliberate secondary poisoning may be used as a potentially cost-effective means to control carnivores which are conservation pests (Dowding et al 1999). However, this also has the potential to affect non-target species through secondary poisoning, such as harrier, falcon, magpie and morepork, which may scavenge on carcasses or prey on rodents.

The use of bait stations (rather than aerial or hand cast methods of distribution) eliminates the potential for direct non-target kills, although spillage of bait out of stations may have an effect. The effect of Brodifacoum on invertebrates is not well known, although beetles, weta and ants have been observed to be attracted to the baits (Spur and Drew 1999). The product used by the Department of Conservation for Operation Ark is an extruded solid cereal block, dyed blue (Pestoff Rodent Block, supplied by Animal Control Products Ltd). The product does not require the purchaser to hold a Controlled Substances License. It is possible that the Department of Conservation will use alternative poisons in the future, such as Cholecalciferol. Cholecalciferol is a poison which interferes with Calcium metabolism and brings about heart attacks in poisoned vertebrates. Its use, and that of other poisons, is likely to be reviewed by DoC over the next few years in anticipation of the next beech mast and consequent predator irruption.

If the Brodifacoum bait operation fails to maintain the rodent population at below 5% tracking levels then aerial 1080 is used as a control method. An aerial 1080 drop was conducted in spring 2006. The 1080 operation also affects possum populations, and has the potential to affect non target species such as deer. 1080 (Sodium

monofluoroacetate) is a highly toxic vertebrate pesticide that has been widely used for possum control in New Zealand since the 1950's. It is biodegradable and breaks down rapidly through microbial action and dilutes readily with water. It may remain for many months in the carcasses of poisoned animals, and therefore can result in secondary poisoning of scavengers or carnivores. For this reason, buffer zones are implemented around aerial 1080 control areas. 1080 is a controlled substance under the Pesticides Act and can only be applied by licensed operators. Regional councils along with local authorities often also require a resource consent or certificate of compliance for aerial operations, although in Otago a resource consent is not required. The 1080 product used by the Department of Conservation in both the aerial drop and the possum bait stations is Pestoff 1080 pellets. The use of 1080 in New Zealand is currently being reviewed by ERMA (Environmental Risk Management Authority New Zealand).

2.3 Possum control

Some possum monitoring takes place periodically, using the residual trap index method, a standard DoC protocol for monitoring possum populations (National Possum Control Agencies 2005). If populations exceed an RTC of 5% then the need for possum control is considered. In other adjacent areas (such as along the bush edge at the start of the Lake Sylvan track) Philproof bait stations with 1080 pellets are used to control populations, with populations monitored before and after.

2.4 Monitoring

Pest populations are monitored using tracking tunnels (a tracking tunnel line is present within the bait station area), with <5% tracking a target. When tracking exceeds 5% poison operations using the bait stations are commenced. Failure to keep the tracking level below 5% in 2006 resulted in an aerial 1080 drop being conducted. Possums are monitored periodically using the Residual Trap Catch method. If the RTC exceeds 5% then possum control is undertaken. No control has yet been undertaken in the area. The RTC method is also used by DoC to monitor contractor's success rates in controlling possum.

Prescribed conservation outcomes for the current pest control are:

- to maintain rodent and stoat tracking rates below 5% to allow mohua to breed successfully; and
- to maintain possum levels to below 5% to permit kaka to breed successfully.

Current monitoring includes five minute bird counts and 1km mohua transects.

3. Recommended Predator Control Programme

It is recommended that the predator control programme be extended to cover all of the beech forest areas below 600m in the vicinity of the road. Figure B shows recommended operational areas. Estimates of establishment and running costs over a five year period are provided in the following tables. Estimates are based on the total predator control programme, including bait stations and traps already installed by the Department of Conservation. Estimates cover all aspects of the existing predator control programme, i.e. poison operations (Brodifacoum and 1080), trapping, tracking, and conservation outcome monitoring. The cost estimates cover a five year period, or single mast event, although any predator control programme would need to continue indefinitely.

Figure B. *Recommended operational areas for pest control, Routeburn Road end.*

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TIFF (LZW) decompressor
are needed to see this picture.

3.1 Rodents

It is recommended that the rodent bait stations are extended to cover the entire beech forest area. Estimates for the establishment and running of these stations are based on methods currently used under Operation Ark with Pestoff Brodifacoum Rodent Blocks. The Department of Conservation may use alternative pesticides (such as Cholecalciferol) in the future. Although the mountain beech forest area to the east of Weka Flat does not appear to be great mohua habitat, the presence of possible

breeding birds in this area (as noted by Ian Southey) would warrant extending rodent control into this area too. Bait stations should be spaced out at one per hectare. It is likely that the rodent poison operation will be undertaken once every five years (based on past mast events). It is recommended that tracking tunnel lines (6 lines with 10 tunnels) are placed within the forest areas to monitor the rodent (and mustelid) populations. The Operation Ark target of less than 5% tracking should be used as a trigger to commence poison operations following a beech mast. These will need to be operated quarterly, with peanut butter used as a lure.

3.2 Stoats

It is recommended that the stoat trapping line is extended along the Routeburn river terrace and around the Double Barrel Falls track. Old fenn traps should be replaced with DoC 200's, a more robust trap which has been approved by the National Animal Welfare Advisory Committee (NAWAC). These traps should be operated monthly all year round, with frequency of checks increasing to fortnightly during the spring and summer, and weekly following mast events. The traps should be spaced at 200m intervals and baited using a fresh egg. Mustelid populations can be monitored using the same tracking tunnels described above, using fresh rabbit meat as a lure.

3.3 Possum

It is recommended that monitoring of possum populations is undertaken. 10 transects with 10 Victor Soft-Catch Traps should be established throughout the area, using the RTC protocol. Bait stations should be established at 100m spacings along the bush and road edge and baited with pesticide annually and additionally if possum numbers exceed the 5% RTC. The Department of Conservation uses contractors to undertake possum monitoring and control in the area and cost estimates are based on information provided by them (Dave McPhee, pers comm). Alternative poisons to 1080 which pose a lower risk to humans, livestock and dogs, such as Cholecalciferol gel baits could be investigated as an alternative to 1080, with the proximity of the location to the road and the Routeburn Station. Possum populations in this area are generally low (Mark Mawhinney, pers. comm), however they still have the potential to impact on vegetation and native fauna. Monitoring the population to ensure it remains low will assist in achieving good conservation outcomes for the area.

3.4 Aerial 1080

During the last predator irruption phase, rodent populations remained high despite poison operations using Brodifacoum poison. An aerial 1080 operation was

undertaken to control rats, also impacting on possum and mustelid populations. It is recommended that should rodent populations fail to be controlled in the future, a contribution towards the funding of a similar operation over the forest to the west of Weka Flat is considered.

3.5 Conservation Outcome Monitoring

Conservation outcome monitoring is a key aspect of establishing the success of predator control programmes. It is recommended that 4 transects are established for the annual monitoring of mohua and other forest birds, as a contribution towards the Department's mohua monitoring programme in the Routeburn, Lake Sylvan and Dart Valley areas. Five minute bird counts are established at the end of these transects. Mistletoe browse monitoring could also be undertaken should mistletoe plants be located.

4. References

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Appendix Three: Species Lists

Routeburn Site

Flora

Asplenium flaccidum
Astelia fragrans
Astelia nervosa
Blackberry (*Rubus fruticosus*)
Blechnum discolor
Blechnum fluviatile
Blechnum novae-zelandiae
Blechnum penna marina.
Blechnum procerum.
Bracken fern (*Pteridium esculentum*)
Broadleaf (*Griselinia littoralis*)
Browntop (*Agrostis capillaris*)
Bush rice
Bush tussock (*Chionochloa conspicua*)
Coprosma foetidissima
Coprosma linariifolia
Coprosma lucid
Coprosma propinqua
Coprosma rhamnoides
Coprosma tayloriae
Crown fern, *Asplenium flaccidum*
Cyathea smithii,
Dracophyllum palustre
Filmy fern (*Hymenophyllum multifidum*)
Fuchsia (*Fuchsia excorticata*)
Grammitis magellanica,
Grass (*Microlaena avenacea*)
Hall's totara (*Podocarpus hallii*)
Hookgrass (*Uncinia uncinata*)
Horopito (*Pseudowintera colorata*) wineberry (*Aristotelia serrata*)
Korokia (*Corokia cotoneaster*)
Koromiko (*Hebe salicifolia*)
Kowhai (*Sophora microphylla*)
Lancewood (*Pseudopanax crassifolius*)
Lily (*Astelia nervosa*)
Manuka (*Letospermum scoparium*)
Marble leaf (*Carpodetus serrata*)
Microsorium novae-zelandiae
Mountain beech (*Nothofagus solandri* var. *Cliffortioides*)
Mountain toatoa (*Phyllocladus alpinus*)
Mountain toatoa (*Raukaua simplex*)
Nertera villosa
Prickly shield fern
Raukaua simplex
Red beech (*Nothofagus fusca*)
Rubus cissoids
Rubus schmidelioides
Scarlet mistletoe (*Peraxilla tetrapetala*)
Shield fern (*Polystichum vestitum*)
Silver beech (*Nothofagus menziesii*)
Sweet vernal (*Anthoxanthum odoratum*)

Three finger (*Pseudopanax colensoi* var. *Ternatus*)
Tutu (*Coriaria sarmentosa*)
Uncinia clavate
Uncinia filiformis
Uncinia gracilentata
Uncinia rupestris
Water fern (*Histiopteris incisa*)
Weeping mapou (*Myrsine divaricata*),
Yorkshire fog (*Holcus lanatus*)

Aquatic Invertebrates

COLEOPTERA

Elmidae

DIPTERA

Aphrophila species
Austrosimulium species

Chironomidae

Eriopterini

Hexatomini

Neocurupira species

EPHEMEROPTERA

Deleatidium species

Nesameletus species

OLIGOCHAETA

PLECOPTERA

Austroperla cyrene
Megaloptoperla grandis
Megaloptoperla species
Zelandobius species
Zelandoperla species

TRICHOPTERA

Aoteapsyche species
Costachorema species
Hydrobiosidae early instar
Hydrobosis frater group
Oeconesus species
Psilochorema species
Pycnocentrodes species

Aquatic Vertebrates

| | |
|----------------|---------------------------------|
| Brown trout | <i>Salmo trutta</i> |
| Chinook salmon | <i>Oncorhynchus tshawytscha</i> |
| Common bully | <i>Gobiomorphus cotidianus</i> |
| Koaro | <i>Galaxias brevipinnis</i> |
| Longfin eel | <i>Anguilla dieffenbachii</i> |
| Rainbow trout | <i>Oncorhynchus mykiss</i> |

Terrestrial Invertebrates

Order Coleoptera

Carabidae

Megadromus sandageri Curculionidae (weevils)

Rhynchodes ursus

Scarabaeidae

Pyronota festiva

- Order Hemiptera (bugs)
 - Tibicinidae (cicadas)
 - Kikihia subalpina*
 - Flat bugs
 - Miridae
 - Red mired bug
- Order Lepidoptera (butterflies & moths)
 - Crambidae
 - Glaucocharis lepidella*
 - Deana hybreasalis*
 - Eudonia aspidota*
 - asterisca*
 - cataxesta*
 - feredayi*
 - manganeutis*
 - philerga*
 - Orocrambus flexuosellus*
 - Scoparia minusculalis*
 - petrina*
 - Udea notata*
 - Noctuidae
 - Aletia moderata*
 - nobilis*
 - virescens*
 - Graphania agorastis*
 - lignana*
 - mutans*
 - rubescens*
 - ustistriga*
 - Persectania aversa*
 - Tmetolophota purdii* larvae on *Astella fragrans*
 - lissoxyla* - Routeburn
 - atristriga*
 - Meterana dotata*
 - tartarea*
 - Geometridae
 - Austrocidaria similata*
 - gobiata*
 - Chloroclystis inductata*
 - Epiphryne undosata* - larvae on underside of *Hoheria lyallii*
 - Epicyme rubropunctata*
 - Helastia corcularia*
 - Hydriomena arida*
 - Pasiphila muscosata*
 - rubella*
 - sandycias*
 - punicea*
 - Pseudocoremia suavis*
 - productata*
 - Tatosoma tipulata*
 - agrionata*
 - Xanthorhoe semifissata*
 - Depressariidae
 - Proteodes carnifex*
 - Oecophoridae
 - Izatha peroneanella*
 - Phaeosaces apocrypta*

- Trachypepla* Sp.
- Tortricidae
 - Catamacta alopecana*
 - Pyrgotis pyramidias*
- Order adonata (dragonfly)
 - Corduliidae
 - Procordulia smithii*
- Order Neuroptera (lacewings)
 - Hemerobidae
 - Micromus tasmaniae*
- Order Hymenoptera (wasps)
 - Ichneumonidae
 - Netelia producta*
- Order Dictyoptera (cockroaches)
 - Blattidae
 - Aboreal cockroach

Avifauna

| | | |
|-------------------------|---------------|--|
| Bellbird | Korimako | <i>(Anthornis melanura melanura)</i> |
| Black Shag | Kawau | <i>(Phalacrocorax carbo navaehollandiae)</i> |
| Black-backed Gull | Karoro | <i>(Larus dominicanus)</i> |
| Blackbird | | <i>(Turdus merula),</i> |
| Brown Creeper | Pipipi | <i>(Mohoua novaeseelandiae)</i> |
| Chaffinch | | <i>(Fringilla coelebs).</i> |
| Eastern Falcon | Karearea | <i>(Falco novaeseelandiae)</i> |
| Fantail | Piwakawaka | <i>(Rhipidura fuliginosa fuliginosa),</i> |
| Goldfinch | | <i>(Carduelis carduelis)</i> |
| Grey Warbler | Riroriro | <i>(Gerygone igata),</i> |
| Hedge Sparrow | | <i>(Prunella modularis)</i> |
| Kea | | <i>(Nestor notabilis)</i> |
| Long-tailed Cuckoo | Koekoea | <i>(Eudynamys taitensis)</i> |
| Morepork | Ruru | <i>(Ninox novaeseelandiae)</i> |
| New Zealand Pigeon | Kereru | <i>(Hemiphaga novaeseelandiae).</i> |
| Paradise Shelduck | Putangitangi | <i>(Tadorna variegata)</i> |
| Redpoll | | <i>(Carduelis flammea)</i> |
| Rifleman | Titipounamu | <i>(Acanthisitta chloris)</i> |
| Shining Cuckoo | Pipiwaharuroa | <i>(Chrysococcyx lucidus lucidus)</i> |
| Silveryeye | Tauhau | <i>(Zosterops lateralis lateralis)</i> |
| South Island Kaka | | <i>(Nestor meridionalis meridionalis)</i> |
| South Island Robin | Toutouwai | <i>(Petroica australis australis)</i> |
| Starling | | <i>(Sturnus vulgaris)</i> |
| Thrush | | <i>(Turdus philomelos),</i> |
| Tomtit | Miromiro | <i>(Petroica macrocephala macrocephala)</i> |
| Tui | | <i>(Prosthemadera novaeseelandiae novaeseelandiae)</i> |
| Yellow-crowned Parakeet | Kakariki | <i>(Cyanoramphus auriceps),</i> |
| Yellowhammer | | <i>(Emberiza citrinella)</i> |
| Yellowhead | Mohua | <i>(Mohoua ochrocephala).</i> |

Bats

- Long-tailed bat (*Chalinolobus tuberculatus*)

Lizards

- Common gecko (*Hoplodactylus* n.sp) - Shed skin only found
- Otago gecko (*Hoplodactylus* aff. *maculatus*) - Likely

Hollyford Site

Flora

Asplenium bulbiferum
Asplenium flaccidum
Asplenium polyodon
Astelia fragrans
Blechnum fluviatile
Blechnum montanum
Broadleaf (*Griselinia littoralis*)
Bush tussock (*Chionochloa conspicua*)
Cabbage tree (*Cordyline australis*)
Carex secta
Climbing fern (*Rumohra adiantifolius*)
Coprosma lucida
Coprosma propinqua
Coprosma rhamnoides
Coprosma rotundifolia
Coprosma tayloriae
Fern (*Blechnum montanum*)
Filmy fern *Trichomanes venosum*
Fuchsia (*Fuchsia excorticata*)
Grass *Microlaena avenacea*
Hall's totara (*Podocarpus hallii*)
Harakeke (*Phormium tenax*)
Horopito (*Pseudowintera colorata*)
Hymenophyllum demissum
Hymenophyllum flexuosum
Kahikatea (*Dacrycarpus dacrydioides*)
Kamahi (*Weinmannia racemosa*)
Katote (*Cyathea smithii*)
Kiokio (*Blechnum novae-zelandiae*)
Kohuhu (*Pittosporum tenuifolium*),
Koromiko (*Hebe salicifolia*)
Lancewood (*Pseudopanax crassifolius*)
Mahoe (*Meliccytus ramiflorus*), *Hebe salicifolia*
Manatu (*Plagianthus regius*)
Mapou (*Myrsine australis*)
Matai (*Prumnopitys taxifolius*)
Microsorium pustulatum
Miro (*Stachypitys ferruginea*)
Muehlenbeckia australis
Native broom (*Carmichaelia arborea*)
Nertera villosa liane *Metrosideros perforata*
Parsonsia heterophylla
Pate (*Schefflera digitata*)
Pigeonwood (*Hedycarya arborea*)
Pokaka (*Elaeocarpus hookerianus*)
Polystichum neozelandicum subsp. *Zerophyllum*
Polystichum vestitu
Putaputaweta (*Carpodetus serratus*)
Raukaua anomala
Raukaua simplex
Rubus schmidelioides

Rush (*Juncus geminata*)
Sedge (*Carex geminata*)
Sedge (*Uncinia uncinata*)
Silver beech (*Nothofagus menziesii*)
Three finger ("*Pseudopanax fiordense*")
Toitoi (*Cortaderia richardii*)
Tree stinging nettle (*Urtica ferox*)
Tree tutu (*Coriaria arborea*)
Tutu (*Coriaria sarmentosa*)
Water fern (*Histiopteris incisa*)
Weeping mapou (*Melicytus divaricata*)
Weki (*Dicksonia squarrosa*)
Wineberry (*Aristotelia serrata*)

Aquatic Invertebrates

COLEOPTERA

Elmidae

DIPTERA

Aphrophila species

Chironomidae

Eriopterini

Mischoderua species

Neocurupira species

EPHEMEROPTERA

Deleatidium species

Nesameletus species

MEGALOPTERA

Archichauliodes diversus

MOLLUSCA

Gyraulus species

Potamopyrgus antipodarum

OLIGOCHAETA

PLATYHELMINTHES

PLECOPTERA

Austroperla cyrene

Megaloptoperla species

Stenoperla species

Zelandobius species

Zelandoperla species

TRICHOPTERA

Hydrobiosidae early instar

Hydrobiosis frater group

Oeconesus species

Olinga species

Philorheithrus species

Psilochorema species

Aquatic Vertebrates

| | |
|----------------|---------------------------------|
| Brown trout | <i>Salmo trutta</i> |
| Chinook salmon | <i>Oncorhynchus tshawytscha</i> |
| Koaro | <i>Galaxias brevipinnis</i> |
| Longfin eel | <i>Anguilla dieffenbachii</i> |
| Rainbow trout | <i>Oncorhynchus mykiss</i> |

Terrestrial Invertebrates

Order Coleoptera

Carabidae

Megadromus sandageri

Scarabaeidae

Odontria australis
striata

Order Hemiptera (bugs)

Tibicinidae (cicadas)

shield bug nymphs on tree fern

Order Lepidoptera (butterflies & moths)

Nepticulidae

Stigmella erichtitus - larval mines in *Senecio erichtitus*

Crambidae

Eudonia aspidota

characta

asterisca

dinodes

dochmia

feredayi

minualis

Scoparia minusculalis

rotuella

ustimacula

Udea notata

Lycaenidae

Lycaena n.sp.

Nymphalidae

Vanessa gonerilla

Noctuidae

Agrotis ipsilon

Aletia moderata

Feredayia graminosa

Graphania agorastis

chlorodonta

nr. morosa

mutans

plena

rubescens

ustistriga

Tmetolophota purdii larvae on *Astella fragrans*

sulcana

atristriga

Meterana merope

ochthistis

dotata

tartarea

Rhapsa scotoscialis

Spodoptera litura

Geometridae

Asaphodes adonis

philpotti

stephenitis

Austrocidaria similata

gobiata

Chloroclystis inductata

Cleora scriptaria

- Declana junctilinea*
- flocossa*
- Epiphryne undosata*
- Gellonia dejectaria*
- pannularia*
- Helastia corcularia*
- cinerearia*
- plumbea*
- Hydriomena purpurifera*
- Pasiphila muscosata*
- malachita*
- rubella*
- Pseudocoremia suavis*
- rudisata*
- leucelaea*
- fenerata*
- Sarisa muriferata*
- Tatosoma lestivata*
- Xanthorhoe semifissata*
- Depressariidae
 - Eutorna symmorpha*
- Sphingidae
 - Agrius convolvuli*
- Carposinidae
 - Heterocrossa gonosemana*
- Oecophoridae
 - Gymnobathra tholodella*
- Gracilariidae
 - Gracilaria elaeas*
 - Caloptilia chrysitis*
 - Parectopa pannaciformes* - mines in lancewood
- Order Plecoptera (stoneflies)
 - Eustheniidae
 - Stenoperla maclellani*
 - Gripopterygidae
 - Megaleptoperla grandis*
 - Zelandoperla fenestrata*
- Order Trichoptera (caddis)
 - Hydrobiosidae
 - Eight species in the genera *Hydrobiosis* and *Psilochorema*
- Order Ephemeroptera (mayflies)
 - Siphonuridae
 - Deleatidium lillii*
 - autumnale*
- Mollusca (snails)
 - Small land snail on foliage

Avifauna

| | | |
|--------------------|------------|---|
| Bellbird | Korimako | (<i>Anthornis melanura melanura</i>) |
| Blackbird | | (<i>Turdus merula</i>), |
| Brown Creeper | Pipipi | (<i>Mohoua novaeseelandiae</i>) |
| Chaffinch | | (<i>Fringilla coelebs</i>). |
| Fantail | Piwakawaka | (<i>Rhipidura fuliginosa fuliginosa</i>), |
| Grey Warbler | Riroriro | (<i>Gerygone igata</i>), |
| New Zealand Pigeon | Kereru | (<i>Hemiphaga novaeseelandiae</i>). |

| | | |
|--------------------|---------------|---|
| Paradise Shelduck | Putangitangi | (<i>Tadorna variegata</i>) |
| Redpoll | | (<i>Carduelis flammea</i>) |
| Shining Cuckoo | Pipiwaharuroa | (<i>Chrysococcyx lucidus lucidus</i>) |
| Silvereye | Tauhou | (<i>Zosterops lateralis lateralis</i>) |
| South Island Kaka | | (<i>Nestor meridionalis meridionalis</i>) |
| South Island Robin | Toutouwai | (<i>Petroica australis australis</i>) |
| Thrush | | (<i>Turdus philomelos</i>), |
| Tomtit | Miromiro | (<i>Petroica macrocephala macrocephala</i>) |
| Tui | | (<i>Prothemadera novaeseelandiae novaeseelandiae</i>) |

Bats

Long tailed bat (*Chalinolobus tuberculatus*) – Thought to be present
Short tailed bat (*Mystacina tuberculata*) – Thought to be present

Lizards

No information available