

Crown Pastoral Land Tenure Review

Lease name : THE GRAMPIANS

Lease number : PT 022

Conservation Resources Report - Part 1

As part of the process of Tenure Review, advice on significant inherent values within the pastoral lease is provided by Department of Conservation officials in the form of a Conservation Resources Report. This report is the result of outdoor survey and inspection. It is a key piece of information for the development of a preliminary consultation document.

Note: Plans which form part of the Conservation Resources Report are published separately.

These documents are all released under the Official information Act 1982.

July

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THE GRAMPIANS

PASTORAL LEASE



CONSERVATION RESOURCES REPORT

DEPARTMENT OF CONSERVATION

JULY 2006

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PART 1 INTRODUCTION

The Grampians Pastoral Lease is leased by The Grampians Station Ltd. The 16057 ha property is located on the Grampian Mountains, Dalgety Range, part Kirkliston Range and the outwash flats of the Mackenzie and Snow rivers at the eastern side of the Mackenzie Basin in South Canterbury. It covers moderately-steep mountainous country on the ranges and areas of gently sloping outwash fans and terraces between the two ranges. The property ranges in altitude from 520 m at its western edge on the floor of the Mackenzie Basin to 1921 m near Black Rocks on the Grampian Mountains. The northern part of the property on the Dalgety Range is drained by the Mackenzie River and its tributaries. The southern part of the property on the Grampian Mountains is drained to the north by the Snow River, and to the south by Dalgety and Grampian streams. The Mackenzie and Snow rivers flow into Grays River, a tributary of the Tekapo River. Dalgety and Grampian streams flow into the Hakataramea River. All lie within the Waitaki River catchment.

Access to the property is from State Highway 8 near Burke Pass via Haldon Road or Mackenzie Pass Road in the north and from State Highway 82 in the lower Waitaki Valley, via the Hakataramea Valley and Hakataramea Pass Road in the south. A number of unformed legal roads provide access to and through parts of the property.

Mountainous parts of Grampians Pastoral Lease lie in the Grampians Ecological District (ED). Lower-altitude parts of the property lie in Pukaki ED. Both these ecological districts are within the Mackenzie Ecological Region (McEwen, 1987), which was surveyed in the early 1980s as part of the Protected Natural Areas Programme. One area on the Snow River fan (Pukaki ED), and one area on the Dalgety Range and one area on the Grampian Mountains (Grampians ED) were recommended for protection by that survey (Espie *et al.*, 1984). Small areas at the southern edge of the property lie in the Kirkliston and Hakataramea ecological districts, at the convergence of three ecological regions (Mackenzie, Waitaki and Pareora). A Significant Site of Wildlife Interest is present along Grays River at the northwest boundary of the property (Jarman, 1986).

The property adjoins Glenrock Pastoral Lease to the north, Mt Dalgety Pastoral Lease to the east, freehold land to the southeast in the Hakataramea Valley, Kirkliston Pastoral Lease to the southwest, Streamlands and Curraghmore pastoral leases to the west, and Grays Hill Pastoral Lease to the northwest in the Mackenzie Basin. Mount Dalgety Conservation Area (Conservation Land Unit I38017) adjoins the property at its southeast boundary on the Dalgety Range.

The tenure review inspection of the property was undertaken during September 2005, January-February and April 2006 by a range of specialists. These specialists' reports (listed below) form the basis of this Conservation Resources Report.

- High Country Tenure Review Programme Landscape Assessment, Grampians Pastoral Lease, Blakely Wallace Associates, March 2006, 24p including photos + map.
- o Grampians Vegetation Report, Mark Davis, April 2006, 34p + maps.
- Assessment of the Fauna Values of Grampians Pastoral Lease, Jane Sedgeley, March 2006, 23p including photos + maps.
- Grampians Pastoral Lease, A Report on the Aquatic Fauna Surveys, Scott Bowie, February 2006, 13p including photos + maps.
- Grampians Pastoral Lease Tenure Review Assessment of Invertebrate Values and Recommendations for their Protection, Rowan Emberson and Pauline Syrett, February 2006, 17p + photos + maps.

PART 2 INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 LANDSCAPE

2.1.1 Landscape Context

The Grampians Pastoral Lease is located on the eastern edge of the Mackenzie Basin approximately 30 kilometres from Tekapo. It forms part of the eastern enclosing ranges of the Mackenzie Basin. The largest part of the property covers the Grampian Mountains. The property also includes a substantial area of alluvial and outwash flats on the edge of the Mackenzie Basin. It covers mountain slopes that enclose in part both Hakataramea Pass and Mackenzie Pass. These passes form low saddles that separate the enclosing mountain ranges.

The Mackenzie Basin/upper Waitaki area is an extensive intermontane basin bounded by high glaciated mountains to the north and west. The Grampian Mountains and adjoining ranges are dissected block mountains that form the southeast margin of the Mackenzie Basin. Deposits of loess and alluvium have subsequently overlain moraine and outwash gravels on the valley floor. Wide open spaces, high enclosing ranges, and a semi-arid climate and landscape define the overall character of the Mackenzie Basin.

2.1.2 Landscape Description

For the purposes of this landscape assessment The Grampians Pastoral Lease is divided into four landscape units, reflecting areas of similar landscape character (see attached map). For each landscape unit, landscape character is evaluated using the following criteria:

- <u>Intactness</u>: the condition of the natural vegetation, patterns and processes and the degree of modification present.
- <u>Legibility</u>: expressiveness: how obviously the landscape demonstrates its formative processes.
- <u>Aesthetic Factors</u>: e.g. distinctiveness and coherence. Distinctiveness is the quality that makes a particular landscape visually striking; this frequently occurs when contrasting natural elements combine to form a distinctive and memorable visual pattern. Coherence is based on characteristics including intactness, unity, continuity, and compatibility (intrusions, alterations, disruptions tend to detract from coherence).
- o <u>Historic Factors</u>: historically valued attributes in the context of a high country landscape.
- <u>Visibility</u>: the visibility of the landscape from public vantage points.
- <u>Significance</u>: the local, regional or national significance of the characteristics and features, or combination of characteristics and features, within each unit.
- <u>Vulnerability</u>: a measure of the susceptibility of the landscape unit to landscape degradation.

Landscape Unit 1, Haldon Road Flats

This distinct unit includes all the outwash and alluvial flats west of the mountain slopes. The flats are a small part of the expansive intermontane floor of the Mackenzie Basin and form peripheral alluvial fans and fan skirts at the base of the mountain slopes. Soils are thin and stony. The flats form a striking contrast to the steep dissected mountain slopes behind them. Key characteristics are openness, expansiveness, the lack of topographic variation and aridness.

Vegetation is variable but over the greater area is sparse low pasture dominated by hawkweed with approximately 20% to 40% bare ground. Shrub species include sweet brier, scattered matagouri and short tussock. Some areas, notably west of Haldon Road, have been cultivated and sown in lucerne and other exotic pasture species, while other areas have never been cultivated. Towards Grays River soils are heavier and ground cover is denser.

Mackenzie Pass Road and vehicle tracks cross the flats. A conifer plantation and shelterbelts occur mainly within adjoining freehold land. These introduce dark green vertical elements, contrasting strongly with the natural form and openness of the flats. Several watercourses including the Mackenzie River cross the outwash flats to join Grays River. In places the streams are defined by willow trees. Some watercourses are seasonally dry. The lack of fences also emphasises the openness of the outwash flats and fans. Power pylons are a dominant introduced feature. The pylons march in straight lines across the landscape.

Visual and Scenic Values

The outwash flats as a whole are a distinctive and highly memorable feature of the Mackenzie Basin. They are also highly legible in terms of the glacial and post-glacial processes. The outwash flats extend out across the basin on a grand scale and visually relate and connect with the glaciated mountains on the west side of the basin, including the main divide of the Southern Alps and Aoraki/Mount Cook. Even within The Grampians Pastoral Lease, the scale, openness and expansiveness of the outwash flats are impressive. The contrast between the horizontal plane of the flats and the vertical form of the mountain slopes is striking and very significant. Though the indigenous vegetation is modified, the landform characteristics are important to natural landscape values.

The conifer plantations and shelterbelts visually disrupt the openness and predominantly brown tones of the landscape. There is; however, sufficient openness remaining within the unit to provide a natural landscape. The power pylons are now an accepted part of the Mackenzie Basin landscape. The scale of the landscape is able to absorb the visual impact of the pylons. This unit is extremely important in terms of the experience of travellers entering the basin from the Mackenzie and Hakataramea passes. The expansiveness and scale of the flats is highly dramatic and memorable and contrasts markedly with the enclosure of the two passes.

Criteria	Value	Comment
Intactness	Low	Some remnant species but highly modified
		except for isolated remnants.
Legibility	High	Highly legible formative processes.
Aesthetic Factors	High	Visually striking due to the scale and
		expansiveness.
Historic Factors	Low	Mainly related to pastoralism and the romance
		of this era but also heritage values associated
		with Mackenzie Pass.
Visibility	Medium	Visible from the Hakataramea and Mackenzie
		passes, Haldon Road and as a distant view from

Evaluation Summary

		State Highway 8.
Significance	Medium	Significant as part of the larger basin landscape
		which is a landscape of at least regional
		significance.
Vulnerability	High	Highly vulnerable to landscape change, e.g.
	-	farm intensification, forestry, irrigation.

Landscape Unit 2, Dalgety Range

This northern unit includes the upper Mackenzie River catchment at the northern boundary of the property (adjoining Mackenzie Pass Road) and the front faces of the mountain slopes between the outwash flats and the main ridge of the Dalgety Range. The upper reaches of Mackenzie River are outside the property, within the adjoining Mount Dalgety Pastoral Lease. Landform patterns include low hills, fans and terraces adjacent to the Mackenzie River and dry hills forming smooth colluvial slopes. The front faces are generally highly modified with moderately steep slopes, scattered short tussock, hawkweed and matagouri shrubland on the lower flanks.

The Mackenzie River catchment is orientated north-south and is generally modified on low and midslopes with extensive drifts of matagouri-*Olearia* shrubland, scattered short tussock and exotic grasses and weeds. North eastern faces and slopes on the true left of the Mackenzie River are often bare and degraded. Shrubland associated with watercourses and on lower slopes is a characteristic feature, contrasting with less vegetated slopes elsewhere.

The upper slopes of the Dalgety Range are more natural with scattered snow-tussock above approximately 800 m which increases in density and cover at higher altitudes. Scree and sheet erosion are features on the steep upper slopes. Boulderfields are also a distinctive feature on the slopes immediately below the ridge. These are associated with shrubland and large rock outcrops, bluffs and scree. The boulders are lichen covered, imparting a black colour.

Mackenzie Pass Road climbs up from the flats at the northern end of the unit. Scattered short tussock, exotic pasture and shrubland on the lower slopes and fans change to scattered snow-tussock near Mackenzie Pass. Scattered wilding conifers occur on the slopes and a stand of pines is located near the bridge over the Mackenzie River, possibly marking a site of early settlement. The Mackenzie Memorial is located near the northern property boundary.

Visual and Scenic Values

The visual and scenic values of this unit include those associated with the range faces forming the eastern enclosure and backdrop to the Mackenzie Basin. Importantly, the unit forms part of the visual corridor along Mackenzie Pass Road. The pass is an important historic route to the Mackenzie Basin. The mountain lands within this unit contribute to the scenic quality and experience of this heritage route.

The bluffs, boulderfields and shrubland on the upper slopes of the Dalgety Range are significant landscape features visible from a wide area. Viewed from the ridge of the Dalgety Range, the association of bluffs, boulders, scree and shrubland, combined with impressive views across the hills and Mackenzie Basin, is memorable and significant. The remnant tussockland and shrubland contribute to the natural character and are especially important within the Mackenzie Pass visual corridor.

Evaluation Summary

Criteria	Value	Comment
Intactness	Medium	Low on low and mid slopes. High on upper
		slopes. Natural processes and patterns

		intact on upper slopes.
Legibility	Medium	
Aesthetic Factors	Medium	Overall typical of Mackenzie Basin. The
		Mackenzie Pass corridor and upper
		Dalgety Range are distinctive and coherent
		landscapes.
Historic Factors	High	Heritage values associated with Mackenzie
		Pass.
Visibility	High	Most of unit is visible from either Haldon
		Road or Mackenzie Pass Road.
Significance	Medium	The Mackenzie Pass corridor and upper
		Dalgety Range are significant at a regional
		level.
Vulnerability	Medium to High	The Mackenzie Pass corridor is very
		vulnerable to landscape change.

Landscape Unit 3, Grampian Mountains

The Grampian Mountains is the largest landscape unit and includes a wide altitudinal range from 550 m to over 1900 m. The unit is variable in character and is split here into three subunits.

Unit 3a, Western Grampian Mountains

The mountain slopes above the homestead and farm buildings form a series of southwest dissected tributaries on steep to moderately steep slopes draining to Grays River. A small area within upper Moffat Stream drains south. The lower and mid slopes are highly modified with scattered short tussock, hawkweed, sweet brier, pasture and weeds. Natural values are low. Snow-tussock is present on mid slopes though is depleted, especially on the dry sunny faces. On upper slopes snow-tussock cover is relatively continuous though variable and reduced in size. Ridges are denuded and dominated by hawkweed. Rock outcrops are extensive on upper slopes. Wilding conifer spread is present. The north-facing slopes adjacent to the boundary with Curraghmore Pastoral Lease are particularly denuded and modified.

Unit 3b, Northeast Grampian Mountains

These northeast faces are very rocky, stony, dry and degraded. Lower slopes include extensive sweet brier and hawkweed with scattered remnant short tussock and some scattered shrubland with prostrate kowhai and porcupine shrub. Shrubland and sweet brier are prominent in the lower gullies and on the upper fans. Mid slopes to about 1300 m have similar patterns but with a marked variation in aspect. South-facing slopes have some snow-tussock and pasture. Scattered wilding conifers are present. Above approximately 1400 m, slim snow-tussock cover is more or less continuous on upper ridges. The ridge has a rounded profile with scattered rock outcrops and tors. Monkey Rock forms a local landmark.

Unit 3c, Southeast Grampian Mountains

This area covers the east slopes of the range south of Monkey Rock, including the high alpine ridge and basins, and the slopes extending down to Hakataramea Pass Road. Fellfield occupies the high ridge and basins, extending over several kilometres along the ridge. Scree, rock and low-alpine herbfield are the main features. Periglacial and nival processes are highly legible. The shattered rock has a distinctive reddish volcanic-like appearance which contrasts with grey scree, black lichencovered rocks and diverse herbfield vegetation patterns.

The high basins descend into a series of steep tussock covered gullies. Snow-tussock is more or less continuous but varies with aspect. Fans, terraces and colluvial slopes are a feature of lower slopes above Hakataramea Pass Road. Tussock slopes alternating with drifts of matagouri shrubland and grassland are the primary vegetation patterns on these landforms. In some areas snow-tussock is present alongside the road and in other areas it has been replaced by pasture grasses, predominantly browntop. The unit includes part of the fans, low hills and alluvial surfaces at the south end of the unit in the Hakataramea Valley. Vegetation patterns here include extensive matagouri, tussock and pasture. Some of this area has been over-sown and top-dressed in recent times. This sub-unit is the most natural within the Grampians Mountains landscape unit.

Visual and Scenic Values

At one level, the visual and scenic values of this unit are related to the Grampian Mountains forming part of the southeast mountain enclosure to the Mackenzie Basin and their visibility from a wide area (including from State Highway 8). The mountains viewed as a whole, while not distinctive or highly memorable, are typical of the eastern enclosing ranges of the Basin. They are important as the physical enclosure and backdrop to the wide, open spaces of the Mackenzie Basin and to the outwash flats and fans adjacent to Hakataramea and Mackenzie passes.

Other aspects of the visual and scenic values of this unit include the views out, which from anywhere on the Grampian Mountains are quite outstanding, especially views to Aoraki/Mount Cook.

The alpine fellfield areas on the summit ridge and upper basins stand out as a striking and distinctive alpine landscape. The combination of scree, lichen-covered rocks and diverse alpine plant communities located high above the Mackenzie Basin forms a landscape with outstanding scenic values. The tussock- and matagouri-covered slopes above the Hakataramea Pass are also important to the context and landscape character of the pass. The pass has significant scenic values, forming an impressive entrance to the Mackenzie Basin. The experience of climbing up to the pass through tussock-covered hills in the upper Hakataramea Valley, and the unfolding of the majestic and stunning views of the Mackenzie Basin is dramatic and highly memorable. It is one of the important iconic landscape experiences of the Mackenzie Basin-South Canterbury area.

Criteria	Value	Comment
Intactness	Variable	Low on mid and lower slopes; high on
		summit ridge and upper basins.
Legibility	High	Very high on summit ridge. Medium to
		high on dissected mountain slopes.
Aesthetic Factors	Variable	The summit ridge and basins are highly
		distinctive; mid and lower slopes are a
		distinctive high country landscape and
		aesthetically coherent.
Historic Factors	Medium	Heritage values associated with the
		Hakataramea Pass.
Visibility	Medium	Visible from the Hakataramea Pass Road.
Significance	High	The summit ridge is highly significant.
		Mountain slopes and the backdrop to
		Hakataramea Pass are regionally significant.
Vulnerability	Varies	Upper slopes and ridge highly vulnerable.
		Lower slopes vulnerable to further loss of
		tussock cover and natural values.

Evaluation Summary

Landscape Unit 4, Grampian Stream

This unit includes the catchment of Grampian Stream at the southern end of the Grampian Mountains and includes the flats and rolling landforms at the base of the range and on the northern end of the Kirkliston Range. It is contiguous with the Grampian Mountains Landscape Unit.

Grampian Stream extends from over 700 m to 1700 m within the property and has a southeast aspect. Upper slopes include scree and snow-tussock grading down to scattered tussock, grey shrubland and pasture. Overall it has a natural appearance with a dominance of indigenous vegetation, and is similar in character to mountain slopes above Hakataramea Pass. A sense of remoteness is part of the character of this unit.

The part of the Kirkliston Range within this unit is low (c.1000 m) and with a discontinuous tussock cover and a high exotic component. On the fans and valley floor are browntop, sweet vernal and short tussock with shrubland (matagouri, *Olearia* and *Coprosma*). The shrubland component is a strong feature, especially where associated with watercourses and alluvial surfaces. As a whole the unit retains a reasonably intact natural character despite the depletion of tussock and its replacement with introduced grasses.

Visual and Scenic Values

This unit retains the appearance of a natural landscape and forms an important part of the wider high country landscape. The dominance of indigenous vegetation (tussockland and shrubland) is important in terms of the context and setting of the Hakataramea Pass landscape. It is a coherent natural landscape. The upper catchment of Grampian Stream is contiguous with the southern end of the Grampian Mountains. Natural processes and patterns are largely intact. The extensive screes and tussock-covered slopes are dominant features. The valley floor and rolling landform at the base of the slope are modified in ecological terms though appear relatively natural. The valley and surrounding high tussock-covered mountain slopes together form an aesthetically coherent landscape.

Criteria	Value	Comment
Intactness	Varies	High on upper slopes, medium on lower slopes
		and the valley floor.
Legibility	High	Formative processes are highly legible.
Aesthetic Factors	Medium	Visually coherent; no disruptive or intrusive
		elements.
Historic Factors	Medium	Forms a backdrop to the Hakataramea heritage
		landscape.
Visibility	Low	Parts are visible from Hakataramea Pass Road.
Significance	Medium	Significant in the context of the Hakataramea
		Pass landscape.
Vulnerability	Medium	Vulnerable to further farm development that
		would fragment vegetation patterns and natural
		character.

Evaluation Summary

Significance of Landscape Values

The outwash flats (Unit 1) are a distinctive and highly memorable feature of the Mackenzie Basin. They are also highly legible in terms of the glacial and post-glacial processes. Their scale, openness and expansiveness are impressive even within the property boundary. The contrast of the horizontal plane of the flats and the vertical form of the mountain slopes is striking and very significant. The

bluffs, boulderfields and shrubland on the upper slopes of the Dalgety Range (Unit 2) are significant landscape features visible from a wide area and complemented by the surrounding tussockland. The remnant tussockland and shrubland within this unit contribute to the natural character and are especially important within the Mackenzie Pass visual corridor. The mountain lands within this unit contribute to the scenic quality and experience of this heritage route. On the Grampian Mountains (Unit 3) the combination of scree, lichen-covered rocks and diverse alpine plant communities located high above the Mackenzie Basin forms a landscape with outstanding scenic values. The tussock- and matagouri-covered slopes above the Hakataramea Pass are also important to the context and landscape character of the pass. The pass has significant scenic values forming an impressive entrance to the Mackenzie Basin. It is one of the important iconic landscape experiences of the Mackenzie Basin-South Canterbury area. The Grampian Stream unit (Unit 4) retains the appearance of a natural landscape and forms an important part of the wider high country landscape. The dominance of indigenous vegetation (tussockland and shrubland) is important and the valley and surrounding high tussock-covered mountain slopes together form an aesthetically coherent landscape.

2.2 GEOLOGY, LANDFORMS AND SOILS

2.2.1 Geology

The basement rocks of the Grampian Mountains and Dalgety Range are moderately-indurated greywacke and argillite of the Torlesse Group (Chlorite Subzone I). Belts of basic lavas and tuffs are present in the basement rocks, though were only observed as basalt outcrops at one location on the property. Hill slopes are mantled with deposits of loess (wind-deposited sediments). The valley floors and terraces of the Mackenzie and Snow rivers comprise outwash gravels of the Tekapo and Mt John formations. Recent alluvial deposits are present along all the major lower-altitude rivers and streams, notably Grampian Stream and the Mackenzie, Snow and Grays rivers. Marine siltstone, sandstone and greensand of Tertiary age are present on lower-altitude slopes in the Dalgety Stream and Grampian Stream valleys. Faults are present along the base of the eastern and southern slopes of the Grampian Mountains and along the Mackenzie River valley between the Dalgety and Rollesby ranges (Gair, 1967).

2.2.2 Landforms

The Grampians Pastoral Lease is dominated by the moderately-steep slopes of the Grampian Mountains and the Dalgety Range, and the relatively extensive outwash flats between the two ranges. The mountain slopes are dissected by small valleys and studded with rock outcrops and bluffs. Gentler lower slopes are smoothed by a mantle of loess. Upper slopes are generally steeper with more extensive areas of exposed rock. Range summits, especially on the Grampian Mountains, are broad with extensive areas of exposed rock, boulderfield and stonefield. The summit of the Dalgety Range lies between 1400 and 1600 m altitude; the summit of the Grampian Mountains lies between 1500 and 1900 m. The main outwash flats of the Mackenzie and Snow rivers, forming the eastern edge of the Mackenzie Basin, lie between 500 and 700 m altitude. These broad gently-sloping fans and terraces feature considerable areas of exposed soil and stones. Even-contoured lower slopes and valley floors are present in the southeast part of the property, along Dalgety and Grampian streams. The mountain ranges on the property, particularly the Grampian Mountains, form the eastern boundary of the Mackenzie Basin and are transitional in character between the mountain ranges of Canterbury and Otago.

2.2.3 Soils

Higher altitude parts of the property on the Grampian Mountains and Dalgety Range have Kaikoura steepland soils along the range summits, Tengawai steepland soils on the upper eastern slopes and Omarama steepland soils on the upper southwest slopes. Mid-altitude slopes mostly have Tengawai hill soils and Dalgety shallow soils. The main outwash fans and terraces mostly have Acheron gravelly-sandy loams. Recent alluvium along rivers and streams has Tasman sandy loams.

Significance of Geology, Landforms and Soils

The Grampian Mountains and Dalgety Range form part of the eastern boundary of the Mackenzie Basin, separating the lower mountain ranges of coastal south Canterbury from the intermontane Mackenzie Basin. The dominance of the mountain ranges, the extensive outwash flats between the ranges, the prominence of the passes between the mountain ranges (Mackenzie and Hakataramea passes) and the presence of basalt outcrops are notable features on the property. The mountain ranges are transitional in character between the mountain ranges of Canterbury and Otago. There are no geopreservation sites listed for the property.

2.3 CLIMATE

The Grampians Pastoral Lease has a semi-arid mountain climate with cold winters and very warm dry summers. Predominant winds are from the northwest, with occasional gales. Snow can affect all parts of the property and lie at higher altitudes for several weeks in winter. Average annual precipitation is between 600 and 800 mm (Tomlinson, 1976). The climate of the area is strongly influenced by the sheltering effects of the Southern Alps, resulting in drier conditions than occur in most of New Zealand's other mountain environments (Leathwick *et al.*, 2003).

2.4 LAND ENVIRONMENTS OF NEW ZEALAND (LENZ)

LENZ is, as described by Leathwick *et al.* (2003): "a classification of New Zealand's landscapes using a comprehensive set of climate, landform and soil variables chosen for their role in driving geographic variation in biological patterns." The classification units of LENZ, termed environments by Leathwick *et al.* (2003), aim to: "identify areas of land having similar environmental conditions regardless of where they occur in New Zealand." The consequences of this are that "LENZ provides a framework that allows prediction of a range of biological and environmental attributes. These include the character of natural ecosystems, the vulnerability of environments to human activity, and the potential spread or productivity of new organisms (Leathwick *et al.* 2003)." Leathwick *et al.* (2003) present the LENZ information at four levels of detail, with level I containing 20 environments, level II containing 100 environments, level III containing 200 environments and level IV containing 500 environments. These LENZ classes are presented nationally to assist use at a range of scales; however, this data should be interpreted with caution, as the predicted extent and suggested vegetation types for each Land Environment (Leathwick *et al.*, 2003) have been extrapolated from limited field data.

In an analysis of the LENZ level IV data, with consideration of the remaining indigenous vegetation cover and the legal protection of these environments, Walker *et al.* (2005) proposed a threat classification for the remaining indigenous biodiversity in New Zealand's environments based on the two components of vulnerability (likelihood of loss): poor legal protection and risk of loss. This threat classification (Table One) has become the recognised benchmark for the promotion of threatened LENZ conservation.

Category	Criterion
Acutely Threatened	<10% indigenous cover remaining
Chronically Threatened	10-20% indigenous cover remaining
At Risk	20-30% indigenous cover remaining
Critically Underprotected	>30% indigenous cover remaining <10% legally protected
Underprotected	>30% indigenous cover remaining 10-20% legally protected
No Threat Category	>30% indigenous cover remaining >20% legally protected

Table OneLENZ threat categories and definitions (Walker *et al.* 2005)

For The Grampians Pastoral Lease small areas along the eastern property boundary on the Mackenzie and Snow river fans are "acutely-threatened". Areas of recently-deposited alluvium along the main rivers are "chronically threatened". Lower mountain slopes are "at risk". All other low- to mid- altitude parts of the property (below c.1150 m) are "critically under-protected".

Significance of Land Environments

Substantial areas of lower-altitude country on The Grampians Pastoral Lease are classified as "much reduced" (acutely- or chronically-threatened) or "at risk" land environments. Several of these land environments have only 1% of their total areas legally protected, and none have more than 6% protected. All remaining mid- and low-altitude parts of the property are classified as "critically under-protected" land environments, with less than 10% of their total areas legally protected.

2.5 VEGETATION

2.5.1 Ecological Context

The Grampians Pastoral Lease covers four Ecological Districts, the Grampians Ecological District (ED), the Pukaki Ecological District (ED) which are in the Mackenzie Ecological Region and the Kirkliston and Hakataramea Ecological Districts. The Kirkliston and Hakataramea Ecological Districts are at the convergence of three ecological regions (Mackenzie, Waitaki and Pareora), indicating an ecological transition zone. Part of the Recommended Area for Protection (RAP) Grampians 3 is located south of Mackenzie Pass on the Dalgety Range. It was identified for a range of representative communities including matagouri/*Olearia* scrub, short tussock grassland, snow-tussockland, slim snow-tussockland, *Brachyglottis* subalpine shrubland, *Dracophyllum pronum* fellfield and alpine fellfield (Espie *et al.*, 1984). Part of the RAP Grampians 6 is located around Black Rocks on the Grampian Mountains and represents alpine fellfield. The summit area includes the only known occurrence of *Celmisia ramulosa* in the Grampians ED and abundant *Aciphylla dobsonii* which is rare in the ecological district. RAP Pukaki 19 is located on the Snow River fan, representing dry fescue tussock grassland.

The vegetation pattern on Grampians Pastoral Lease is similar to that elsewhere on the Grampian Mountains and Dalgety Range. Fellfield communities are present on the summits of both ranges, though they are much more extensive on the higher Grampian Mountains. A cap of slim snow-tussock occurs at higher altitudes, grading into narrow-leaved snow-tussock and short tussock at lower altitudes. Grey shrublands are associated with lower valleys, alluvial fans and terraces.

McGlone (2001) suggests that the pre-human vegetation of the intermontane basins of Central Otago and South Canterbury was mixed grassland and shrubland, dominated by non-*Chionochloa* grasses and small-leaved shrubs. Low scrub-forest appeared on lower slopes with species such as mountain totara, mountain toatoa, bog pine, kowhai, *Coprosma, Myrsine* and *Dracophyllum* shrubs. Upslope, the scrub-forest gave way to snow totara and turpentine shrublands, with patches of narrow-leaved snow-tussock on rocky habitats. The alpine slopes and tops were dominated by slim snowtussocklands.

2.5.2 Vegetation and Flora

Tall tussockland dominates upper and mid slopes on the property, giving way to modified short tussock grassland and exotic herbfield on mid to lower slopes and fans. Rockland communities are associated with rock tors on upper and mid slopes, while grey shrublands are found on foot slopes and in lower gullies, especially around rock outcrops and talus patches. Wetlands are largely restricted to cushion bogs on southeast fans in the Hakataramea Valley, small valley floor wetlands and those associated with Grays River. The vegetation is described below for five separate parts of the property (see attached map). Naturalness is rated using low, medium, and high.

Area 1 Mackenzie and Snow fans

This area covers the fans of the Mackenzie and Snow rivers and a small isolated fan further to the southwest near the homestead. The two major fans are dominated by exotic herbfield (mainly mouse-ear hawkweed). They previously supported depleted fescue tussock grassland, but this has deteriorated over the last two decades to its current state. Matagouri shrubland is found on terraces and floodplains, along with small isolated wetlands. Minor parts of the Grays River wetland complex are found at the base of the fans. The small southwest fan supports exotic herbfield and some cultivated paddocks.

The fan adjacent to the Mackenzie River supports mouse-ear hawkweed (40-60% cover) with browntop, the lichens *Chondropsis semiviridis* and *Cladia aggregata*, scabweed, creeping pohuehue, mosses, sheep's sorrel, fescue tussock, blue tussock, *Raoulia hookeri*, *Pimelea pulvinaris*, sweet vernal and St John's wort. Naturalness is low. The fan south of the Snow River is again dominated by mouse-ear hawkweed, while other prominent species are mosses, sweet vernal, blue tussock, and fescue tussock (up to 5%). Very few other plant species are present, and soil erosion has resulted in the pedestalling of some plants. Naturalness is low. *Raoulia monroi* (threat status: gradual decline) is present on degraded fan surfaces north of the Snow River and below the Haldon Road bridge south of the riverbed. Sheep, rabbits and hares were seen on the fans. Below Haldon Road is a mosaic of degraded exotic herbfield, areas of silver tussock with exotic grasses and thistles, and cultivated paddocks. Within the exotic herbfield and adjacent to the lower riverbeds, patches of indigenous plants include *Pyrrhanthera exigua, Coprosma petriei*, mat daisies, *Carex breviculmis, Scleranthus uniflorus* and patotara. However, these areas are invariably dominated by mouse-ear hawkweed with a cover of 30-40% and bare ground of 40-50%. Naturalness is low or low/medium.

A small area of grassland on the northeast edge of the Mackenzie River fan provides an interesting contrast to the otherwise degraded communities of these fans. It is approximately 500 x 200 m and occurs on a slightly higher terrace between two outwash meanders. It supports a higher number and cover of indigenous species than elsewhere on the Mackenzie and Snow fans. The tiny grass Pyrrhanthera exigua is co-dominant with browntop, while other prominent species include mouseear hawkweed, Pimelea oreophila, Coprosma petriei, Cladia aggregata and Chondropsis semiviridis. Pyrrhanthera exigua has a ground cover of up to 50%, while mouse-ear hawkweed has a cover of 10-40%. Additional species include Pimelea pulvinaris, blue tussock, fescue tussock, sweet vernal, Leucopogon "muscosus", patotara, Stackhousia minima, Raoulia parkii, Raoulia sp. "grey", scabweed, patchy and abundant Carex muelleri (threat status: sparse), Geranium sessiliflorum, harebell, dainty daisy, Colobanthus buchananii, mosses, Poa maniototo, creeping pohuehue, matagouri, silvery hair grass and wire moss. Fescue tussock and blue tussock seedlings are locally common, and naturalness is low/medium to medium. This landform extends across the property boundary into Glenrock Station, supporting a similar community but with the addition of taller and denser fescue tussock. Rabbit browsing of blue tussock, fescue tussock and sometimes Carex muelleri is severe. Dead or moribund matagouri here is probably the result of rabbit browsing, though sheep grazing may also be responsible.

The upper Snow River fan is dominated by mouse-ear hawkweed and *Poa pratensis*. Other prominent species are fescue tussock, sweet vernal, browntop, blue tussock and lichens. Additional species include *Oxalis exilis, Convolvulus verecundus* (sparse), harebell, sweet brier, sheep's sorrel, *Carex colensoi*, moss and scabweed. Stonecrop is common nearby. Scattered matagouri, mostly less than one metre tall, is present. Rabbits and sheep are depleting the vegetation, with many plants being heavily browsed or grazed. The only other indigenous woody plants in the area are porcupine shrub and rarely *Olearia odorata*. Bare ground is around 50% and naturalness is low/medium. Elsewhere on the Snow River fan, the vegetation is dominated by mouse-ear hawkweed (with a cover of 30-40%) with prominent lichens, browntop, *Poa pratensis* and sometimes Chewings fescue. Fescue tussock is always less than 5% cover, bare ground is 40%-60% and naturalness is again low. Some of the land has been cultivated and planted in exotic grasses and a broad pine shelter belt. The upper fan on the south side of the Snow River between the Grampian Mountains and Hakataramea

Pass Road has similar plant communities. Mouse-ear hawkweed comprises around 35% ground cover, bare ground is approximately 60% and species diversity is very low. Naturalness is low.

Some terraces of the Snow River immediately above the active riverbed have a moderate diversity and cover of indigenous plants. The vegetation is dominated by lichens, mosses, patotara and mouse-ear hawkweed. Other plants include stonecrop, St John's wort, sweet vernal, *Scleranthus uniflorus*, haresfoot trefoil, blue wheatgrass, scabweed, *Poa maniototo*, red woodrush, *Colobanthus buchananii*, creeping pohuehue, low matagouri and sweet brier. Naturalness is low/medium to medium.

Terraces on or adjacent to the floodplains of both rivers support matagouri shrubland. These shrublands are most extensive in the upper reaches of the Snow River where they support patches of matagouri up to three metres tall, with porcupine shrub and scattered sweet brier. Scattered crack willow trees are present, as they are on the upper Mackenzie River floodplain. Adjacent terrace risers have similar shrublands with the addition of *Olearia odorata*, scrub pohuehue and *Clematis marata*. Open areas between the shrublands support sheep's sorrel, haresfoot trefoil, *Veronica verna*, browntop, mouse-ear hawkweed, *Bromus tectorum*, mosses, creeping pohuehue, viper's bugloss, woolly mullein, stonecrop, *Coprosma petriei*, silver tussock, scabweed, *Scleranthus uniflorus*, Chewings fescue and storksbill. Their naturalness is low/medium, with stock tracks, dung, rabbit scratchings and browsing common. Much of the Snow River floodplain is unallocated Crown land, while that of the Mackenzie River is pastoral lease.

The active riverbeds are usually dry and support communities characterised by viper's bugloss, matagouri, stonecrop, creeping pohuehue, *Epilobium melanocaulon*, woolly mullein, St John's wort and *Bromus tectorum*. Naturalness is generally low, though the bed of the Mackenzie River has more *Epilobium melanocaulon* at around 10% cover and is of medium naturalness in its upper reaches.

The acutely threatened spring annual *Ceratocephala pungens* (nationally critical) was found at three locations on terraces adjacent to the Snow River. It occurs among degraded grassland or herbfield dominated by mouse-ear hawkweed, with other prominent plants being sheep's sorrel, browntop, *Poa maniototo*, purging flax, viper's bugloss, white clover, mouse-ear chickweed, *Myosotis discolor*, yarrow, storksbill and *Chondropsis semiviridis*. The ground surface has approximately 20% exposed soil with embedded stones and is subject to rabbit browsing and scratching and frost heave.

The floodplains contain scattered small wetlands in old depressions and meanders, often at the base of terrace risers. These support plants such as rautahi, *Carex kaloides*, *C. petriei*, *C. buchananii*, *C. berggrenii*, bog rush, selfheal, mosses, *Juncus novae-zelandiae*, soft rush and sometimes toetoe. In shallow water, plants such as jointed rush, musk, monkey musk, spike sedge and *Hydrocotyle tripartita* are present. These wetlands are more numerous on the Snow River floodplain. Their naturalness is low/medium, reflecting the prominence of exotic plants.

The margins of the Grays River wetland complex are characterised by dense Chewings fescue, scattered rautahi, silver tussock, lotus, browntop, oval sedge, *Carex diandra*, Californian thistle, curled dock, clovers, timothy and Yorkshire fog. Small waterways and depressions support *Potentilla anserinoides*, duckweed, monkey musk, soft rush, stitchwort, spike sedge and *Epilobium pallidiflorum*. Pukio is present and crack willows are scattered through the wetland; some next to Grays River have been sprayed. Several small patches of *Carex tenuiculmis* (sparse) and one *Aciphylla subflabellata* (sparse) are present in the wetland. Overall, the wetland is dominated by exotic species and naturalness is low, except alongside small waterways where it is low/medium. Cattle grazing and pugging is widespread and willows are continuing to spread.

Area 2 Dalgety Range

This area comprises the northwest end of the Dalgety Range, which is separated from the remainder of the property by freehold land to the west. The main eastern ridge is dominated by tall tussockland, with depleted exotic herbfield and grassland on lower slopes. Matagouri shrubland and prostrate kowhai are present in a lower valley above Mackenzie Pass Road. Rockland communities occur on rock outcrops, while shrublands are associated with shady slopes, rocky gorges, lower river valleys and toe slopes. The lower western ridge is characterised by degraded exotic herbfield and grassland, with scattered matagouri and sweet brier shrublands.

The un-named stream valley immediately east of the Mackenzie River valley is a major component of RAP Grampians 3. The lower valley has a mosaic of snow-tussock, fescue tussock grassland and low but dense matagouri. All of these communities have been over-sown and top-dressed. The snow-tussock is rather patchy but has a ground cover of up to 50%, and its naturalness is low/medium to medium. In the fescue tussock community, fescue tussock has cover of up to 20% and naturalness is low/medium. Open areas without tussock are dominated by browntop, which has a cover of 30-50%. Matagouri shrubland up to two metres tall occupies the mid-valley. It is quite extensive and is dominated by matagouri, mingimingi, common broom and porcupine shrub. Olearia odorata and Olearia bullata are present but uncommon. Other species include scrub pohuehue, lawyer, golden speargrass, little hard fern and prickly shield fern. Naturalness is medium to medium/high where the shrubland is most dense. The margins and open areas are dominated by exotic grasses and mouse-ear hawkweed. Male fern is present near the adjacent stream bank. The shrubland continues into the tributary catchments merging with snow-tussock, short tussock (silver and fescue) and talus patches, one of which supports a single mountain toatoa. The northern-most sub-catchment supports a small population of prostrate kowhai on sunny northwest slopes. The prostrate kowhai has cover of around 20% and there are probably c.100 plants present. Matagouri is co-dominant with the prostrate kowhai. Other plants are blue tussock, browntop, mouse-ear hawkweed, common broom, porcupine shrub, sweet vernal and scrub pohuehue. The vegetation is rather degraded here but overall naturalness is medium. A small patch of introduced broom is present in the gully below.

The sunny northeast-facing slopes and spur crest on the west side of the main stream are more degraded. Sheep tracks, grazing and rabbit browsing are widespread but despite this, significant values remain. *Raoulia monroi* (gradual decline) is present and prostrate kowhai is sparsely scattered across the upper slopes, especially below low shattered rock outcrops. The prostrate kowhai is heavily grazed and disturbed by sheep, with abundant tracks and dung throughout. The spur crest supports plants such as mouse-ear hawkweed, scabweed, *Raoulia parkii*, *Raoulia* sp. "grey", creeping pohuehue, *Colobanthus buchananii*, porcupine shrub, lichens, mosses, fescue tussock, blue tussock, blue wheatgrass, *Scleranthus uniflorus, Carmichaelia enysii*?, *Oxalis exilis*, browntop and sheep's sorrel.

The lower to mid slopes above Mackenzie Pass support a mosaic of exotic grasses, low matagouri, scattered golden speargrass and common broom. Other prominent plants are fescue tussock, white clover, blue tussock, blue wheatgrass, sheep's sorrel and bracken. There are several wilding pines here and two crack willows in a small gully, while nodding thistle and Californian thistle occur alongside the vehicle track. Naturalness is low to low/medium. Narrow-leaved snow-tussock dominates upper slopes with a cover of up to 50%, while other plants include mouse-ear hawkweed, golden speargrass, sweet vernal, patotara and *Raoulia subsericea*. Naturalness here is low/medium to medium.

Low rock outcrops on the summit ridge and upper slopes support mosses, lichens, edelweiss, *Brachyglottis bellidioides, B. haastii,* snowberry, *Pentachondra pumila, Kelleria dieffenbachii, Anisotome flexuosa,* turpentine shrub, *Dracophyllum pronum, Rytidosperma buchananii,* creeping mapou, *Gaultheria crassa, Celmisia densiflora,* false speargrass, little hard fern and *Aciphylla montana.* Naturalness is medium/high to high. Upper north-facing slopes near the summit ridge

support mossfield with slim snow-tussock. Woolly moss is dominant and other prominent species are slim snow-tussock, *Dracophyllum pronum, Raoulia subsericea* and blue tussock. Additional species include comb sedge, fescue tussock, alpine fescue tussock, catsear, *Brachyglottis bellidioides, Ranunculus multiscapus*, mouse-ear hawkweed, *Gaultheria/Pernettya* hybrids, mountain clubmoss, *Anisotome flexuosa, Scleranthus uniflorus* and *Pentachondra pumila*. There is evidence of wallaby, hare and sheep and wilding pines are present. Naturalness is medium/high to high.

Mid north-facing slopes are rubbly and support narrow-leaved snow-tussock, with a cover of up to 25%. Other prominent species are mouse-ear hawkweed, blue tussock and snowberry. Additional species include *Raoulia subsericea*, patotara, sheep's sorrel, red woodrush, golden speargrass, *Carex breviculmis*, harebell, *Celmisia densiflora*, turpentine shrub and inaka. Wilding pines are sparsely scattered across these slopes and naturalness is medium. On shady slopes snow-tussock cover is up to 60% and the tussocks are more vigorous. A similar range of species is present, with the addition of bog rush, *Anisotome aromatica*, *A. filifolia*, *Acaena caesiiglauca*, *Pimelea pseudo-lyallii* (sparse), Yorkshire fog and *Leucopogon colensoi*. Naturalness is medium. Localised dead tussock, disturbance and hawkweed invasion appear to be caused by wallabies. Small seepages are also scattered across these shady slopes. They support plants such as bog rush, snow-tussock, mosses, native violet, giant speargrass, white clover, common pennywort, liverworts, browntop, mouse-ear hawkweed, *Ranunculus multiscapus*, silver tussock, sweet vernal, *Rytidosperma unarede?*, *Gentiana bellidifolia*, *Carex gaudichaudiana* and *Geranium microphyllum*. There is localised wallaby damage and naturalness is medium/high to high.

Turpentine shrubs are prominent on south-facing mid slopes with a cover of 60-70%, while other common plants in this community are mosses, blue tussock and snow-tussock. Additional species include inaka, *Hebe subalpina*, *Pimelea oreophila*, red woodrush, lichens, *Geum leiospermum*, *Kelleria dieffenbachii*, *Brachyglottis bellidioides*, snowberry, *Anisotome aromatica*, *Pratia macrodon* and *Epilobium chlorifolium*. Wallaby disturbance is obvious with tracks, dead snow-tussocks and localised mouse-ear hawkweed invasion. Naturalness is medium/high to high. Turpentine shrubs are also common around rock outcrops and sometimes co-dominant with snow-tussock on exposed west-facing spurs. Talus patches on shady slopes support *Coprosma cheesemanii*, *Coprosma* aff. *pseudocuneata*, creeping mapou, little hard fern, mosses, lichens, thousand-leaved fern, harebell, everlasting daisy, giant speargrass, blue tussock, *Celmisia densiflora*, turpentine shrub, prickly shield fern and mouse-ear hawkweed. Naturalness is medium/high to high. Coral broom (gradual decline) is associated with talus and rocky areas among the snow-tussockland and turpentine shrubland.

Lower sunny slopes support sparse snow-tussock of low/medium to medium naturalness and exotic herbfield of low to low/medium naturalness. The latter is characterised by mouse-ear hawkweed (up to 50% cover) and patotara, sweet vernal, browntop, Carex breviculmis, Raoulia parkii, Raoulia sp., scabweed, blue tussock, Scleranthus uniflorus, porcupine shrub and Coprosma petriei. Adjacent rocky gorges support Dracophyllum shrublands with scattered snow-tussock, Hebe subalpina, Olearia nummularifolia, porcupine shrub, Gaultheria crassa, Olearia odorata, mountain flax, Astelia nervosa, giant speargrass, golden speargrass, prickly shield fern and patches of mountain Talus is occupied by matagouri, mingimingi, porcupine shrub, mountain wineberry, kiokio. bracken, golden speargrass, scrub pohuehue, lawyer, Clematis marata, snow-tussock and scattered coral broom. Additional plants on low rock outcrops include Colobanthus sp., bristle tussock, Helichrysum intermedium and Hebe cheesemanii. Grey shrubland on sunny lower slopes has a similar composition to that in the Mackenzie Valley. It is dominated by matagouri and Olearia odorata, with mountain wineberry, common broom, mingimingi, porcupine shrub, occasional Olearia bullata, Clematis marata, scrub pohuehue and sweet brier. Small patches of threatened Coprosma intertexta occur in the lower Mackenzie River valley.

The banks of the Mackenzie River support grey shrublands, tutu and feathery tutu, with exotic grasses, fescue tussock, silver tussock, blue tussock, bracken fern, prickly shield fern, mountain kiokio, *Acaena caesiiglauca*, *Parahebe lyallii*, everlasting daisy and *Gaultheria crassa*.

Vegetation on the lower western ridge is very degraded. North-facing rubbly slopes (at around 700 m) are characterised by plants such as mouse-ear hawkweed, St John's wort, Chewings fescue, sweet vernal, sweet brier, matagouri, haresfoot trefoil, sheep's sorrel, woolly mullein and occasional porcupine shrub. Patches of matagouri are disturbed by stock tracks, trampling and grazing and naturalness is low. On higher sunny slopes additional plants include fescue tussock, silver tussock, creeping pohuehue, patotara and scabweed. Shady slopes are also dominated by mouse-ear hawkweed (up to 50% cover), while other prominent plants are patotara, blue tussock and fescue tussock. Other plants include sweet vernal, browntop, *Raoulia subsericea, Scleranthus uniflorus*, harebell, lichens, *Anisotome aromatica*, red woodrush, *Carex breviculmis* and sheep's sorrel. Naturalness is low to low/medium. The vegetation of western slopes above the Mackenzie and Snow fans is similarly degraded and characterised by mouse-ear hawkweed, exotic grasses, low matagouri, sweet brier and patches of short tussock.

Area 3 North Grampian Mountains

The northern end of the Grampian Mountains is largely devoid of snow-tussock except for a higher altitude apron in the upper catchments around Monkey Rock. Rockland plants occur on rock outcrops which are mostly concentrated in these upper catchments. Mid to lower slopes comprise most of the area and are characterised by degraded exotic herbfield and grassland. Scattered matagouri and sweet brier shrublands occur in lower gullies and on toe slopes, while prostrate kowhai is found on a number of lower sunny slopes and spurs. The informal name "Home Creek" is used to refer to the catchment extending southeast from the homestead to Monkey Rock and the ridge above Moffat Stream.

The upper catchment of "Home Creek" contains a fairly sparse cover of narrow-leaved snowtussock. On sunny slopes its cover is about 15-20%, which includes some hybrids with slim snowtussock. Mouse-ear hawkweed is up to 25% cover and other prominent species are golden speargrass, fescue tussock and king devil hawkweed. Additional species include catsear, Craspedia incana, blue tussock, porcupine shrub, sweet vernal, sheep's sorrel, Carex breviculmis, snowberry, lichens and Raoulia subsericea. Naturalness is low/medium. On shady slopes snow-tussock cover is up to 40%, with other prominent species being lichens, mouse-ear hawkweed, Anisotome flexuosa, king devil hawkweed, snowberry and dainty daisy. Additional species not recorded on sunny slopes include patotara, red woodrush, Brachyglottis bellidioides, Ranunculus multiscapus and native violet. Naturalness is medium. Wilding pines are sparsely scattered through this catchment. The adjacent catchment further to the south has a narrower band of degraded snow-tussock on its upper slopes. Depending on aspect, snow-tussock cover varies from <5% to 10-15%, and mouse-ear and king devil hawkweed are the dominant plants providing up to 30-40% cover. Wilding conifers are scattered through this catchment and naturalness is low to low/medium. The upper catchment northeast of Monkey Rock has similar snow-tussock communities. Carex muelleri (sparse) is widespread here, as well as being common on ridgeline tracks radiating out from Monkey Rock. Wilding conifers are again scattered through this catchment. The snow-tussock in the shady Moffat Stream valley has a cover of around 10% and a naturalness of low/medium to medium.

Talus and rock outcrops are common in these upper catchments. Talus patches support golden speargrass, narrow-leaved snow-tussock, *Coprosma depressa*, *C. cheesemanii*, *Anisotome flexuosa*, creeping mapou, porcupine shrub, little hard fern, *Pimelea oreophila*, dainty daisy, red woodrush and king devil hawkweed. Naturalness is medium. Rock outcrops to 30 m high provide habitat for lichens, mosses, bristle tussock, *Rytidosperma buchananii*, *Helichrysum intermedium*, *Hebe cheesemanii*, *H. buchananii*, *Cystopteris tasmanica*, *Celmisia angustifolia*, dainty daisy, blue tussock, turpentine shrub, *Aciphylla montana*, *Colobanthus acicularis*, patotara, *Luzula traversii*, *Coprosma* aff. *pseudocuneata*, everlasting daisy, edelweiss, sheep's sorrel, mouse-ear hawkweed

and king devil hawkweed. Naturalness is medium/high, reflecting the presence of exotic plants where farm animals have access. Tussock shrubland on adjacent shady slopes is dominated by narrow-leaved snow-tussock and turpentine shrub. Other prominent species are *Aciphylla montana*, mosses, lichens and blue tussock. Additional plants include *Celmisia angustifolia*, everlasting daisy, mountain clubmoss, common pennywort, *Lagenifera cuneata*, little hard fern, bristle tussock and *Brachyglottis bellidioides*. Exotic species are insignificant but stock tracks have caused localised disturbance. Naturalness is medium/high to high.

Mid northeast facing slopes on the west side of "Home Creek" are all severely degraded. Vegetation is dominated by mouse-ear hawkweed (around 40% cover) and browntop and sweet vernal are common. Few indigenous plants are present and all are very sparse (<1% cover). On other similar slopes the cover of mouse-ear hawkweed can be as high as 60% and naturalness is low. Shady southeast facing slopes and toe slopes support more browntop. Seepages are also degraded, typically supporting fescue tussock, silver tussock, bog rush, sweet brier, exotic grasses, mingimingi, *Olearia odorata*, matagouri and common broom. Their naturalness is low. Further downstream all slopes are highly degraded and dominated by browntop, mouse-ear hawkweed or sweet brier. Introduced broom is common in the lower valley and wilding pines are also common. Naturalness is low.

Gully shrublands are common below about 900 m in "Home Creek", though the great majority have been sprayed to kill introduced broom within them. They are dominated by matagouri, mingimingi and *Olearia odorata*, with sweet brier and porcupine shrub occurring throughout but more prominent on the margins. Introduced broom occurs in nearly all the shrublands, often in patches or as a ribbon along stream sides. Apart from a few side gullies that have not been sprayed, only the margins of shrublands have survived where they extend up adjacent slopes. The un-sprayed shrublands generally have a naturalness of low/medium to medium. One large crack willow remains in the mid-valley, while others have been removed. Elsewhere the most diverse shrublands have additional species such as mountain wineberry, *Clematis marata* and giant speargrass.

Mid altitude slopes above the Snow River support similarly degraded vegetation. Sunny slopes are dominated by mouse-ear hawkweed with a cover of up to 50%, while fescue tussock is <5% cover. Species diversity is low. Additional plants are blue tussock, sweet vernal, harebell, sheep's sorrel, creeping pohuehue, *Scleranthus uniflorus* and porcupine shrub. Naturalness is low. Patchy snow-tussock extends down shady slopes, but it is sparse and mouse-ear hawkweed is dominant and exotic grasses widespread.

The most significant find in the North Grampian Mountains are prostrate kowhai shrublands on lower sunny slopes and spurs. Large numbers (thousands) of prostrate kowhai are present up to an altitude of 1000 m, making this a very important area for this regionally uncommon species. There are a range of plant sizes, with the largest two metres tall. Younger plants are present, but a brief assessment indicates that seedlings are not very common. This may reflect the impact of stock grazing, rabbits and possibly hares. The prostrate kowhai is most abundant on rubbly slopes and around low rock outcrops, but even the best habitats are highly disturbed and contain many exotic plants. Common associates include porcupine shrub, scrub pohuehue, common broom, mingimingi, sweet brier, mouse-ear hawkweed, sweet vernal, fescue tussock, blue tussock, the rock fern *Cheilanthes sieberi* and woolly mullein. Occasionally present are *Coprosma virescens* and *Einadia allani*. Coral broom is sometimes present, but invariably it is severely browsed. Introduced broom and wilding conifers are common near the south western populations above the homestead.

Gentle fans on the toe slopes north east of Monkey Rock are dominated by exotic grasses, with scattered but vigorous fescue tussock. There are large patches of matagouri up to two metres tall that can be quite dense and semi-continuous and which also contain common broom and sweet brier.

Area 4 Central Grampian Mountains

Sparse alpine vegetation is found on boulderfield and stonefield in upper basins and on exposed spurs and rockland plants occur on rock outcrops. The higher mountain slopes and spurs have a cap of slim snow-tussock, while narrow-leaved snow-tussock is present on most other slopes. Short tussock is prominent on lower slopes and fans, and minor wetlands are present on fans and river terraces. Grey shrubland occurs in lower valleys and on lower slopes, especially around rock outcrops, and on river terraces and fans.

Steep boulderfields of large angular rocks near the summit ridge support lichens, mosses, blue tussock, Aciphylla dobsonii, Hebe haastii, H. pinguifolia, Phyllachne colensoi, Luzula pumila, Raoulia hookeri and Epilobium pycnostachyum. Nearby rock outcrops support some of the same plants but have additional species such as slim snow-tussock, vegetable sheep, Gentiana corymbifera, bristle tussock, Trisetum spicatum, Luzula traversii, little hard fern, Koeleria novo-zelandica, Celmisia brevifolia?, Dracophyllum pronum, Hebe cheesemanii, Poa lindsayi, Colobanthus strictus and edelweiss. Stonefield on exposed spurs is dominated by lichens, Dracophyllum prostratum and Raoulia hectori. Other plants include Gentiana corymbifera, blue tussock, Kelleria dieffenbachii, Chionohebe pulvinaris, Luzula pumila, Colobanthus buchananii, Leptinella pectinata ssp. villosa, mosses, Anisotome flexuosa and Phyllachne colensoi. All these communities have very few weeds and their naturalness is typically high.

Upper eastern facing slopes support herbfield dominated by *Phyllachne colensoi*, mouse-ear hawkweed, Carex muelleri and Raoulia hookeri. Other plants include slim snow-tussock, Kelleria dieffenbachii, Raoulia hectori, Anisotome flexuosa, blue tussock, wire moss, bristle tussock, Geranium sessiliflorum, harebell, catsear, mosses, Luzula pumila, Scleranthus uniflorus, Stellaria gracilenta and Colobanthus buchananii. Naturalness is medium to medium/high. Rock outcrops and talus patches are common in the area. Eastern basin slopes are dominated by blue tussock (20% cover), with other prominent species being slim snow-tussock, Raoulia subsericea and mouse-ear Additional species include Dracophyllum pronum, D. prostratum, Rytidosperma hawkweed. pumilum, Raoulia grandiflora, Luzula traversii, Celmisia densiflora and little hard fern. Naturalness is medium. Slim snow-tussock on upper slopes and the summit ridge would have been more abundant in the past, but it has been depleted by grazing and possibly burning. The best example seen on the summit ridge has a snow-tussock cover of around 70% and a naturally low diversity of other species due to shading. Naturalness is medium/high, reflecting the presence of mouse-ear hawkweed (up to 5% cover) and king devil hawkweed. Elsewhere snow-tussock has been replaced by bristle tussock, blue tussock or fescue tussock, hawkweeds are more abundant and naturalness is medium.

With decreasing altitude narrow-leaved snow-tussock becomes prominent on eastern slopes, with a cover up to 25%, while other prominent species are lichens, mouse-ear hawkweed, king devil hawkweed and fescue tussock. Additional species include turpentine shrub, golden speargrass, *Pimelea traversii, P. oreophila, Carex breviculmis,* red woodrush, bristle tussock, *Anisotome flexuosa, Craspedia incana, Celmisia angustifolia,* dainty daisy, sheep's sorrel, blue tussock, snowberry, patotara, *Raoulia subsericea* and sweet vernal. Naturalness is low/medium to medium. North-facing slopes have a sparser snow-tussock cover, especially at lower altitudes, with more hawkweed, exotic grasses and fescue tussock. Tussock cover is typically higher on shady slopes, but rubbly southeast slopes are often very disturbed by stock and rabbits. As a consequence, mouse-ear hawkweed is dominant but *Carex muelleri* (sparse) and *Raoulia monroi* (gradual decline) are also present. Wilding pines are scattered across the eastern catchments, with prolific saplings and seedlings around some mature trees.

On lower eastern slopes north of Hakataramea Pass, matagouri and mouse-ear hawkweed each have a cover of 25% or more, while fescue tussock and narrow-leaved snow-tussock have a cover of around 10-15%. Other species present are similar to those on mid slopes; additional species are *Scleranthus uniflorus*, *Brachyglottis haastii*, tumble grass, white sun orchid, *Carmichaelia enysii*, *C*.

monroi, common broom and coral broom (gradual decline). Naturalness is low/medium. Gentle toe slopes and fans support exotic grasses and sparse snow-tussock with matagouri, scattered mingimingi, white clover, common broom, *Olearia odorata*, tauhinu and golden speargrass. Bog rush seepages with a naturalness of low/medium occur in some channel depressions. A patch of c.12 *Coprosma intertexta* (sparse) occurs on a low stream terrace and *Kirkianella novae-zelandiae* (sparse) occurs east of the road in over-sown and top-dressed fescue tussock grassland. Vegetation south of Hakataramea Pass is a similar mosaic of grassland, sparse snow-tussock and matagouri shrubland. Matagouri shrubland is widespread with mingimingi, common broom, *Coprosma rugosa*, tutu, porcupine shrub, *Olearia odorata* and occasionally manuka present. The low-stature matagouri has probably been induced by fertiliser application, though taller and more diverse shrublands are associated with stream terraces.

A remnant wetland occurs at Hakataramea Pass. It is dominated by comb sedge. Other prominent plants are *Carex gaudichaudiana*, dainty daisy, soft rush, browntop and dandelion. Additional plants include sweet vernal, mouse-ear hawkweed, *Epilobium komarovianum*, *Plantago triandra*, *Pratia angulata* agg., *Euchiton laterale*, bog rush and rautahi. The wetland is heavily grazed by sheep, with widespread trampling and dung. Naturalness is low/medium to medium.

The riparian margins of the upper Snow River and upper Dalgety Stream support snow-tussock, exotic grasses, matagouri, *Olearia odorata*, mingimingi, golden speargrass, giant speargrass, monkey musk and Californian thistle. There is a substantial infestation of exotic broom in the bed of the upper Snow River. The riparian margins of lower Dalgety Stream are dominated by grasses and other exotic plants. There are patchy wetlands on the floodplain, supporting rautahi, exotic grasses, monkey musk, rushes and bog rush. Naturalness is low/medium. A patch of exotic broom and an elderberry tree are present adjacent to a nearby tributary stream.

Area 5 South Grampian Mountains

The south end of the Grampian Mountains has similar stonefield habitat on exposed upper ridges to that in the vicinity of Black Rocks (Central Grampian Mountains), though with fewer steep blocky boulderfields. There are minor areas of scree, talus and rockland (rock outcrop) habitat. A cap of slim snow-tussock on the higher slopes gives way to extensive narrow-leaved snow-tussock on mid to lower slopes, extending onto the fans below. Minor areas of subalpine shrubland occur on shady slopes, while matagouri shrubland occupies lower gullies, floodplains and terraces. Wetlands, including cushion bogs, are present on floodplains and fans.

Exposed alpine ridge tops have stone pavements supporting similar plants to those in the Central Grampian Mountains. Plants include *Aciphylla dobsonii*, blue tussock, *Colobanthus acicularis*, *Epilobium pycnostachyum*, *Leptinella pectinata* ssp. *villosa*, *Celmisia ramulosa*, *Anisotome flexuosa*, *Luzula pumila*, *Chionohebe pulvinaris*, *Poa novae-zelandiae*, *Kelleria dieffenbachii*, *Hebe epacridea*, *Raoulia grandiflora* and *R. petriensis* (range restricted). Vegetable sheep and *Dracophyllum pronum* occur on rock outcrops, and *Raoulia mammillaris* is also present at exposed sites. Fine screes adjacent to the ridge top provide habitat for *Myosotis elderi?*, *M. australis*, *Epilobium pycnostachyum*, *Leptinella* sp. (*atrata* or *dendyi*), *Lobelia roughii*, *Poa buchananii* and *Lignocarpa carnosula*. The slim snow-tussockland on higher slopes and ridges is similar in character to that described for the Central Grampian Mountains, but it again appears to be limited in extent and gives way to narrow-leaved snow-tussock with decreasing altitude.

On shady mid slopes and ridges narrow-leaved snow-tussock has a cover of 10-20%. Other prominent species are *Coprosma cheesemanii*, snowberry, mouse-ear hawkweed, blue tussock, *Dracophyllum pronum*, lichens and fescue tussock. Additional plants include *Anisotome flexuosa*, *Carex colensoi?*, *Pimelea oreophila*, *Deyeuxia avenoides*, *Geranium sessiliflorum*, everlasting daisy, *Carex breviculmis*, sweet vernal, *Raoulia subsericea*, *Trisetum antarcticum* (gradual decline), *Epilobium alsinoides* ssp. *tenuipes* and *Uncinia divaricata*. Naturalness is medium. At c.1050 m snow-tussock cover is around 30-40% and there is a similar range of other species. Additional

species include *Craspedia* cf. *uniflora*, *Acaena inermis*, *Lobelia linnaeoides* and *Euphrasia zelandica* agg. Naturalness is medium. On toe slopes snow-tussock cover is sparse, with fescue tussock and matagouri becoming more common, though naturalness is still up to medium. Further north over-sown and top-dressed foot slopes support patchy matagouri with mingimingi, some Olearia odorata, scattered sweet brier, common broom, tauhinu, *Coprosma rugosa*, occasional *Coprosma ciliata*, sparse snow-tussock and golden speargrass. Occasional wilding pines are scattered through the southeast catchments, increasing in number towards the north.

Turpentine shrubs occur on rocky shady mid-slopes with a cover of around 60%, while other prominent species are creeping mapou, blue tussock, lichens, snowberry and narrow-leaved snow-tussock. Additional plants include *Hebe lycopodioides*, mountain clubmoss, *Geum parviflorum*, *Uncinia divaricata, Kelleria dieffenbachii*, red woodrush, *Celmisia laricifolia, C. brevifolia*?, dainty daisy, *Pratia angulata* agg., mosses, everlasting daisy, *Pimelea oreophila, Aciphylla montana* and coral broom. Naturalness is high. Adjacent gully talus at around 1300 m altitude supports *Coprosma cheesemanii, C. depressa*, little hard fern, everlasting daisy, *Acaena inermis, A. anserinifolia, Dracophyllum pronum*, golden speargrass, creeping mapou, turpentine shrub, prickly shield fern, snowberry, scrub pohuehue, sheep's sorrel and sweet vernal. Sheep tracks and dung are common on the talus and naturalness is medium.

The Grampian and Morton streams areas both support matagouri shrubland and small floodplain wetlands, but Grampian Stream has an active gravel bed. Thick, but patchy, floodplain shrubland in the lower south branch of Grampian Stream is dominated by matagouri to three metres tall, with *Olearia odorata*, sparse mingimingi, porcupine shrub, common broom, scrub pohuehue, rarely *Olearia bullata* and sweet brier. Exotic grasses and herbs dominate the ground surface beneath the shrubs, and a small patch of male fern is present. Native plants include creeping pohuehue, *Acaena inermis* and blue wheatgrass, and naturalness is medium. A nearby terrace riser supports a patch of perhaps as many as 100 plants of *Coprosma intertexta* (sparse). Further upstream, the floodplain is occupied by dense but lower matagouri, with common broom and rarely *Olearia odorata*.

The riparian margins of the lower south branch of Grampian Stream support soft rush, jointed rush, tutu, feathery tutu, monkey musk, *Carex kaloides*, pukio, bog rush, toad rush and silver tussock. Floodplain wetlands are quite numerous but usually small in Grampian Stream. An example in the south branch is dominated by rautahi, monkey musk, bog rush, jointed rush, *Carex diandra* and spike sedge. Other plants include clovers, exotic grasses, matagouri, Maori onion, *Epilobium brunnescens*, little hard fern, oval sedge, *Ranunculus glabrifolius*, soft rush, common pennywort, *Juncus novae-zelandiae*, toad rush, king devil hawkweed, *Pratia angulata* agg., duckweed and *Carex pyrenaica* var. *cephalotes*? The wetland has been modified by sheep, cattle and wallabies, reducing its naturalness to low/medium. Despite modification, these wetlands are important remnants especially in conjunction with adjacent shrublands and grasslands.

The dry stony fan between the two branches of Grampian Stream is dominated by mouse-ear hawkweed with browntop, matagouri, fescue tussock, sweet vernal, mosses and *Pyrrhanthera exigua*. Additional plants include silvery hair grass, harebell, blue tussock, *Carex breviculmis*, lichens, *Coprosma petriei*, Chewings fescue, creeping pohuehue, purging flax, *Pimelea oreophila* and red woodrush. Naturalness is low/medium. The terraces above Grampian Stream support *Pernettya nana*, mouse-ear hawkweed, blue tussock, fescue tussock, sweet vernal and Chewings fescue. Other plants include mountain clubmoss, red woodrush, *Raoulia subsericea*, Yorkshire fog, white clover, *Helichrysum filicaule, Carmichaelia monroi, Carex breviculmis, Anisotome flexuosa*, patotara, matagouri and golden speargrass. Naturalness is low/medium to medium. The older and higher fan surfaces between the two branches of the stream support similar moderately diverse short tussock grasslands. They have more low matagouri and scattered narrow-leaved snow-tussock, which is being heavily grazed (and may have been burned in the past), as there are dead and moribund tussock bases. Threatened *Aciphylla subflabellata*, *Pterostylis tristis* and coral broom are present here.

The highest terrace on the true left fan of Grampian Stream supports a matagouri snow-tussock association. Matagouri is dominant, with narrow-leaved snow-tussock, mouse-ear hawkweed, mosses, *Rytidosperma pumilum*, lichens, woolly moss, *Coprosma petriei*, browntop and sweet vernal all prominent. Other species include blue tussock, golden speargrass, *Carex breviculmis*, patotara, *Stackhousia minima, Pimelea oreophila, Raoulia subsericea*, snowberry, tauhinu, wire moss, white clover and fescue tussock. Stock tracks are widespread and grazing impacts on the snow-tussock are locally severe, despite tussock seedlings being present. Naturalness is low/medium to medium. A seepage channel around 20-30 m wide meanders down the fan surface for several hundred metres, dominated by comb sedge, bog rush, mosses, and exotic grasses. Less modified portions support white clover, *Carex gaudichaudiana, Pratia angulata* agg, *Hydrocotyle tripartita*, soft rush, *Epilobium komarovianum*, dainty daisy, *Gentiana grisebachii, Euchiton traversii, Gonocarpus micranthus*, sundew, rautahi, Maori onion and patches of sphagnum moss. Occasional red tussocks are present. Overall naturalness varies from low/medium to medium.

The high fans between the two branches of Grampian Stream support scattered cushion bogs and seepages among the tussock grasslands. The bogs are mostly dominated by comb sedge and *Carex gaudichaudiana*, with rautahi, bog rush and *Gonocarpus micranthus*. Other species include mosses, dainty daisy, soft rush, king devil hawkweed, sundew, *Kelleria croizatii*, *Anisotome aromatica*, *Microtis oligantha*, *Pernettya nana*, browntop, sweet vernal, *Epilobium komarovianum*, *Pratia angulata* agg., *Carex sinclairii*, *Gentiana grisebachii*, Maori onion and *Carex muelleri* (sparse). Stock pugging and dung is abundant and naturalness varies from low/medium to medium/high, depending on the extent of stock damage and exotic plants. The bogs and seepages occur on gentle fan slopes and their steeper edges, as well as on some terrace risers and gentle toe slopes of the adjacent mountains. There is also a substantial bog rush/sedge community occupying a gully depression. It receives water from the adjacent fans and their wetland complexes, contributing water to the south branch of Grampian Stream.

The hill slopes at the north end of the Kirkliston Range are below 1000 m altitude, and have a relatively uniform vegetation pattern. All but upper slopes support degraded fescue tussock grassland dominated by browntop and mouse-ear hawkweed with fescue tussock and low-stature matagouri. Other plants include sweet vernal, golden speargrass, purging flax, lichens, *Coprosma petriei*, plume grass, *Acaena buchananii*, blue wheatgrass, harebell, patotara and *Carex breviculmis*. Coral broom (gradual decline) and *Raoulia monroi* (gradual decline) are scattered across rocky knolls and slopes. Naturalness is low/medium at best. Scattered snow-tussock is more common on upper slopes, becoming continuous where the hills meet the Grampian Mountains. A small patch of gorse is present in this area. The southernmost corner of the property is characterised by degraded slopes of exotic grasses, mouse-ear hawkweed and white clover. Low rock outcrops do, however, support low-stature matagouri, porcupine shrub and coral broom.

Notable Flora

Notable plant species recorded on the property are listed in Table Two below. Threat categories are those proposed by de Lange *et al.* (2004).

Table Two	Notable plant	species,	Grampians	Pastoral	Lease

Plant species	Threat status	Distribution on property	
Aciphylla subflabellata	Sparse	Wetland on southern fans; Grays River wetland.	
Carex muelleri Sparse		Locally common on ridges, upper to mid slopes of	
		Central Grampian Mountains; Mackenzie fan,	
		lower Snow fan; cushion bogs on southern fans.	
Carex tenuiculmis	Sparse	Grays River wetland.	
Carmichaelia	Gradual decline	Scattered across Dalgety Range and Grampian	
crassicaule (coral		Mountains on low to upper slopes, especially dry	
broom)		aspects, rocky slopes and rock outcrops.	
Carmichaelia vexillata	Serious decline	Previously recorded from northern Grampian	
		Mountains and alongside Mackenzie River.	
Ceratocephala pungens	Nationally critical	Upper Snow River terraces and fan.	
Convolvulus verecundus	Sparse	Degraded east ridge of Dalgety Range; upper	
		Snow fan.	
Coprosma intertexta	Sparse	Southern terraces; terrace near Hakataramea Pass;	
		lower Mackenzie Valley floodplain.	
Geranium microphyllum	Data deficient	Seepage, east ridge Dalgety Range	
Kirkianella novae-	Sparse	Fan north of Hakataramea Pass; previously	
zelandiae		recorded south of Hakataramea Pass.	
Pimelea pseudo-lyallii	Sparse	East ridge of Dalgety Range; shady slopes South	
	~	Grampian Mountains.	
Pterostylis tristis	Sparse	Fan below South Grampian Mountains.	
Raoulia monroi	Gradual decline	Snow fan and terraces; South Grampian hills;	
		disturbed mid slopes of Central Grampian	
		Mountains; lower slopes of Dalgety Range.	
Trisetum antarcticum	Gradual decline	Shary initia stope South Grampian Mountains.	
Vittadinia australis agg.	Data deficient	Sunny slopes near Monkey Rock in Central	
	<u>C'</u>	Grampian Mountains.	
A · 1 11 1 1 ···	Significance		
Acipnylla aobsonii	Uncommon in ED	Central and South Grampian Mountains on	
A anastis subulsts	Dongo restricted	Linner clones North Crempion Mountains neer	
Agrostis subulata	Range restricted	Monkey Bock	
Colmisia namuloga	Uncommon in ED	South Grampian Mountains on avnosed tons	
Drosong gnoturi	Uncommon in	Cushion bogs on fans at south and of Grampian	
Drosera arciari	eastern Canterbury	Mountains	
Helichrysum nlumeum	Range restricted	Previously recorded from alongside Mackenzie	
meticni ysum piumeum	Range Testricted	River	
Raoulia petriensis	Range restricted	Top of Central and South Grampian Mountains	
Sophora prostrata	Regionally	North end of North Grampian Mountains on low	
sophora prosiraia	uncommon.	sunny spurs and slopes: north end of Dalgety	
	original shrub	Range.	
Sphagnum cristatum	Uncommon in	Cushion bogs on fans at south end of Grampian	
~	eastern Canterbury	Mountains.	

Significance of Vegetation and Flora

The vegetation of the Snow and Mackenzie fans is very degraded and dominated by exotic plants. There is a small area on the northeast side of the Mackenzie fan where the diversity of indigenous plants is much higher and *Carex muelleri* (threat status: sparse) is present. The floodplains support matagouri shrublands that are more extensive on the Snow River and are representative of original communities. *Ceratocephala pungens* (nationally critical) is present on the upper Snow terraces, while *Raoulia monroi* (gradual decline) occurs on the Snow fan and terraces. *Aciphylla subflabellata* (sparse) and *Carex tenuiculmis* (sparse) occupy the margins of the Grays River wetland.

The eastern ridge of the Dalgety Range supports slim snow-tussock and narrow-leaved snowtussock, with turpentine shrubland on shady mid slopes. Grey shrublands occur on lower rocky slopes, talus patches and lower river valleys, while rockland plants live on the many rock outcrops. Slim snow-tussock, shrubland and rockland all represent original communities. Coral broom (gradual decline) is scattered across the area, while *Pimelea pseudo-lyallii* (sparse) occurs on eastern slopes and *Coprosma intertexta* (sparse) is present on the Mackenzie valley floor. *Geranium microphyllum* (data deficient) is present in a mid-altitude seepage. Prostrate kowhai, *Raoulia monroi* and good matagouri shrublands occur in the un-named valley immediately northeast of the upper Mackenzie valley. *Convolvulus verecundus* (sparse) occurs on the lower western ridge.

The vegetation of most of the northern Grampian Mountains is very degraded and dominated by exotic plants. Narrow-leaved snow-tussock occurs in the higher catchments with talus communities, rock outcrops and minor areas of turpentine shrubland, all of which represent original communities. Low sunny spurs and slopes at the north end of the range support large populations of prostrate kowhai, which is regionally uncommon and an original woody plant. Coral broom is scattered across the area and *Agrostis subulata* (range restricted) and *Carex muelleri* (sparse) occur in upper catchments, the latter being common on tracks and extending to lower altitude.

The central Grampian Mountains have remnants of original slim snow-tussock communities near the summit, with original communities on the many rock outcrops and coarse boulderfields. Stonefield communities are widespread on exposed ridges, though they are induced to some extent. Narrow-leaved snow-tussock is extensive, but rather open on eastern slopes. Scattered turpentine shrubs occur on shady mid to upper slopes. Foot slopes and fans support scattered snow-tussock, exotic grasses, hawkweed and matagouri shrublands. Coral broom is scattered throughout and *Carex muelleri* is locally common on mid to upper slopes and ridges. *Raoulia petriensis* (range restricted) occurs in the summit area and *Raoulia monroi* is present on one degraded rocky slope. *Vittadinia australis* agg. (data deficient) occurs near Monkey Rock and *Aciphylla dobsonii* (uncommon in ED) is common in the summit area. *Coprosma intertexta* (sparse) and *Kirkianella novae-zelandiae* (sparse) occur on lower fans.

The south Grampian Mountains have an extensive cover of narrow-leaved snow-tussock and minor slim snow-tussock. Boulderfield, stonefield and minor scree communities occur on upper slopes and exposed ridges, which, with slim snow-tussock represent original communities. Minor talus patches occur on mid slopes and turpentine shrubland occurs on shady slopes, both being original communities. Matagouri shrublands are widespread on floodplains and terraces and the largest patch of threatened *Coprosma intertexta* occurs here on a terrace. Small wetlands are common on the floodplain, while fans support cushion bogs, narrow-leaved snow-tussock and matagouri. All these communities contain elements of the original communities. A substantial number of threatened plants are present including coral broom, *Raoulia monroi*, *R. petriensis*, *Trisetum antarcticum*, *Carex muelleri*, *Coprosma intertexta*, *Pimelea pseudo-lyallii* and *Pterostylis tristis*. High altitude areas support *Aciphylla dobsonii* and *Celmisia ramulosa*, both of which are uncommon in the ED.

2.5.3 Problem Plants

Introduced plants that may have an important effect on indigenous plant communities on the property and that can be controlled or contained, are listed and discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical, such as mouse-ear hawkweed and pasture grasses, are not discussed here but are listed in the vegetation descriptions.

Broom

Infestations of broom are present alongside Dalgety Stream, in the bed of the upper Snow River, in the valley southeast of the homestead and in the bed of the Mackenzie River above and below Haldon Road. These infestations pose a significant threat to riverbeds, disturbed ground and grassland plant communities.

Gorse

A small infestation of gorse is present near the property boundary on the crest of the Kirkliston Range above upper Morton Stream. A single gorse bush was observed on the vehicle track on the ridge northwest of upper Moffat Stream.

Sweet brier

Sweet brier is scattered across lower slopes and valley floors throughout northern parts of the property. Control of this species is probably impractical.

Crack willow

Crack willow trees are present on the lower slopes near Mackenzie Pass, on the floodplains of the upper Mackenzie and Snow rivers, and along Grays River.

Male fern

Male fern is present in the upper Mackenzie River valley and near Grampian Stream in the south of the property. This species is now widespread in the high country. Removal or containment is probably impractical.

Stonecrop

Stonecrop is common on river floodplains and adjacent terraces. This species is now widespread in the high country. Removal or containment is probably impractical.

Elderberry

An elderberry tree is present alongside Dalgety Stream. The fleshy fruits of this species are readily dispersed by birds.

Wilding conifers

Wilding conifers (mostly Corsican pine and contorta pine) are sparsely scattered along the slopes of the Dalgety Range, densely spread downwind of a shelterbelt on the north side of the Mackenzie River fan and scattered over the Grampian Mountains (especially on the northwest slopes). The presence of wilding conifers threatens conservation and landscape values on the property.

2.6 FAUNA

2.6.1 Bats

Short-tailed bats have not been recorded in Canterbury since the arrival of Europeans. A small population of South Island long-tailed bat is present in South Canterbury. The closest bat records to The Grampians Pastoral Lease are from the Tengawai River (Sedgeley, 2002). The property was not surveyed for bats because bat roosting and feeding habitats (forest and mature shrubland) are not present in the area.

2.6.2 Birds

There is virtually no indigenous forest present in the Grampians and Pukaki ecological districts (McEwen, 1987) and none recorded on The Grampians Pastoral Lease. Therefore, bird fauna is characterised by species that inhabit open tussockland, shrubland and riverbed habitats. Australasian harrier, paradise shelduck, New Zealand pipit and New Zealand falcon (threat status: gradual decline) are widespread and have been recorded recently on nearby Bauchops Hill, Invercroy and Caberfeidh pastoral leases. Silvereye, South Island fantail, New Zealand falcon and grey warbler have been recorded breeding along the lower Grays River (Jarman, 1986).

Rivers of the region provide important habitats for black stilt (nationally critical), banded dotterel (gradual decline), Australasian pied stilt, black-fronted tern (nationally endangered) and wrybill (nationally vulnerable). Threatened blue duck (nationally endangered) has been recorded in these districts, and marsh crake (sparse) occurs in several swamps and wetlands (Jarman, 1986; McEwen, 1987).

Grays River is single channelled with some oxbows and lagoons, and stands of willow trees. Grays River Wetland SSWI straddles part of the property boundary and provides habitat for bird species including South Island pied oystercatcher and marsh crake (Jarman, 1986).

Birds observed on Grampians Pastoral Lease are described for the six distinct parts of the property surveyed.

Mackenzie River and Snow River Fans

This area covers the dry alluvial fans and terraces between the Grampian Mountains and the northern property boundary along the Mackenzie River. This area is very open with bare ground, rocks, sparse short tussock, mat plants and occasional sweet brier. Banded dotterel (two birds), Australasian harrier, welcome swallow, white-faced heron and southern black-backed gull were recorded in these habitats. Introduced skylarks were abundant.

Grays River wetlands

This area comprises a network of meandering river channels, tributary streams and seepages within the property boundary on the western side of Haldon Road. Dominant vegetation includes sedgeland, rushland, pasture and willow trees. Australasian harrier, welcome swallow, black shag, southern black-backed gull and introduced Canada goose and mallard were recorded in these habitats.

Mackenzie River Valley shrublands and rocklands

This area covers the slopes of the lower Mackenzie River Valley. It supports degraded short tussock grassland with snow-tussock restricted to a few scattered patches, mainly on sunny aspects.

Matagouri, *Olearia odorata* and mingimingi shrublands are present on the valley floor and lower slopes, and around rock outcrops and gorges. Similar shrublands occur in tributary streams and gorges. The shrublands provide breeding and feeding habitat for silvereye, grey warbler and a range of introduced passerines. Three black shags were recorded along the river. Rock bluffs may provide nesting habitat for New Zealand falcon, which was recorded on two separate occasions in the valley.

Dalgety Range

This area covers tussockland, rockland and fellfield habitats on the Dalgety Range and rockland and degraded tussockland habitats along the upper Mackenzie River. New Zealand pipit, Australasian harrier, redpoll and yellowhammer were recorded along the ridge crest and a New Zealand falcon was heard calling below the vehicle track on the west-facing slopes of the upper Mackenzie River Valley.

Grampian Mountains

This area covers high-altitude tussockland, rockland and fellfield habitats on the Grampian Mountains. These habitats were surveyed along the vehicle track that runs along the ridge crest of the Grampian Mountains from Haldon Road to Black Rocks and then down to Hakataramea Pass Road. Habitats were also inspected along the vehicle track southwest of Monkey Rock. New Zealand pipit was recorded throughout these habitats and New Zealand falcon was recorded on the lower hill slopes of the Grampian Mountains close to the Hakataramea Pass Road and Black Rocks. Introduced birds present were yellowhammer and chukor.

Grampian Stream and Kirkliston Range

This area covers the southern part of the property. Tussockland, rockland (small rock outcrops) and matagouri-dominated shrubland (largely confined to areas along streams) habitats were surveyed along the vehicle track between Hakataramea Pass Road and the Kirkliston Range. Silvereye and grey warbler were recorded in shrublands throughout. Australasian harrier, welcome swallow, southern black-backed gull, spur-winged plover and New Zealand pipit were also present. New Zealand falcon was recorded on the east-facing slopes of the Kirkliston Range and black shag was recorded along Grampian Stream.

Bird Species Recorded

Twenty-eight bird species were recorded on The Grampians Pastoral Lease during this inspection: 11 indigenous species and 17 naturalised species.

Bird species	Threat status	Distribution on property
^		• • •
Australasian harrier	Not threatened	Throughout.
banded dotterel	Gradual decline	Snow River flats.
black shag	Sparse	Mackenzie River; Grays River; Grampian
		Stream.
grey warbler	Not threatened	Indigenous shrubland throughout.
New Zealand falcon	Gradual decline	Mackenzie River valley; Grampian
(eastern)		Mountains; Hakataramea Pass Road;
		Kirkliston Range.
New Zealand pipit	Not threatened	Throughout at higher altitudes.
silvereye	Not threatened	Indigenous shrubland throughout.
southern black-backed gull	Not threatened	Throughout.
spur-winged plover	Not threatened	Grampian Stream.
welcome swallow	Not threatened	Shrubland throughout.
white-faced heron	Not threatened	Snow River.

Table ThreeIndigenous bird species recorded from Grampians Pastoral Lease,January/February 2006.

Naturalised bird species observed on the property were Australian magpie, blackbird, California quail, Canada goose, chaffinch, chukor, dunnock, goldfinch, greenfinch, house sparrow, mallard, redpoll, rock pigeon, skylark, song thrush, starling and yellowhammer.

Significance of the Bird Fauna

The Grampians Pastoral Lease provides relatively extensive areas of intact high-altitude habitat and areas of more modified low-altitude open-country and wetland habitat contiguous with other areas of similar habitat on adjoining properties. Three threatened bird species were recorded on the property: banded dotterel (gradual decline), black shag (sparse) and New Zealand falcon (gradual decline). The dry alluvial flats of the Snow and Mackenzie rivers provide excellent nesting habitat for banded dotterel. There were five sightings of New Zealand falcon during this survey; rock tors and larger rock outcrops at higher altitudes on the property may provide suitable nesting habitat for this species.

2.6.3 Lizards

The Department of Conservation's Herpetofauna Database has records of several threatened lizard species in the vicinity of The Grampians Pastoral Lease. Jewelled gecko (gradual decline), spotted skink (gradual decline), scree skink (gradual decline) and long-toed skink (sparse) have been reported from the margins of the Tasman and Tekapo rivers, Lake Tekapo and Edward Stream in the adjacent Mackenzie Basin. Large skinks observed in a boulderfield above Mackenzie Pass in the 1960s and recorded as *Leiolopisma otagense waimatense* (McEwen, 1987) and *Leiolopisma grande* (Espie *et al.*, 1984), are most likely to have been scree skinks (gradual decline). More common species of lizard (common skink, McCann's skink and Southern Alps gecko) are widespread and abundant in the Mackenzie Ecological Region and have been recorded recently on nearby Bauchops Hill, Invercroy and Caberfeidh pastoral leases.

There are several lizard records from The Grampians Pastoral Lease in the Herpetofauna Database. McCann's skink has been recorded on the Snow River flats, the east-facing slopes of the Dalgety Range and around Hakataramea Pass. Jewelled gecko has been recorded on the property south of Hakataramea Pass. Lizards observed on The Grampians Pastoral Lease are described below for the five distinct parts of the property surveyed.

Mackenzie River Valley shrublands and rocklands

This area covers the slopes of the lower Mackenzie River Valley. It supports degraded short tussock grassland with snow-tussock restricted to a few scattered patches, mainly on sunny aspects. Matagouri, *Olearia odorata* and mingimingi shrublands are present on the valley floor and lower slopes and around rock outcrops and gorges. Similar shrublands occur in tributary streams and gorges. Rock outcrops and talus with low vegetative cover provide abundant lizard habitats. Twenty-five lizards were recorded in this area. Six Southern Alps geckos and four McCann's skinks were recorded in rocky habitats on the lower hill slopes. One common skink was recorded in damp grassland along the river margin and 14 other skinks (common skink or McCann's skink) were recorded in this habitat.

Dalgety Range

This area covers tussockland, rockland and fellfield habitats on the Dalgety Range and rockland and degraded tussockland habitats along the upper Mackenzie River. Three McCann's skinks and two Southern Alps geckos were recorded in these habitats.

Hakataramea Pass

Three sites along Hakataramea Pass Road were investigated. Two sites previously supporting jewelled gecko were surveyed, but these areas no longer contain the shrubland habitat favoured by this species. Lizard habitats at these sites now comprise small rock outcrops with scattered snow-tussock, short tussock and speargrass. The third site inspected is a small valley running southwest from Hakataramea Pass. Habitats here include fescue tussock grassland with scattered small rock outcrops, snow-tussock, small screes and dense patches of speargrass and low matagouri shrubland. Thirty-seven lizards were recorded at these three sites, comprising 34 McCann's skinks and three Southern Alps geckos.

Grampian Mountains

This area covers high-altitude tussockland, rockland and fellfield habitats on the Grampian Mountains. These habitats were surveyed along the vehicle track that runs along the ridge crest of the Grampian Mountains from Haldon Road to Black Rocks and then down to Hakataramea Pass Road. Habitats were also inspected along the vehicle track southwest of Monkey Rock. Thirty-one lizards were recorded in these high altitude habitats, comprising 26 McCann's skink and five Southern Alps geckos. Several McCann's skinks were found higher than 1800 m altitude, which is particularly high for this species.

Grampian Stream and the Kirkliston Range

The area covers the southern part of the property. Tussockland, rockland (small rock outcrops) and matagouri-dominated shrubland habitats were surveyed along the vehicle track between Hakataramea Pass Road and the Kirkliston Range. Small areas of talus in the Grampian Stream valley were also inspected. Sixty-two lizards were found in these habitats, comprising two common skinks, 56 McCann's skinks and four Southern Alps geckos.

Lizard species recorded

One hundred and sixty lizards were recorded from 48 different locations on the property, comprising three species: three common skinks, 123 McCann's skinks, 20 Southern Alps geckos and 14 unidentified lizards (common skink or McCann's skink).

Table Four Lizard species recorded from Grampians Pastoral Lease, January/February 2006.

Lizard species	Threat status	Distribution on property
common skink	Not threatened	Mackenzie River Valley; Grampian Stream.
McCann's skink	Not threatened	At a range of altitudes and habitats throughout.
Southern Alps gecko	Not threatened	At a range of altitudes and habitats throughout.

Significance of lizard fauna

The property provides extensive habitat for three common lizard species: common skink, McCann's skink and Southern Alps gecko. McCann's skinks recorded at 1876 m on the Grampian Mountains are among some of the highest altitudinal records for this species (DOC Herpetofauna Database; B. Kappers, *pers. comm.*). Jewelled gecko (gradual decline) has previously been recorded in two locations along the Hakataramea Pass Road. However, suitable shrubland habitats are no longer present at these locations and shrubland habitats elsewhere on the property do not appear large enough or mature enough to support this species.

2.6.4 Freshwater Fauna (fish and invertebrates)

The Grampians Pastoral Lease is drained by two major rivers: Grays River (a tributary of the Tekapo River) in the north and Hakataramea River in the south. These rivers are part of the Waitaki River catchment. The major streams and rivers on the property are: Mackenzie River, Fett Stream, Snow River and Grays River in the Tekapo catchment; Dalgety Stream, Grampian Stream and Morton Stream in the Hakataramea catchment; and Moffat Stream which drains via Stony River to Lake Benmore.

One of the distinguishing features of the Waitaki Catchment is the presence of hydroelectric dams. This has two major effects on fish communities. The first is that fish communities upstream from the dams are generally composed of only non-diadromous species (those species without a marine phase in their lifecycle), although some exceptions do occur (e.g. longfin eel may still be present and common bully and koaro have become non-diadromous substituting lakes for the sea). The second effect is that fish communities are separated into discrete populations preventing re-colonization of previously dewatered streams. The Hakataramea River is the only large tributary of the Waitaki River that is not affected by dams. This has two effects on the fish communities. The first is that diadromous species (those species with a sea-going phase in their lifecycle) are more likely to be present. The second effect is that fish are able to move between catchment tributaries, allowing re-colonisation of streams.

The New Zealand Freshwater Fish Database (NZFFD) has 890 records from the Waitaki River catchment (at 29th of March 2006). Species recorded from the Tekapo River catchment streams near the property are longfin eel, alpine galaxias, bignose galaxias, Canterbury galaxias, koaro, common bully, upland bully, rainbow trout and brown trout. Species recorded from the Hakataramea River catchment streams near the property lease are longfin eel, Canterbury galaxias, upland bully, rainbow trout, brook char and brown trout. Also of note are a find of lowland longjaw galaxias less than 10 km downstream of the pastoral lease. Longfin eel and bignose galaxias have been recorded from streams adjacent to and on the property (Bowie, 2005). Hitchmough and Bull (*in press*) list the threatened fish species as lowland longjaw galaxias (nationally critical), longfin eel (gradual decline) and bignose galaxias (gradual decline).

The Grampians Pastoral lease comprises four main geographic areas of freshwater habitat, classified by physical character and location. Freshwater habitats and the fish and macro-invertebrate species recorded are described below for each of these areas.

Grays River

This area of approximately 3660 ha incorporates the low-lying flats and terraces of Grays River including the lower reaches of its tributaries, Mackenzie River and Snow River. The main rivers in this area flow from beyond the property boundary and occur on the property as intermittently flowing rivers (Mackenzie River and Snow River) or as a large slow-flowing river (Grays River). The other waterways, streams and springs in particular, generally start inside the pastoral lease. Parts of the bed of Snow River are unallocated Crown land. Wetlands are present on the margins of Grays River and in places along the Mackenzie and Snow rivers. These rivers flow across flat arable land, which is dominated by pasture, exotic grassland, depleted fescue tussock grassland and scattered shrubland. Willow trees are present along some river margins. The Grays River wetland supports willow trees, introduced grasses, lotus, sedgeland and rushland. Stock and wild animal access appears unrestricted. Several vehicle tracks cross the streams through fords or over bridges and culverts.

These rivers vary from two to 15 metres wide, though are generally about five metres wide. Streams are one to two metres wide. The wetlands vary in size. The largest wetland, near Grays River, covers c.580 hectares (Jarman, 1986), though only one-third of this wetland lies on the property.

The rivers range from 200 to 400 mm in depth, except Grays River which is approximately one metre deep with pools up to one and a half metres deep. The wetlands have seepages and springs, rather than standing surface water. River substrates vary from mud in Grays River to gravels and cobbles in Mackenzie and Snow rivers. Streams have gravel, cobble and boulder substrates, with occasional areas of mud and silt, except one stream near the power pylons which has a concrete bed in places where excess concrete from the construction of the pylon line was disposed. The wetlands generally have mud and silt substrates.

Seven sites were electro-fished in this area. Upland bullies were found at all seven sites, Canterbury galaxias at five sites, alpine galaxias at three sites, brown trout at two sites, rainbow trout at one site, and bignose galaxias at one site. Additional species recorded in the NZFFD are common bully and longfin eel. The presence of bignose galaxias in a springfed tributary of Grays River and of longfin eel in the main channel of Grays River, near the bridge west of the intersection of public roads (Bowie, 2005) is important. The other important feature of this block is that four native species (bignose galaxias, Canterbury galaxies, longfinned eel and upland bully) are all found in the wetland part of the Greys River block.

Macro-invertebrates observed in this area were: Archichauliodes diversus, Ameletopsis perscitus, Coloburiscus humeralis, Deleatidium spp., Stenoperla prasina, Aoteapsyche sp., Beraeoptera roria, Hydropsychidae sp., Olinga feredayi, Pycnocentria sp. and Rhantus sp.

Dalgety Range

This area of approximately 2325 hectares covers the main headwaters of Mackenzie River within the property boundary. It includes some steep country with ephemeral streams on the upper slopes of the Dalgety Range and gentler hill country between the upper Mackenzie River and the outwash flats. A water-race is present, drawing water from the Mackenzie River near the Mackenzie Memorial. Riparian vegetation in this area includes shrubland, depleted tussockland, grassland and small areas of wetland vegetation (sedgeland and rushland). Monkey musk is present along some streams. Stock and wild animal access is unrestricted. Waterways in this area vary from about one metre wide in some of the smaller tributary streams and the water race, to five metres wide in the Mackenzie River. Most parts of the waterways are 100 to 300 mm deep, although pools of more than one metre occur in some areas. Stream substrates include bedrock in the upper reaches, but generally comprise boulders and cobbles.

Five sites were electro-fished in this area: three in the Mackenzie River, one in a small tributary stream and one in the water race. Upland bullies were found at four sites, rainbow trout at three sites, brown trout at two sites and Canterbury galaxias at two sites. No records of other species are listed for this area in the NZFFD.

Macro-invertebrates observed in this area were: Archichauliodes diversus, Coloburiscus humeralis, Deleatidium spp., Zelandobius sp., Aoteapsyche sp., Helicopsyche albescens, Hydrobiosis sp., Olinga feredayi, Pycnocentria sp., Pycnocentrodes aeris and Potamopyrgus sp.

North Grampian Mountains

This area of approximately 5965 hectares covers a series of stream gullies on the east side of the Grampian Mountains, generally containing ephemeral streams and occasionally permanent streams. These streams are all tributaries of the Snow River, a large freshwater system with some areas of wetland along its margins. Another large stream drains the northern Grampian Mountains and flows past the homestead and farm buildings to Grays River. These streams typically flow through shrubland, tussockland (at higher altitudes) and grassland. Monkey musk is present along some streams. Stock and wild animal access appears unrestricted, except where it is naturally restricted by steep topography. The streams vary from one to five metres wide, but they are commonly less than

three metres wide. They are between 100 and 200 mm deep with occasional deeper pools of about 800 mm. The stream substrates are mainly boulders and cobbles with some areas of bedrock and areas of mud.

Six sites were electro-fished in this area: three in the Snow River, two in tributaries of the Snow River and one in the large stream near the homestead. Canterbury galaxias were found at four sites, upland bully at four sites, brown trout at three sites and alpine galaxias at two sites. One site had no fish present. No records of other species are listed for this area in the NZFFD.

Macro-invertebrates observed in this area were: Archichauliodes diversus, Coloburiscus humeralis, Deleatidium spp., Nesameletus sp., Aoteapsyche sp., Beraeoptera roria, Helicopsyche albescens, Hydropsychidae sp., Olinga feredayi, Pycnocentria sp. and Potamopyrgus sp.

South Grampian Mountains

This area of approximately 4155 hectares covers the headwaters of two large streams flowing from the southern Grampian Mountains, Dalgety Stream and Grampian Stream. Waterways in this area all drain to the Hakataramea River. Streams flow through shrubland, tussockland and grassland. Monkey musk is present along some streams. Cushion bogs and seepages are present along the gentler lower reaches of Grampian Stream. Stock and wild animal access appears unrestricted. The streams vary from one to four metres wide, with most being about two metres wide, and are between 100 and 200 mm deep with occasional deeper holes of about 600 mm. Stream substrates are mainly boulders and cobbles with some areas of bedrock.

Ten sites were electro-fished in this area: five in the Dalgety Stream catchment, three in the Grampian Stream catchment and two in the Morton Stream catchment. Brook Char is the most common species present, occurring at nine sites, Canterbury galaxias were found at five sites, upland bully at two sites and rainbow trout at one site. Additional species recorded in the NZFFD are longfin eel and brown trout. The longfin eel record dates from 1985, though several longfin eels have been recorded less than ten kilometres away since January 2006 (*pers. obs.*).

Macro-invertebrates observed in this area were: Coloburiscus humeralis, Deleatidium spp., Helicopsyche albescens, Hydropsychidae sp., Olinga feredayi, Pycnocentria sp., Pycnocentrodes aeris and Potamopyrgus sp.

Species Recorded

Seven fish species were recorded during this survey of The Grampians Pastoral Lease.

Fish Species	Threat Status	Known Distribution on Property
alpine galaxias	Not threatened	Only in Grays River catchment: in Snow River and
		tributary streams.
bignose galaxias	Gradual decline	Only in Grays River catchment: spring-fed streams in
		the wetland bordering Grays River.
brook char	Introduced	Only in the Hakataramea catchment: most waterways.
brown trout	Introduced	Some large stream catchments, but only found in
		Grays River catchment during this survey.
Canterbury galaxias	Not threatened	Many permanent waterways including Snow River.
rainbow trout	Introduced	Some large stream catchments.
upland bully	Not threatened	Many permanent waterways at low altitudes including
		Snow River.

Table Five Fish species recorded from The Grampians Pastoral Lease, January-February 2006.

Significance of the Freshwater Fauna

Two threatened fish species are present in freshwater habitats on the property: bignose galaxias (gradual decline) and longfin eel (gradual decline). The presence of bignose galaxias is significant as it adds a new population to the few known populations, confirming the importance of the Tekapo catchment for this species. The presence of longfin eel is also significant, as this species requires access to the sea to breed. Longfin eels in the upper Waitaki Catchment River must be at least 50 years old, since access for eels up the Waitaki River has been restricted since the completion of the first dam in 1954. Although the population of longfin eels will be declining, it remains an important component of the upper Waitaki River system. Five areas of freshwater habitat in the catchment of the Snow River are significant for species diversity (three native fish species). Aquatic invertebrates were generally indicative of good water quality over most of The Grampians Pastoral Lease; however, no threatened species were identified by this freshwater fauna survey. Most of the Waitaki River including all catchments on the property is listed as 'Type II' Waters of National Importance (Chadderton *et al.*, 2004).

2.6.5 Terrestrial Invertebrates

The Grampians Pastoral Lease includes most of the Grampian Mountains, the western slopes of the northern Dalgety Range, areas of dry flats around the Snow and Mackenzie rivers, wetland areas bordering Grays River, the eastern slopes of the northern Kirkliston Range and a wetland (including cushion bogs) associated with Grampian Stream. The dry flats on the northern part of the property provide important habitat for the rare grasshoppers *Brachaspis robustus* and *Sigaus minutus* (White, 1994, Simon Morris, *pers. comm.*). During a survey of the Lake Tekapo and Pukaki areas Davis (1989) concluded that *Sigaus minutus* was most abundant on younger river terraces. Although these often supported higher proportions of native mat and cushion vegetation, he noted that introduced plants were also prominent in sites favoured by grasshoppers. At the time of White's (1994) survey, the Snow River population of *Brachaspis robustus* was the largest known, so he recommended its formal protection. He advocated no change to current grazing practice, but recommended trialling feral cat control to reduce grasshopper predation. The critically threatened moth, *Orocrambus fugitivellus*, is known from only one population that occurs just outside the property along Haldon Road. Its host plant is unknown and little is known of its biology (Pawson and Emberson, 2000).

Because the property supports well-known rare grasshopper species (White, 1994; Simon Morris, *pers. comm.*) and the very rare moth *Orocrambus fugitivellus* occurs just outside the property in the Grays River wetlands (Patrick, 1992), time was spent looking for these species. Otherwise collecting was concentrated on beetles (Coleoptera). This order comprises the largest and most diverse group of insects in New Zealand. Beetles occur in all terrestrial and freshwater habitats and have the widest range of feeding habits of any group of terrestrial invertebrates. They are relatively well known in New Zealand compared with some other groups and have been used extensively in ecological surveys (e.g. Harris and Burns, 2000). Invertebrates of The Grampians Pastoral Lease are described below for the main parts of the property surveyed.

Mackenzie River and Snow River Fans

This area includes all the gently-sloping outwash fans of the Mackenzie and Snow rivers that are within the property boundary. It is prime habitat for the threatened grasshoppers *Brachaspis robustus* and *Sigaus* cf. *minutus*. Although the vegetation is highly modified, as the area has been invaded by many exotic species, healthy populations of the grasshoppers survive here. *Brachaspis robustus* was found on open, stony areas, while *Sigaus* cf. *minutus* was more often associated with mat plants and other low vegetation. Disturbed areas, such as the riverbeds, tracks and quarries are often favoured by *Brachaspis robustus*. The uncommon Central Otago grasshopper, *Phaulacridium otagoense*, was found in and around the Mackenzie riverbed. The boulder copper and common copper butterflies were common throughout the area.

Upper Mackenzie River Valley and hill country west of the Dalgety Range

This area comprises the hill country on the northeast part of the property, rising to 1588 m on the crest of the Dalgety Range. The upper slopes of the range support a diverse range of native plant communities in a moderately natural state, however collection was unable to occur here due to very strong winds at the time of the survey. Small patches of diverse shrubland survive in gullies. One in particular supported a rich and diverse insect fauna, including a fungus beetle not previously recorded from the Mackenzie region. A single specimen of the very large ground beetle, *Megadromus crassalis* (nationally endangered), was collected under a fence post on the highly modified, drier subsidiary range west of the Dalgety Range. This species occurs mostly in South Canterbury hill country at mid-altitudes and although only known from about 20 specimens (Johns, 2005), seems able to survive in disturbed habitats.

Northern Grampian Mountains

This area includes all of the Grampian Mountains north of Hakataramea Pass, rising to 1921 m near Black Rocks. The lower slopes of the range have been substantially modified, but at higher altitudes the vegetation retains much of its original character. The northern and eastern slopes support large populations of prostrate kowhai that host the kowhai moth caterpillar. Mountain stone weta occurred through most of this area. An unusual ant-beetle (Anthicidae), not previously collected from the Mackenzie region, was found under rocks on the lower northern slopes. Above about 1300 m a diverse, largely endemic beetle fauna was found. Populations of several species of flightless ground beetles, the localised *Megadromus alternus*, a new species in the genus *Holcaspis* and a species of *Mecodema* occur here. Two large weevils, vulnerable to mammalian predation, were collected from speargrass plants. Two localised species of darkling beetles were found under rocks. The alpine grasshoppers *Brachaspis* 'Hunter Hills' and *Sigaus australis* also occurred in this area, especially on rockland on the ridge crest.

A rich and diverse alpine beetle fauna was found in an area of seepages below Black Rocks, including two species of moss beetles, two ground beetles not seen elsewhere on the property and the only leaf beetle found on the property. Black mountain ringlet and the two grasshopper species also occurred here.

Southern Grampian Mountains and Northern Kirkliston Range

This area comprises the eastern slopes of the Grampian Mountains south of Hakataramea Pass and the adjoining Kirkliston Range at the south end of the property. The more gentle country to the south and east of these ranges is also included. The areas above about 1100 m support a similar fauna to that of the Northern Grampian Mountains. The ground beetle, *Holcaspis abdita* (nationally critical), was collected along the ridge. At lower altitudes barer ridges and tussock provide habitat for the tiger beetle, *Cicindela austromontana*, and Butler's mountain ringlet respectively. Shrublands in the headwaters of Grampian Stream support a diverse and representative beetle fauna. The wetland areas in the lower part of Grampian Stream catchment appear to be in relatively natural condition, but conditions were poor here for collecting during the time of the survey.

Species Recorded

During this survey, 101 species of invertebrate were collected from 50 collection sites across the property. Several specimens of a previously unknown species of the ground beetle genus *Holcaspis* were collected from the Grampian Mountains. This genus is well known (Butcher, 1984) and has been well collected. The new species is the smallest *Holcaspis* known. One specimen of the very large ground beetle, *Megadromus crassalis* (nationally endangered), was collected under a fence post at 1100 m in highly degraded vegetation. This species, known from only c.20 specimens, is a close relative to a common species which is widespread in Canterbury, *M. antarcticus* (Johns, 2005), and may be a sub-species of this species. The small grasshopper, *Sigaus minutus*, is currently being revised because it has been shown to consist of a number of distinctive forms (Simon Morris, *pers. comm.*). Two of these (referred to here as *Sigaus* cf. *minutus* 'blue' and *Sigaus*. cf. *minutus* 'green') were collected.

Species	Significance	Distribution on Property
Anthicus otagoensis	Previously known from Ashburton and	Grampian Mountains.
	Central Otago only.	
Artystona lata	Range restricted*	Dalgety Range; Grampian
		Mountains.
Brachaspis 'Hunter	Range restricted*	Grampian Mountains; Kirkliston
Hills'		Range.
Brachaspis robustus	Nationally endangered*	Mackenzie River and Snow
		River flood plains.
Holcaspis abdita	Nationally critical*	Kirkliston Range.
Holcaspis n. sp.	First record of species from a well known	Grampian Mountains.
	genus.	
Inophloeus cf.	Large, flightless weevil vulnerable to	Grampian Mountains; Kirkliston
sulcifer.	mammalian predation.	Range.
Lyperobius carinatus	Large, flightless weevil vulnerable to mammalian predation, sparse*	Grampian Mountains.
Megadromus crassalis	Nationally endangered*	Dalgety Range.
Mimopeus convexus	Not-threatened but previously known only	Snow River terrace; Grampian
1	from very few sites in Mackenzie and	Mountains.
	South Canterbury.	
Phaulacridium	An uncommon species near its northern	Mackenzie riverbed.
otagoense	limit.	
Sigaus cf. minutus	Reproducing populations of species in	Mackenzie River and Snow
'blue'	gradual decline.	River flood plains.
Sigaus cf. minutus	Reproducing populations of species in	Snow River terrace.
'green'	gradual decline.	
Sigaus cf. minutus	Reproducing populations of species in	Snow River flood plain.
	gradual decline, but only juveniles	
	collected from these sites.	

Table Six Notable invertebrate species recorded from Grampians Pastoral Lease, January 2006.

*Threat status from Hitchmough and Bull (in press).

Significance of the Invertebrate Fauna

During this invertebrate assessment of The Grampians Pastoral Lease 101 species of insects were collected or observed from 50 sites across the property. There were 68 beetle species (Coleoptera) from 26 families. Twelve of the beetle species are naturalised, which is an unusually high proportion. Fourteen notable species were recorded: one is nationally critical, two are nationally endangered, one is a new species of a well known and well-collected genus, three are species in gradual decline, two are range restricted, two are large, flightless weevils (one listed as sparse) vulnerable to mammalian predation, one is previously known from very few sites and two are range extensions. Invertebrate values are scattered over the property and five disjunct areas with significant values have been identified.

2.6.6 Problem Animals

Introduced animal species that may have an important effect on indigenous plant or animal communities on the property and that can be controlled or contained, are listed and discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical (such as rodents) are not discussed here.

Brushtail possum

Possum sign was observed in rockland habitats throughout the property. Possums are browsers of palatable indigenous plants and predators of birds, lizards and invertebrates.

Rabbits and hares

Hares were observed throughout the property and rabbits were observed at lower-altitudes.

Cats and hedgehogs

Scats (droppings) of cats and hedgehogs were observed on the property. These animals are predators of indigenous invertebrates.

Wallaby

Wallabies were observed on the Dalgety Range and on the Grampian Mountains, especially at the southern end.

<u>Fallow deer</u> Fallow deer were observed on the southern part of the property.

2.7 HISTORIC

2.7.2 European Heritage Values

The part of The Grampians Pastoral Lease known as the homestead run (Run 296) was first leased by John Hall (later Sir John Hall and Prime Minister of New Zealand) in 1859. In 1860 the run was transferred to John Tucker Ford, who already leased a large area on the Kirkliston Range, bringing the area of the combined property to 36,000 hectares. The property transferred in 1866 to Dr Fisher. Substantial areas on the Kirkliston Range were subdivided from the property and large blocks of arable land adjacent to Grays Hills Station were freeholded. Dr Fisher sold the property to John Sutton in 1882, who sold it shortly after to Ernest Chapman, G.G. Russell and J.M. Ritchie. Chapman transferred his share to his partners in 1888 and the property was then sold to William Grant in 1892. Grant sold the property to John McArthur in 1908. The property was split up in 1911, forming Curraghmore and Streamlands and leaving The Grampians homestead run with only 6,475 hectares. The property was taken over by Donald Burnett in 1912 and then transferred to Selwyn Peter Hope in 1914. Later, parts of Hakataramea Station between the Grampian Mountains and Dalgety Range (known as Whalesback) were added to the property (Pinney, 1971).

Mackenzie Pass at the northeast corner of the property and the Mackenzie Basin west of the property derive their names from the Scotsman James McKenzie. In March 1855, 1000 sheep were taken from the Levels Run by James McKenzie and mustered inland up the Tengawai River (Andersen, 1916). It is difficult to discern fact from folklore in accounts of the event. However, McKenzie was captured just west of Mackenzie Pass on what was then part of the Opawa Run (Pinney, 1971). The Mackenzie Memorial stands at this site today.

Significance of Historic Resources

No significant historic resources are known from the property.

2.8 PUBLIC RECREATION

2.8.1 Physical Characteristics

The property can be divided into two main recreation units.

Dalgety Range and Grampian Mountains

This recreation unit covers the higher-altitude parts of the property on the northwest slopes of the Dalgety Range and the northern and eastern flanks of the Grampian Mountains. The predominance of indigenous vegetation (tussockland, herbfield, rockland and boulderfield), unmodified landforms and remoteness from structures provide a highly natural setting for recreation. The terrain is moderately steep with minor areas of steeper country around rock bluffs at higher altitudes. Vehicle tracks traverse the crests of both ranges. These higher-altitudes parts of the property are clearly visible from Haldon Road, Mackenzie Pass Road and Hakataramea Pass Road, and distantly visible from the Fairlie Tekapo Road (State Highway 8) and other roads in the Mackenzie Basin. The range crests provide opportunities for spectacular views of the Mackenzie Basin and the Southern Alps, including Aoraki/Mount Cook.

Valleys and Flats

This recreation unit covers the lower-altitude parts of the property along Haldon Road, Mackenzie Pass Road and Hakataramea Pass Road. It includes the eastern edge of the Mackenzie Basin along Grays River, the broad fans of the Mackenzie and Snow rivers, the valley corridors along Dalgety and Grampian streams and the lower slopes of the main mountain ranges. It is modified, with extensive areas of depleted vegetation and smaller areas of cultivated pasture. Its position between the Dalgety Range and Grampian Mountains, its location at the edge of the expansive Mackenzie Basin and the largely unmodified landforms provide a relatively natural recreation setting. This unit is traversed by a number of roads, vehicle tracks and pylon lines. This area is clearly visible from the public roads and surrounding mountains.

2.8.2 Legal Access

Roads

Three formed legal roads provide access to the property: Mackenzie Pass Road in the northeast, Haldon Road in the west and Hakataramea Pass Road through the centre and along the southeast boundary of the property. The northern formed portion of Hakataramea Pass Road across the Snow River Flats to its junction with Haldon Road does not follow the legal road line. The legal road line crosses the outwash fan north of lower Snow River to meet Haldon Road near the junction of Mackenzie Pass Road and is traversed by a rough vehicle track. Unformed legal roads provide access from Haldon Road to Grays River, along the base of the northern slopes of the Grampian Mountains (south of and roughly parallel to the northern section of Hakataramea Pass Road), up the valley to the range crest southeast of the homestead and onto the lower-altitude slopes of the southeast Grampian Mountains in the vicinity of Dalgety and Grampian streams.

Marginal Strips

No marginal strips are present along streams on or within the property boundaries. Lower parts of Snow River, between the confluence of Fett Stream and Haldon Road lie outside the property boundary (UCL).

Adjoining Public Conservation Land

One small Conservation Area lies adjacent to the eastern boundary of the property on the crest of the Dalgety Range: Mount Dalgety Conservation Area (Conservation Land Unit I38017). The property adjoins pastoral lease or freehold land on all other boundaries.

2.8.3 Activities

The Dalgety Range and Grampian Mountains provide good opportunities for walking, nature study and scenery viewing. Formed roads on the ranges provide opportunities for mountain-biking, horseriding and four-wheel-drive vehicle use. The range crests, especially the crest of the Grampian Mountains, provide terrain that may be suitable for ski-touring. Tracks on the property provide the most practical routes to gain access to the northern end of the Dalgety Range and the northern, eastern and southern Grampian Mountains and provide opportunities for challenging and interesting round-trips. Lower-altitude parts of the property provide opportunities for walking, mountainbiking, horse-riding, nature study and access for fishing (especially at Grays River). The property provides a very important scenic backdrop for travellers on the legal roads through the property, especially the spectacular views gained by travellers from Mackenzie Pass and Hakataramea Pass.

Significance of Recreation

The most significant features of the property for recreation are the extensive areas of relatively natural country at higher altitudes on the Dalgety Range and Grampian Mountains, the opportunities to provide access to these ranges for recreation, opportunities for access to Grays River and the setting provided by the property for spectacular views of the Mackenzie Basin from Mackenzie and Hakataramea passes.

PART 3 OTHER RELEVANT MATTERS AND PLANS

3.1 CONSULTATION

Information-gathering meetings were held with representatives of non-governmental organisations (NGOs) at Christchurch on 5th September 2005 and at Geraldine on 6th September 2005. Comments made at those meetings are summarised below.

- Concerns expressed about the extent of degraded land and that such land should not be freeholded.
- The future of unsustainable grazing should be addressed through tenure review.
- The property has a Rabbit and Land Management Plan, which restricts grazing on the higheraltitude blocks on the Mackenzie Basin side of the range.
- Water quality in Grays River and its associated wetlands should be protected by fencing to exclude stock, especially cattle.
- The Hakataramea Pass and Mackenzie Pass routes have high scenic values which should be protected.
- The property makes an important contribution to the natural landscapes of the area.
- Fencing mid-slope should be avoided, to help protect landscape values.
- There are RAPs (identified as part of the PNAP) on the property.
- The property provides important access to the Grampian Mountains; public access should be provided through the property, such as along the route from Hakataramea Pass to Black Rocks.
- The Grampian Mountains provide spectacular country for recreation.
- Public access should be provided along the Dalgety Range, preferably with multiple access points so that round trips can be undertaken.
- Public access for fishing and other public recreation should be provided to Grays River.

3.2 DISTRICT PLANS

The northern part of The Grampians Pastoral Lease lies within the Rural Zone of the Mackenzie District. Four Sites of Natural Significance are present on the property:

- o 47a Grampians: on the crest of the Grampian Mountains northeast of Black Rocks
- o 47b Grampians: in the upper Snow River, north of Hakataramea Pass
- o 51 Rollesby and Dalgety Ranges: on the northwest flank of the Dalgety Range.
- 51b Mackenzie and Snow River Fans: on the fan north of lower Snow River (east of Haldon Road)

Parts of the property west of Haldon Road and north of Snow River are listed as a Scenic Viewing Area in the Mackenzie District Plan. The Mackenzie District Plan contains a number of rules relating to land use activities within sites of natural significance, within riparian areas and in high altitude areas (i.e. areas above 900 m):

The southern part of the property, on the southern Grampian Mountains lies within the Rural Zone of the Waimate District. The Waimate District Plan contains a number of rules that restrict or control activities in the Rural Zone, covering activities such as the clearance of indigenous vegetation, tree planting and set-backs from waterways.

3.3 CONSERVATION MANAGEMENT STRATEGIES

The Grampians Pastoral Lease lies within the Waitaki Place Unit of the Canterbury Conservancy. Relevant priority objectives for this unit listed in the CMS (Department of Conservation, 2000) are:

- To identify, maintain and seek to enhance the natural landscapes and natural landscape values of the Waitaki Unit.
- o To identify the significant indigenous vegetation and threatened species of the Waitaki Unit.
- To use a range of effective methods to protect the indigenous biodiversity of the Waitaki Unit.
- To protect and enhance the viability of priority threatened species populations and their habitat(s) in the Waitaki Unit.
- To improve the range of viable riparian habitats for indigenous species in the Mackenzie Basin.
- To encourage landholders to cooperate in protecting braided river systems.
- To prevent the loss of natural and landscape values from wilding trees on land managed by the Department.
- o To liaise with land managers and regulatory agencies to control and contain wilding trees.
- To reduce and maintain rabbit and thar densities to levels that ensure their adverse effects on natural values are minimised.
- To provide new recreational facilities and opportunities by the Department and other organisations and concessionaires where natural and historic values are not compromised.
- To liaise with adjacent landholders to resolve conflicts over access for recreation to land managed by the Department.
- To provide quality interpretation at priority sites in the Mackenzie Basin.
- o To increase public awareness of the natural and historic values of the Waitaki.

3.4 NEW ZEALAND BIODIVERSITY STRATEGY

The New Zealand Government is a signatory to the Convention on Biological Diversity. In February 2000, Government released the New Zealand Biodiversity Strategy. This strategy is a blueprint for managing the country's diversity of species and habitats. It sets a number of goals to achieve this aim. Of particular relevance to tenure review is Goal 3, which states:

- Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified systems in production and urban environments, and do what is necessary to:
- Maintain and restore viable populations of all indigenous species across their natural range and maintain their genetic diversity.

PART 4 ATTACHMENTS

4.1 ADDITIONAL INFORMATION

4.1.1 Scientific Names of Species

Plant Species referred to in text

Species names follow those in the published volumes of New Zealand Flora and the name changes listed in A Checklist of Indigenous Vascular Plants of New Zealand, 10th Revision (*Unpublished Document*, S. Courtney, Department of Conservation, Nelson). Maori names are included for taonga species listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998. Naturalised species are indicated by an asterisk (*).

Common name	Scientific name
alpine fescue tussock	Festuca matthewsii
blue tussock	Poa colensoi
blue wheatgrass	Elymus solandri
bog pine	Halocarpus bidwillii
bog rush	Schoenus pauciflorus
bracken	Pteridium esculentum
bristle tussock	Rytidosperma setifolium
broom*	Cytisus scoparius
browntop*	Agrostis capillaris
Californian thistle*	Cirsium arvense
catsear*	Hypochoeris radicata
Chewings fescue*	Festuca rubra
clover*	<i>Trifolium</i> spp.
comb sedge	Oreobolus pectinatus
common broom	Carmichaelia australis
common pennywort	Hydrocotyle novae-zeelandiae
contorta pine*	Pinus contorta
coral broom	Carmichaelia crassicaule
Corsican pine*	Pinus nigra ssp. laricio
crack willow*	Salix fragilis
creeping mapou	Myrsine nummularia
creeping pohuehue	Muehlenbeckia axillaris
curled dock*	Rumex crispus
dainty daisy	Celmisia gracilenta
dandelion*	Taraxacum officinale
duckweed	Lemna minor
edelweiss	Leucogenes grandiceps
elderberry*	Sambucus nigra
everlasting daisy	Helichrysum bellidioides
false speargrass/taramea	Celmisia lyallii
feathery tutu	Coriaria plumosa
fescue tussock	Festuca novae-zelandiae
giant speargrass/taramea	Aciphylla scott-thomsonii
golden speargrass/taramea	Aciphylla aurea

gorse*	Ulex europaeus
harebell	Wahlenbergia albomarginata
haresfoot trefoil*	Trifolium arvense
hawkweed*	Hieracium spp.
inaka	Dracophyllum longifolium
iointed rush*	Juncus articulatus
kahikatea	Dacrycarpus dacrydioides
king devil hawkweed*	Hieracium praealtum
kowhai	Sophora microphylla
lawver	Rubus schmidelioides
little hard fern	Blechnum penna-marina
lotus*	Lotus pedunculatus
lucerne*	Medicago sativa
male fern*	Drvonteris filix-mas
manuka	Lentospermum scoparium
Maori onion	Rulhinella angustifolia
matagouri	Discaria tournatou
mataj	Discuria iounaiou Drumpopitus tarifolia
mingimingi	Convoging propingua
miniginingi	Coprosma propinqua
monkey musk*	
mountain clubmoss	Lycopoaium fastigiatum
mountain flax/wharariki	Phormium cookianum
mountain kiokio	Blechnum montanum
mountain toatoa	Phyllocladus alpinus
mountain totara	Podocarpus hallu
mountain wineberry	Aristotelia fruticosa
mouse-ear chickweed*	Cerastium fontanum
mouse-ear hawkweed*	Hieracium pilosella
musk*	Mimulus moschatus
narrow-leaved snow-tussock	Chionochloa rigida
native violet	Viola cunninghamii
nodding thistle*	Carduus nutans
oval sedge*	Carex ovalis
patotara	Leucopogon fraseri
plume grass	Dichelachne crinita
porcupine shrub	Melicytus alpinus
prickly shield fern	Polystichum vestitum
prostrate kowhai	Sophora prostrata
pukio	Carex secta
purging flax*	Linum catharticum
rautahi	Carex coriacea
red tussock	Chionochloa rubra
red woodrush	Luzula rufa
scabweed	Raoulia australis
scrub pohuehue	Muehlenbeckia complexa
selfheal*	Prunella vulgaris
sheen's sorrel*	Rumex acetosella
short tussock	Festuca sp
silver tussock/wi	Poa cita
silvery hair grass*	Aira carvonhullea
slim enow-tussock	Chionochlog maera
shin show-tussour	Caultharia derrange
show being	Bodoogmus nivelie
snow tuesool	rouocarpus nivalis Chieneeble a cr
SIIOW tuSSOCK	<i>Chionochioa</i> sp.
soπ rusn [↑]	Juncus effusus

sphagnum moss	Sphagnum sp.
spike sedge	Eleocharis acuta
stitchwort*	Stellaria graminea
St John's wort*	Hypericum perforatum
stonecrop*	Sedum acre
storksbill*	Erodium cicutarium
sundew	Drosera arcturi
sweet brier*	Rosa rubiginosa
sweet vernal*	Anthoxanthum odoratum
tauhinu	Ozothamnus leptophyllus
thousand-leaved fern	Hypolepis millefolium
timothy*	Phleum pratense
toad rush*	Juncus bufonius
toetoe	Cortaderia richardii
totara	Podocarpus totara
tree tutu	Coriaria arborea
tumble grass	Lachnogrostis filiformis
turpentine shrub	Dracophyllum uniflorum
tutu	Coriaria sarmentosa
vegetable sheep	Raoulia eximia
viper's bugloss*	Echium vulgare
water forget-me-not*	Myosotis laxa ssp. caespitosa
white clover*	Trifolium repens
wire moss	Polytrichum juniperinum
woolly moss	Racomitrium pruinosum
woolly mullein*	Verbascum thapsus
yarrow*	Achillea millefolium
Yorkshire fog*	Holcus lanatus

Animal Species referred to in text

Species names follow King (1990) for mammals, the June 2003 version of the New Zealand Recognized Bird Names list (compiled by C.J.R. Robertson and D.G. Medway for the Ornithological Society of New Zealand Inc.) for birds, Whitaker (1998) for lizards and McDowall (2000) for fish. Common names for invertebrates are those listed in the Entomological Society of New Zealand Insect Names (Scott and Emberson, 1999). Maori names are included for taonga species listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998. Naturalised species are indicated by an asterisk (*).

Common name	Scientific name
alpine galaxias	. Galaxias paucispondylus
Australasian harrier/kahu	. Circus approximans
Australasian pied stilt/poaka	Himantopus himantopus leucocephalus
Australian magpie*	.Gymnorhina tibicen
banded dotterel	. Charadrius bicinctus bicinctus
bat	see South Island long-tailed bat
Bennett's wallaby*	Macropus rufogriseus rufogriseus
bignose galaxias	. Galaxias macronasus
blackbird*	.Turdus merula
black-fronted tern	.Sterna albostriata
black mountain ringlet	Percnodaimon pluto
black shag/koau	.Phalacrocorax carbo novaehollandiae
black stilt/kaki	Himantopus novaeseelandiae
blue duck/kowhiowhio	Hymenolaimus malacorhynchos

boulder copper butterfly	. Lycaena boldenarum
brook char*	. Salvelinus fontinalis
brown hare*	. Lepus europaeus occidentalis
brown trout*	. Salmo trutta
brushtail possum [*]	. Trichosurus vulpecula
Butler's mountain ringlet	. Erebiola butleri
California quail*	. Callipepla californica brunnescens
Canada goose*	Branta Canadensis maxima
Canterbury galaxias	Galaxias vulgaris
cat*	see house cat
chaffinch*	Fringilla coelebs
chukor*	Alectoris chukar
common bully	Gobiomorphus cotidianus
common copper butterfly	I vegena rauparaha
common skink	Oligosoma nigrinlantare polychroma
dunnock*	Prupalla modularis
Furenean hadgehog*	Fringeous europaeus occidentalis
European neugenog	Ormatal agus anniadha anniadha
fallow door*	. Oryciolagus cuniculus cuniculus
failow deer*	Dama aama aama
reral cat* (nouse cat)	. Felis catus
goldfinch*	. Carduelis carduelis
greenfinch*	. Carduelis chloris
grey duck/parera	. Anas superciliosa superciliosa
grey warbler/riroriro	. Gerygone igata
hare*	. <i>see</i> brown hare
hedgehog*	. see European hedgehog
house cat*	. Felis catus
house sparrow*	. Passer domesticus
jewelled gecko	.Naultinus gemmeus
koaro	. Galaxias brevipinnis
kowhai moth	. Uresiphita polygonalis maorialis
little owl*	.Athene noctua
longfin eel/tuna	. Anguilla dieffenbachii
long-toed skink	. Oligosoma longipes
lowland longjaw galaxias	. Galaxias cobitinus
McCann's skink	. Oligosoma maccanni
mallard*	. Anas platyrhynchos platyrhynchos
marsh crake	. Porzana pusilla affinis
mountain stone weta	.Hemideina maori
New Zealand falcon/karearea	. Falco novaeseelandiae
New Zealand pipit/pihoihoi	Anthus novaeseelandiae novaeseelandiae
paradise shelduck/putakitaki	. Tadorna variegata
possum*	see brushtail possum
rabbit*	see Furopean rabbit
rainbow trout*	Oncorhynchus mykiss
rednoll*	Carduelis flammea
rock nigeon*	Columba livia
soroo skink	Oligosoma waimatansa
short toiled bet	Mustaging tuberoulata
silonenano	Mystacina tubercutata
SIIVCICYC	Losierops internits internits
SKyldfK [*]	. Alauda arvensis
song unrusn [*]	. 1 uraus philomelos
Southern Alps gecko	. <i>Hopiodactylus</i> aff. <i>maculatus</i> "Southern Alps"
southern black-backed gull/karoro	. Larus dominicanus dominicanus
South Island tantail/piwakawaka	. Rhipidura fuliginosa fuliginosa

South Island long-tailed bat	Chalinolobus tuberculatus
South Island pied oystercatcher	Haematopus ostralegus finschi
spotted skink	Oligosoma lineoocellatum
spur-winged plover	Vanellus miles novaehollandiae
starling*	Sturnus vulgaris
upland bully	Gobiomorphus breviceps
wallaby*	see Bennett's wallaby
welcome swallow	Hirundo tahitica neoxena
white-faced heron	Ardea novaehollandiae novaehollandiae
wrybill	Anarhynchus frontalis
yellowhammer*	Emberiza cintrenella

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