Simons Pass Station

Baseline Terrestrial Invertebrate Survey
Prepared for Simons Pass Station

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Boffa Miskell

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Introduction

Simons Pass Station has been granted resource consent (CRC082311) by the Canterbury Regional Council (ECan) to divert, take and use surface water from the Tekapo Stilling Basin for spray irrigation and stock water use at Simons Pass Station, State Highway 8 Lake Pukaki.

This resource consent requires that a Dryland Recovery Management Plan (DRMP) be prepared with the objective of promoting and achieving the recovery of the indigenous dryland ecosystems within the Dryland Recovery Area, over a long-term period by restoration management. As part of this DRMP, baseline surveys of the plant species and native fauna (lizards, birds and invertebrates) was required to be carried out within 12 months of commencement of the consent.

This report details the methodology and findings of the baseline survey of invertebrate fauna of the Dryland Recovery Area.

Site Description

The Dryland Recovery Area that has been put aside from grazing and irrigation activities is approximately 2550 ha (Figure 1). The Dryland Recovery Area can be divided into six blocks, each representing different vegetation types (Upper Downs, Lower Downs, Desert Block, Pukaki Flats, Rosehips, and Tekapo Flats).

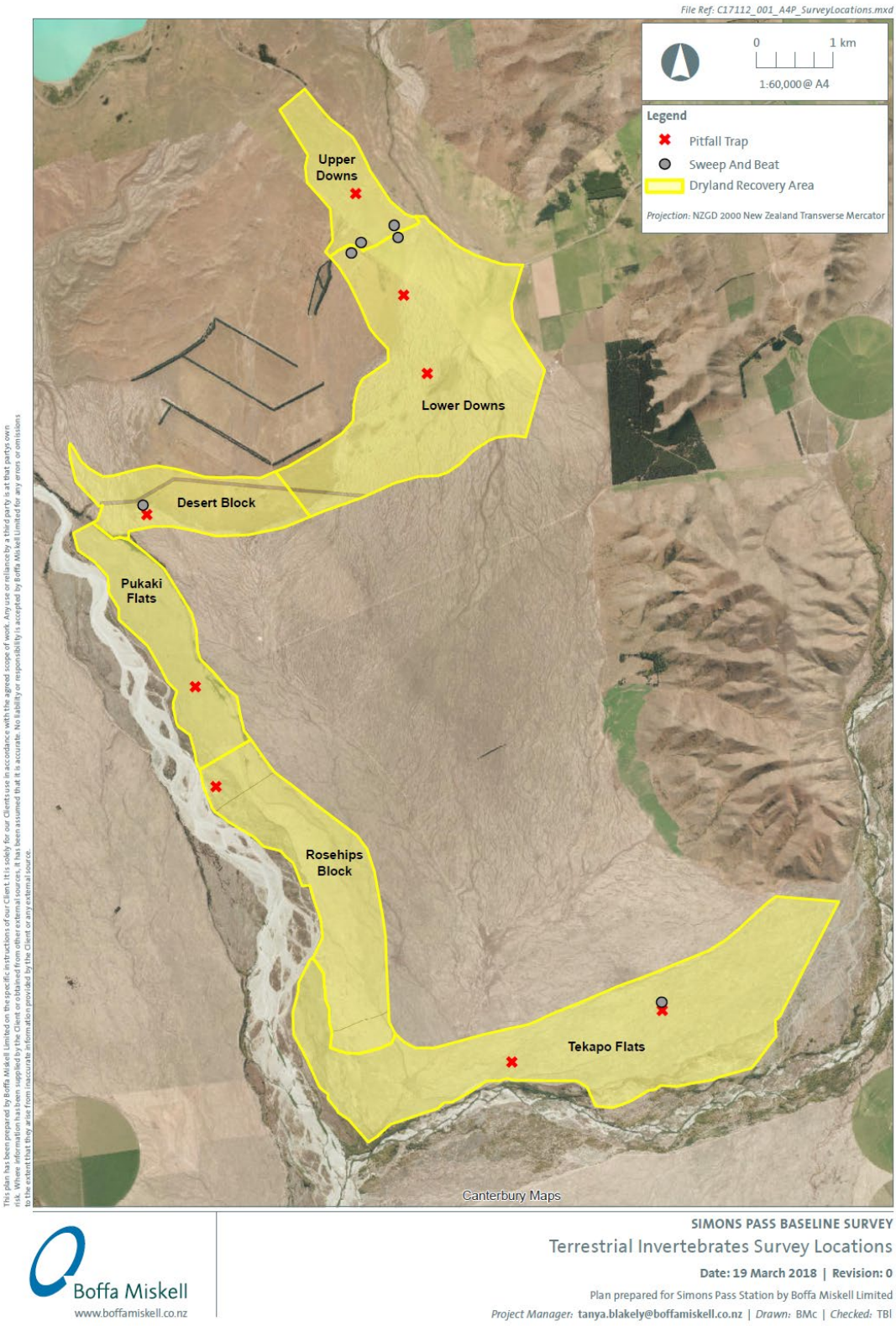

Figure 1. Locations of pit-fall traps and hand searching ("sweep & beat") of terrestrial invertebrate community for the baseline survey, December 2017.

Methodology

Taxonomic Focus

Because of limitations (including available expertise), the baseline survey of the invertebrate community primarily focused on beetles (Coleoptera), acridid grasshoppers (Orthoptera), spiders (Araneida) and harvestmen (Opiliones).

It's important to note that the objective of the DRMP is to promote and achieve the recovery of the indigenous dryland ecosystems within Area G over a long-term period, by restoration management. As such, it is not essential to complete a complete inventory of all plants (flora) and animals (fauna) present. It is important to provide sufficient baseline information on particular groups that are likely to respond to management of the Dryland Recovery Area, but using a relatively simply methodology that is repeatable and suitable to show potential change / response of the selected groups.

While bees, wasps, ants (Hymenoptera) and moths and butterflies (Lepidoptera) may be insects orders with high diversity and that reflect habitat change, given the time available and the size of the area to be surveyed, the beetle fauna and spiders and grasshoppers have been selected as terrestrial invertebrate indicators of restoration success, or change.

Beetles occur in all terrestrial and freshwater habitats, have the widest range of feeding habits of any group of terrestrial invertebrates, and comprise the largest and most diverse group of insects in New Zealand. They are relatively well known in New Zealand, and have been used extensively in ecological surveys.

Members of the family Acrididae (short-horned grasshoppers) are characteristic of dry, open areas such as the Mackenzie Basin. At least two species are endemic (known from nowhere else) to the area.

Spiders (Araneida) and harvestmen (Opiliones) are important predatory species occupying a key role in most ecosystems. There is high diversity of native species, as well as a high rate of endemism.

Surveying Invertebrates

As noted above, the baseline data and surveying methodology was focused on beetles, grasshoppers, spiders and harvestmen, using trapping methods best suited to surveying these invertebrate groups. As such, pit-fall trapping and hand searching, rather than Malaise trapping light trapping, and other survey methods were not required.

Pit-fall trapping

Pit-fall traps were placed in each of the six blocks (Upper Downs, Lower Downs, Desert Block, Pukaki Flats, Rosehips, and Tekapo Flats) of the Dryland Recovery Area, on 4 & 5 December 2018. One set (consisting of four individual pit-fall traps) was placed in each of Upper Downs, Desert Block, Pukaki Flats and Rosehips. Because of the larger size of Lower Downs and Tekapo Flats, two sets of pit-fall traps (i.e. a total of eight traps) were placed in each of these areas.

Trap sites were chosen for their representativeness of the block, for diversity of vegetation, and for ease of access. The placement of each of the four traps, which made up each set of pit-fall traps, was largely determined by finding areas of ground where holes could be dug. Much of the ground was very stony, which limited the ability to dig holes and set the pit-fall traps.

Each pitfall trap consisted of an 85-mm diameter plastic pottle, inserted into a hole in the ground with the lip level and in contact with the surrounding ground surface. A small amount of monoethylene glycol was added to each container, to act as an invertebrate preservative. Each pottle was covered by a metal roof to prevent rain entering it while allowing free access to invertebrates underneath.

Hand searching

Hand searching, beating of shrubby vegetation, and sweeping of grasses were also carried out within each of the blocks. Sampling of the invertebrate community was mainly concentrated around the pit-fall trap sites. However, at Upper Downs, one site was selected on a terrace riser that supported remnant shrubby vegetation, which had not been observed anywhere else in the Dryland Recovery Area. A second Upper Downs site, and the two Lower Downs sites, were also selected because there was some (albeit relatively limited) diversity of vegetation.

Invertebrates captured during hand searching were preserved in ethanol, with some readily identified species noted but not preserved. The time spent on these hand-searching activities was recorded to provide a measure of ‘effort’.

Laboratory identifications

Pit-fall trap catches were hand sorted under a binocular microscope. Debris was removed, and all beetles and adult grasshoppers observed were preserved in ethanol. For spiders, only representative material was removed, as disentangling these specimens from debris and other insects was very time consuming. That is, not all invertebrates collected in pit-fall traps were identified, particularly juvenile where species level identifications would not have been possible.

Some of the beetles and grasshoppers collected were pinned and placed in the Lincoln University Entomology Research Collection. Some spiders were preserved in ethanol in the Canterbury Museum.

Invertebrates were identified to species level, where possible. Beetle identifications were undertaken by Dr Rowan Emberson, who also identified grasshoppers after consultation with Simon Morris. Spider identifications were made by Dr Cor Vink.

Results

A list of all invertebrates collected or observed, and identified, during this baseline survey is presented in Table 1.

A total of 72 invertebrate taxa were found during the survey, in pit-fall traps and during hand searching. This included 40 beetles, 3 short-horned grasshoppers, 14 spiders, and 1 harvestman species.

Of the beetles, 77.5% of those captured were native species, while the remaining 22.5% were adventive or introduced species. There were some notable differences in the beetle community found (i.e. the pit-fall catches) between the six blocks within the Dryland Recovery Area. Many of the blocks (4 out of 6) had one or more beetle species captured in pit-fall traps that seemed particularly associated with that block. For example, one specimen of *Hypharpax australis* (a carabid beetle associated with open areas) was found in 3 of 4 pit-fall traps on Desert Block, but nowhere else; two species of Latrididae (*Corticaria* sp. and *Cortinicara hirtalis*) and two species of Oedemeridae (*Selenopalpus aciphyllae* and *Thelyphassa* n. sp[1].) were captured in nearly every trap on Rosehips, but found only sparsely elsewhere; the tiger beetle *Neocicindela dunedensis* was encountered in all four traps on Pukaki Flats, and in 6 out of 8 traps on Tekapo Flats, but found only sparsely elsewhere; and the currently undescribed tiger beetle *Zecicindela* n. sp. was only encountered at Tekapo Flats (with just one individual in each of 3 of 8 traps). Tiger beetles are associated with open habitats having only short vegetation, and are relatively well studied in New Zealand. This family of beetles has been recently revised, so finding a new species makes a significant addition to the beetle fauna.

No beetles were collected in pit-fall traps set at Upper Downs. There were also insufficient beetle records collected from pit-fall traps at Lower Downs to show whether any species were particularly characteristic of that area.

Fewer grasshoppers were collected, than beetles. This, in part, reflects the relative difficulty of collecting grasshoppers in pit-fall traps. However, the following are notable finds as far as grasshoppers were concerned. The short-horned grasshopper, *Sigaus* sp. A was found in all four traps on Rosehips, but not found in pit-fall traps in any other areas. The Threatened, Nationally Vulnerable *Sigaus* “blue” was hand collected from Pukaki Flats, but found nowhere else in the Dryland Recovery Area. The robust grasshopper, *Brachaspis robustus*, an endemic of the MacKenzie Basin (and therefore could have been present in the Dryland Recovery Area) and classified as Threatened, Nationally Endangered, was not found in any samples collected from the Dryland Recovery Area.

There were a few small patches of native scrub found on a terrace riser in Upper Downs, including some remnant *Carmichaelia*. Hand searching found six beetle species, found nowhere else in the Dryland Recovery Area, on these plants.

Conclusions & Recommendations

<u>Timing of further surveys:</u>

- To be comparable with this baseline survey, future surveys should be conducted using similar methodology and under similar conditions, with similar effort.
- This survey was conducted in December 2017, when the weather was unusually warm for the time of year, which would likely lead to increased invertebrate activity. However,

[1] The numerous specimens of the flightless lax beetle, *Thelyphassa* species, represents an undescribed, new species. There is a relatively modern (1975) revision of the NZ species. Using this, and the Entomology Research Collection held at Lincoln University, Rowan Emberson has confirmed this as an undescribed species.

December 2017 was noted to also be drier than usual, which may have reduced invertebrate activity (and therefore likelihood of detection).

- In any case, it is recommended that future surveys be undertaken in the first half of December, as long-term trends should stand out from any yearly variation.

Locations of surveying:

- As there was considerable local variation in vegetation, we recommend that pit-fall traps be placed in approximately the same locations in future surveys (Figure 1). This also then accounts for local vegetation change due to the management (and goals) of attaining representative floral assemblages. Also, hand collecting, sorting of samples, and identifications should be carried out by Entomologists familiar with beetles, grasshoppers and spiders.

Key indicators of recovery:

- If future management of the Dryland Restoration Area includes improvements of vegetation communities with native shrubs, along with weed and predator control, changes in the invertebrate fauna are likely to reflect this (with natural losses and gains).
- If local native shrubs can be encouraged to spread / regenerate in the Dryland Recovery Area, this could have a large positive impact on the invertebrate biodiversity of the Dryland Recovery Area, but also some potentially resulting in the loss of species associated with open habitats and short vegetation (such as tiger beetles).
- An increase in invertebrate (particularly beetle) diversity by itself would not necessarily indicate success (as this could be due to adventive or introduced species diversity increasing). An increase in native species diversity might be expected in areas where native vegetation is enriched. While in areas that were previously naturally high in bare ground (but were recovering with shrublands) might result in a reduction in overall diversity. This might be due to a decline in exotic species that are usually associated with introduced weeds.
- The proportion of native: adventive / introduced species (particularly beetles) is likely to be a good biotic index to measure improvements in the terrestrial invertebrate community. It is expected that as vegetation communities in the Dryland Recovery Area improve (with a greater diversity of woody vegetation and shrubs), there will also be an increase in presence and relatively abundances of native species (esp. beetles).
- Other measures include no loss of native species and / or the addition of not previously recorded native species, especially those associated with native shrublands.
- It would be advantageous to include survey methodology that is applicable to insect orders such as Lepidoptera (e.g. light trapping). Moths and butterflies (Lepidoptera) can be good indicators of changes in the dominant vegetation and particularly changes in shrubland communities. This could be conducted at less frequent intervals to the full invertebrate survey, for example, every 5 years.

Table 1. List of all invertebrate taxa collected and identified from the Dryland Recovery Area surveyed in December 2017.

Order	Family	Species	Origin[2]	Upper Downs	Lower Downs	Desert Block	Pukaki Flats	Rose-hips	Tekapo Flats	Observed /collected	Comments
Coleoptera (beetles)	Anobiidae	*Ernobius mollis*	adventive				+			beaten from dead pine	
	Anthicidae	*Pseudocyclodinus otagoensis*	native		+		+	+	+	pitfall traps	
	Anthribidae	*Euciodes suturalis*	adventive	+	+	+				swept from grass and herbs, pitfall trap	
	Carabidae	*Demetrida dieffenbachii*	native					+		pitfall traps	
		Holcaspis ohauensis	native				+			pitfall traps	Probably a Mackenzie endemic
		Hypharpax australis	native			+				pitfall traps	
		Metaglymma aberrans	native				+	+		pitfall traps	South Canterbury
		Neocicindela dunedensis	native		+		+	+	+	observed, pitfall traps	SE South Island only
		Zecicindela n. sp.	native						+	pitfall traps	an undescribed species
	Cerambycidae	*Hybolasius* sp. 1	native	+						beaten from *Carmichaelia*	
		Hybolasius sp. 2	native	+						beaten from *Carmichaelia*	
	Chrysomelidae	*Chrysolina hyperici*	introduced	+			+	+	+	Under rock, beaten from shrubs	St John's wort beetle
	Coccinellidae	*Adalia bipunctata*	introduced	+	+	+	+	+	+	beaten from shrubs	2-spot lady-bird

[2] The categories in the Origin column refer to how the species came to be in New Zealand. 'Native' refers to all species believed to be part of the original insect fauna of New Zealand, prior to European discovery and settlement; 'Adventive' species are those that have established in New Zealand since European settlement; and 'Introduced' are those that have been deliberately imported and released, usually for biological control of weeds and pests, or as pollinators.

Order	Family	Species	Origin[2]	Upper Downs	Lower Downs	Desert Block	Pukaki Flats	Rose-hips	Tekapo Flats	Observed /collected	Comments
		Coccinella leonina	native	+	+	+	+		+	beaten from shrubs	predatory
		Coccinella undecimpunctata	introduced				+		+	beaten from shrubs	11-spot lady-bird
		Stethorus griseus	native	+						beaten from *Carmichaelia*	predatory
		Veronicobius sp.1	native	+					+	swept	
		Veronicobius sp.2	native					+		beaten from *Rosa*	
	Curculionidae	*Hypocryphalus* sp.	native	+						beaten from *Carmichaelia*	
		Listroderes delaiguei	adventive			+				pitfall trap	
		Peristoreus acalyptoides	native	+						beaten from *Carmichaelia*	specific to *Carmichaelia*
		Peristoreus sudus	native	+						beaten from *Carmichaelia*	seed-feeder on *Carmichaelia*
		genus indet.	native		+	+	+			pitfall traps	
	Dermestidae	*Trogoderma antennale*	native		+					pitfall trap	
	Dytiscidae	*Rhantus suturalis*	native			+				observed	
	Elateridae	*Conoderus exsul*	adventive				+		+	pitfall traps	
	Latridiidae	*Corticaria elongata*	adventive		+					pitfall trap	
		Corticaria sp.	adventive			+				pitfall traps	
		Cortinicara hirtalis	adventive		+	+				beaten, pitfall traps	
	Melyridae	*Dasytes* blue	native	+	+					beaten from shrubs	
		Dasytes green	native	+	+					swept, beaten from shrubs	
	Mycetophagidae	*Triphyllus* sp.	native						+	pitfall trap	
	Oedemeridae	*Selenopalpus aciphyllae*	native		+		+	+		swept from grass	

Order	Family	Species	Origin[2]	Upper Downs	Lower Downs	Desert Block	Pukaki Flats	Rose-hips	Tekapo Flats	Observed /collected	Comments
		Thelyphassa sp.	native				+	+		pitfall traps	possibly an undescribed flightless species
	Scarabaeidae	*Costelytra giveni*	native		+					pitfall trap	New Zealand grass grub
		Pyronota edwardsi	native	+	+	+		+		beaten from shrubs	manuka beetle
		Pyronota festiva	native		+					pitfall traps	manuka beetle
	Tenebrionidae	*Zeadelium nigritulum*	native			+	+			pitfall traps	
	Trogosittidae	*Grynoma* sp.	native	+				+	+	beaten from shrubs	
	Zopheridae	*Ablabus* sp.	native					+		pitfall traps	
Dermaptera (earwigs)	Forficulidae	*Forficula auricularia*	adventive						+	observed	
Diptera (two-winged flies)				+	+	+	+	+	+	observed	
Hemiptera (true bugs)				+	+	+	+	+	+	swept, pitfall traps	
Hymenoptera (ants, bees, wasps)	Apidae	*Apis mellifera*	introduced	+	+	+	+	+	+	observed	honey bee
		Bombus terrestris	introduced	+	+	+	+	+	+	observed, pitfall traps	bumble bee
Lepidoptera (butterflies, moths)	Arctiidae	*Nyctemera annulata*	native	+						observed	magpie moth
	Lycaenidae	*Lycaena boldenarum*	native				+			observed	boulder copper
		Lycaena salustius	native				+			observed	common copper
		Zizina labradus	native				+			observed	common blue
Mantodea (mantids)	Mantidae	*Orthodera novaezealandiae*	native	+	+					swept, observed	Praying mantis
Odonata	Coenagrionidae	*Xanthocnemis zealandica*	native			+				observed	red damselfly

Order	Family	Species	Origin[2]	Upper Downs	Lower Downs	Desert Block	Pukaki Flats	Rose-hips	Tekapo Flats	Observed /collected	Comments
	Lestidae	*Austrolestes colensonis*	native			+				observed	blue damselfly
Orthoptera (crickets, grasshoppers weta)	Acrididae	*Phaulacridium otagoense*	native			+	+	+	+	swept herbs, bare ground, pitfall traps	Mackenzie and Central Otago
		Sigaus "blue"	native				+			swept	Nationally vulnerable
		Sigaus species A	native				+	+		swept, pitfall traps	Mackenzie and Central Otago
	Anisostomatidae	*Hemiandrus* sp.	native				+		+	pitfall traps	ground weta
	Tettigoniidae	*Conocephalus* sp.	native	+	+	+				observed	tussock katydid
Opiliones (harvestmen)	Phalangiidae	*Phalangium opilio*	adventive	+	+	+	+	+		pitfall traps	European harvestman
Araneida (spiders)	Corinnidae	*Nyssus coloripes*	adventive					+		pitfall trap	
	Gnaphosidae	*Anzacia gemmea*	native	+	+				+	pitfall traps	silvery vagabond spider
		Zelanda obtusa	native	+	+				+	pitfall traps	
	Linyphiidae	*Pseudafroneta incerta*	native	+						pitfall trap	
	Lycosidae	*Anteropsis hilaris*	native	+	+	+	+		+	pitfall traps	garden wolf spider
		Notocosa bellicosa	native	+			+			pitfall traps	
	Theridiidae	*Steatoda grossa*	adventive					+		pitfall trap	house cobweb spider
		Steatoda lepida	native		+				+	pitfall traps	
		Steatoda truncata	native				+	+		pitfall traps	