

# Crown Pastoral Land Tenure Review

# Lease name : MOA HILLS

# Lease number: PO 314

# 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.

# November 05

# DOC CONSERVATION RESOURCES REPORT ON TENURE REVIEW OF MOA HILLS PASTORAL LEASE (P 314) UNDER PART 2 OF THE CROWN PASTORAL LAND ACT 1998



Final Moa Hills Pastoral Lease Conservation Resources Report. OTACO-42926

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#### PART 1

#### INTRODUCTION

#### 1.1 Background

The lessees of the Moa Hills Pastoral Lease (the lease) have applied to the Commissioner of Crown Lands for a review of the property's pastoral lease tenure.

The lessees are JA Deans Family Trust and the Michelle Partnership. This 3,589 ha lease straddles the rangeland between Mt Benger in the south and the higher Old Man Range in the north. The homesteads of the partners are located some 5 km from the lease in Ettrick and Coal Creek respectively. The JA Deans Family Trust has approximately 971 ha of freehold near Ettrick, while the Michelle partnership has approximately 285 ha of freehold near Coal Creek.

The lease rises from approximately 580 m at the confluence of Bullock Creek and the Pomahaka River to 1184 m at its southeastern corner.

The tenure review inspection of the lease was conducted by a multi-disciplinary team of nine people from 24<sup>th</sup>- 27<sup>th</sup> January 2005.

#### 1.2 Ecological Setting

The lease is within the Umbrella Ecological District (ED), one of the two districts that make up the Waikaia Ecological Region. The ED is approximately 150,000 ha and is a southern continuation of the Old Man Range, bounded in the east by the Clutha River and in the west by the Waikaia River. It has a block-faulted landscape with extensive upland plateaux and low- to mid- rolling foothill country. The climate is cool/temperate.

The lease adjoins the following areas of public conservation land:

- a) On its western boundary conservation unit G43002, Pomahaka River, a fixed marginal strip of approximately 55 ha;
- b) On its northern boundary conservation unit G43004, Bullock Creek, a fixed marginal strip of approximately 8 ha; and
- c) On its southeastern boundary, conservation unit G43055, Mt Benger Scenic Reserve, area approximately 892 ha.

# PART 2

INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

#### 2.1 Landscape

In broad terms, the main physical components that typify the lease's tectonic landscape include a wide upland plateau and slopes that gently dip towards the west. The eastern flanks feature steep colluvial slopes that are frequently incised by straight runnels feeding directly into the Clutha River.

The lease is basically square in shape. It shares common boundaries with Mt Hope and Grafton Hills pastoral leases in the north, Gem Lake pastoral lease on the opposing side of the Pomahaka River, freehold land to both the east and south and the Mt Benger Scenic Reserve to the southeast. The lease spans a wide altitudinal and topographical sequence from 580 m close to the margins of the Pomahaka River ascending to 1184 m at a high point near the southern apex corner of the lease.

The main structural components of the lease include the western faces that overlook the Pomahaka River, which at this point flows through a narrow asymmetric valley, with rotational slumping being more prevalent on the opposite Island Country. The balance of the lease encompasses several sub-catchments of Bullock Creek that drain into the Pomahaka River at the southwest corner. These sub-catchments are characterized by concave valley floors, moderately steep side slopes that contain incised gully heads and ridge crests that are round and at a constant grade. The absence of wilding pines is a special feature of the entire lease.

The lease is subdivided into five grazing blocks (defined on plan 4.2.6), with access via Mt Benger Road in the south and Pomahaka Road in the north. The closest rural service town is Roxburgh which is located 5 km to the east.

#### Methodology

The lease was inspected from external and internal formed access tracks and from numerous vantage points.

The fundamental components of the landscape assessment included dividing the lease into four landscape units (LUs) principally based on water-catchment areas. The following assessment criteria were applied to each unit to help determine its distinctive character and landscape values with the overall appearance of each LU being assessed by common descriptive terms that included landform, land cover and land use. The criteria used to assess and evaluate each LU's landscape value were based on the following attributes:

- Naturalness which is an expression of the degree of indigenous content of the vegetative cover, and the extent of human intervention.
- Legibility which is an expression of the clarity of the formative processes and how striking these physical processes are.
- Aesthetic values which include the concepts of memorability and naturalness.

- Aesthetic factors, which can make a particular landscape vivid, include simplicity in landform, muted colours and fine-textured ground cover.
- Visual values which are a subset of landscape values and relate to the visibility of a particular landscape or natural feature seen from public vantage points such as along district highways.

# 2.1.1 Wilsons Swamp (LU1)

#### Description

LU 1 comprises most of the northeast sub-catchment area of Bullock Creek. The source of the creek is within a seepage area just north of the lease, close to the Pomahaka Road. To the east, rounded ridgecrests define the west and south of the unit while to the north the unit's limit is an arbitrary survey line that bisects the sub-catchment.

The dominant landform is the even side slopes that surround Bullock Creek. The deep mantle of colluvium that clad these side slopes is regularly indented by gullies that extend to just under the crest of the ridgeline. There is a wide scattering of block tors along the ridgeline that forms the watershed between Bullock Creek (a main tributary of the Pomahaka River) and the other watercourses that drain directly into the Clutha River. Bullock Creek winds around a sequence of low intersecting spurs with the creek's watercourse being lined by stable, well-vegetated banks. A notable in-stream feature of the creek is the exposed ledges of schist rock that help to create a series of small plunge pools.

The vegetative cover has been influenced by both altitude and access with the principle ground cover being modified narrow-leaved snow tussock supplemented by hard tussock and introduced pasture species such as browntop, sweet vernal and white clover. At a low density there is a wide distribution of hawkweed. Along the ridgecrest there are frequent sphagnum moss bogs, the structure of these damp areas has been modified due to stock trampling. Surrounding these damp areas generally there is an abundance of Maori onion.

Sited along the eastern ridgeline is the lease's main access track that links the Pomahaka Road with Mt Benger Road.

#### Landscape Values

This unit conveys moderately high inherent landscape values principally due to the overall impression of uniformity, the result of a subtle merging of natural and exotic ground cover. This unit is representative of the broader generic landscape type that encompasses the whole lease, with the homogeneous qualities being the manifestation of a relatively even grazing regime over the total lease.

#### Potential Vulnerability to Change

LU 1 has the potential to be adversely affected by changes in land use and activities including the following:

- Further subdivision fencing which would adversely affect the existing coherent qualities of the unit.
- Further earth disturbances, which would allow opportunist species such as hawkweed to spread.
- Scalping of snow tussocks to form geometric fire breaks.

- Spread of wilding pines.
- Unsympathetic siting, colour and exterior finish of "built" structures.

#### 2.1.2 Upper Snowys (LU2)

#### Description

LU 2 incorporates a large proportion of the central northern sub-catchment of Bullock Creek and also includes the rolling plateau that separates the central north catchment from the deep valley containing the main stem of Bullock Creek.

The sub-catchment area is typified by a complex of low interlocking ridgelines intervened by V-shaped gullies. The side slopes of these gullies are regularly broken by indentations that contain both permanent and ephemeral watercourses; the head of these indentations often contains finger cushion bogs or fluves. The ridgelines are generally uniform, being occasionally punctuated by clusters of block tors. In isolated areas these rock formations continue down to the mid side slopes. The rolling plateau features random high points surrounded by subdued topography; a network of fluves or seepage areas extends over the plateau.

Across the whole of this unit the variations in ground cover are very subtle. Changes are more detectable in the lower south country where the inter-tussock spaces are occupied frequently by adventives. Further to the north the variations in the plant associations become less apparent with the rounded colluvial slopes being clad in dense and moderate stature narrow-leaved snow tussock. Leaf litter, blue tussock and dwarf snowberry occupy the intertussock spaces. There is only a spasmodic presence of golden spaniard. Across the rolling plateau the fluves are dominated by sphagnum moss bogs and cushion bogs with comb sedges being prominent.

#### Landscape Values

The northwest section of this unit possesses significant inherent landscape values due to its overall sense of being natural in character. The degree of change in the original vegetation component is acceptable in this context, with the landscape still conveying an overall impression of being coherent and natural in character.

It is particularly important in this region that an area identified as having significant inherent landscape values is not seen as a separate entity, but as a part of a broader landscape that reinforces the district's character. Consequently, the balance of this unit (north end of the Snowy grazing block), although slightly modified, complements the overall inherent landscape values of these grasslands.

#### Potential Vulnerability to Change

This unit has the potential to be adversely affected by changes in land use and activities including the following:

- Further intensification of land use, which would adversely affect the existing homogeneous attributes of the unit.
- Further subdivision that would lead to artificial fragmentation of the existing uniform ground cover.
- Scalping of snow tussocks to form firebreaks.

- Spread of wilding pines.
- Unsympathetic siting, colour and exterior finish of "built" structures.
- Further damage to fragile bog areas.

# 2.1.3 Ewe/Lower Snowys (LU3)

#### Description

LU 3 encompasses a large tract of broken rangeland in the centre and south of the lease. The unit's northern limits follow both the ridgecrest that contains the formed track that leads to the lease's mustering hut (located at G43 152 115) and the upper edge of the rolling plateau (LU 2). The eastern boundary follows the wide, rounded ridgeline that overlooks the Clutha River. The western boundary is a narrow ridgeline that forms the watershed between two sub-catchments of Bullock Creek. In the south, a survey line close to the summit of Mt Benger bounds the unit.

The main components of the unit are the two major sub-catchment areas of Bullock Creek and the deep valley containing this creek as it winds out towards the Pomahaka River. The sub-catchments feature side slopes that are generally moderate in relief and rounded in form owing to the deep deposit of colluvium. These side slopes are regularly indented by an intricate pattern of depressions that contain permanent and ephemeral watercourses originating from fluves just below the ridgecrests.

The southern sub-catchment has a narrow derivative character and is typified by oversteepened slopes and rocky bluffs. This rugged character continues down into the deep valley containing the main stem of Bullock Creek.

The vegetative cover is primarily narrow-leaved snow tussock. The density, stature and condition of the snow tussock are influenced greatly by aspect. This factor is especially evident in the northern sub-catchment, which is orientated directly east-west, with the darker slopes being covered in undiversified snow tussock while the corresponding sunnier and drier slopes are clad in mixed short grasslands. Within this specific sub-catchment are patches of woody shrublands confined to the head gully. The sub-catchment further to the south contains numerous sphagnum moss bogs that are normally restricted to the ridgecrests. The southern apex of the unit, adjacent to Mt Benger, has been fenced into several burn-off trial plots.

#### Landscape Values

Both the southern sub-catchment of Bullock Creek and the north-facing flanks of the creek have significant inherent landscape values. The mid section of the southern sub-catchment that extends out from Mt Benger is gorge-like and contains special features that include entrenched creek channel, rocky bluffs and over-steepened side slopes. These rugged traits contrast markedly with the surrounding unvarying colluvial slopes. The north-facing slopes possess an overall impression of uniformity in the tussock grasslands with a distinctive characteristic being the absence of woody species. The landscape values close to the summit of Mt Benger have been compromised owing to the geometric shape of the burn-off trial plots imposed on the gently rounded terrain.

The balance of the unit still conveys an overall impression of being both uniform and generally natural. However, in the lower country the inter-tussock spaces increasingly become more occupied by adventives.

#### Potential Vulnerability to Change

This unit has the potential to be adversely affected by changes in land use and activities including the following:

- Further subdivision that would lead to artificial fragmentation of the existing uniform grass cover.
- Further scalping of snow tussock to form firebreaks.
- Further unnecessary earth disturbances that would allow opportunist species such as hawkweed to spread.
- Spread of wilding pines.
- Further damage to fragile bog areas, especially close to Mt Benger.
- Unsympathetic siting, colour and exterior finish of "built" structures, particularly in close proximity to the crest of Mt Benger.

# 2.1.4 Pomahaka Faces (LU4)

#### Description

This unit includes all of the western faces that overlook the Pomahaka River. The lower boundary to the unit is the marginal strip that has been laid off from the edge of the river. The upper limits to the unit follow the wide ridgecrest that separates the Pomahaka from the numerous catchment areas of Bullock Creek.

The side slopes are dominated by long narrow spurs that descend towards the Pomahaka River. The river frequently has to wind around a series of interlocking spurs. Along the ridgecrest and jutting out from the mid slopes are prominent groups of block tors.

The vegetation over the Pomahaka faces has been extensively modified, with the upper and mid side slopes being covered in a mixture of fescue and snow tussock grasslands. The lower slopes are commonly covered in short grasslands with a wide distribution of hawkweed over the drier ridgelines.

A ribbon of beech forest lines the steep slopes close to where the Bullock Creek links up with the Pomahaka River. There are also small outliers of *Olearia* shrublands scattered around the confluence of these two waterways.

#### Landscape Values

In general, LU 4 possesses moderate inherent landscape values owing to the degree of change that has occurred to the original ground cover for production purposes. The area in close proximity to where Bullock Creek joins the Pomahaka River possesses significant inherent landscape values due to the quality of the tussock grasslands and the remaining residual areas of beech forest and shrublands. These woodlands and shrublands contrast markedly with the surrounding extensive grasslands owing to their distinctive diversity in colour, texture and habit.

#### Potential Vulnerability to Change

This unit has the potential to be adversely affected by changes in land use and activities including the following:

- Loss of forest understorey vegetation, especially palatable species, due to further stock browsing.
- Fire, which would reduce the size and sustainability of the beech forest remnants.
- Spread of wilding pines.

# 2.1.5 Significance of the Landscape

A special visual feature of the lease is the sweeping, uncluttered views that are accessible from the complex of ridgecrests. Generally though the inward views of the surrounding landscape are more significant than outward views, except along LU4 where a panoramic view of the whole eastern extent of the Garvie Mountains is accessible. Also close to the summit of Mt Benger in LU3 the mid section of the Clutha River valley is conspicuous.

The enclosed gorge-like section of the southern catchment of Bullock Creek, along with the lower section of the main stem of the creek, possess wild and scenic qualities owing to the rocky bluffs and the over-steepened slopes that help to create a sense of enclosure.

LU3 contains significant inherent landscape values attributable to the fact that this area conveys an overall impression of being natural in character and is contiguous with the Mt Benger Scenic Reserve. This results in an uninterrupted ecological sequence and diversified high country landscape spanning from near the summit of Mt Benger down to the contrasting enclosed Bullock Creek. Likewise, the tussock grasslands in LU2 possesses an overall sense of coherence and pleasantness attributable to the homogenous qualities of the tussock grasslands connecting within their wider context and therefore should not be looked upon as an "island", but need to be integrated with their more modified surrounds.

# 2.2 Landforms, Geology & Soils

# Description

The lease straddles the summit of the Old Man Range, which is one of several ranges uplifted in Central Otago during late Miocene to Pliocene. Extensive areas of flat to rolling hills are part of the uplifted and eroded Otago peneplain surface (which in turn is part of the Waipounamu Erosion surface) exposed following erosion of Manuherikia Group cover (Turnbull 2000, LeMasurier and Landis 1996). This surface has been incised by the Bullock Creek catchment.

The basement rocks are Haast schist of the Caples Terrane textural zone 3 (Turnbull 2000). Prominent schist rock tors are present in places, particularly on ridge crests. Tors are usually blocks of rock between joints where softer material has been removed by erosion and lines of tors probably result from intersection of joints with lineations such as fold hinges in schistosity, or less frequently from more resistant rocks (Forsyth 2001).

An anticline crosses the lease in a northwest to southeast direction, intercepting with Bullock Creek at GR G43 160 125.

Soils on the lease include Upland and Highcountry yellow – brown earths, Teviot on the uplands, and Dunstan in Bullock Creek catchment, and lowland yellow-brown earths Tuapeka in the Pomahaka catchment (Soil Map of the South Island, New Zealand Soil Bureau Bulletin No. 27).

No geopreservation sites listed in Hayward and Kenny (1998) are present on the lease nor are there any other significant geological features.

# 2.3 Climate

The lease experiences a cool temperature, humid/subhumid climate, with precipitation varying with altitude from between 750 mm to 1000 mm and annually between 500 mm-1000 mm. In winter a large proportion of this falls as snow with much of the higher country being under snow for about 4 months of the year while in sheltered positions drifts may persist until late December. A distinctive climatic characteristic of the lease and the adjoining area is the frequent fogs, which occur during all seasons and are very often unaccompanied by rain.

# 2.4 Land Environments of New Zealand (LENZ)

# 2.4.1 Introduction

There are two databases that have been used to assess biodiversity protection (Walker et al 2004).

- 1. Environmental distinctiveness has been assessed through the Land Environments of New Zealand (LENZ). This is a classification of New Zealand landscapes using a comprehensive set of climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns. It is presented at four levels of detail containing 20, 100, 200 or 500 environments nationally. LENZ Level IV, the most detailed, is analysed below.
- 2. The area of unprotected indigenous cover in threatened land environments has been identified in the national land cover database (LCDB).

From the above databases, spatial data depicting indigenous cover and legal protection were overlaid on LENZ Level IV environments to identify biodiversity that is most vulnerable (most likely to be lost). This provides a measure for:

- a. percentages legally protected and;
- b. percentages of remaining indigenous cover

Based on these two criteria, five categories of threatened environments have been used to identify environments containing indigenous biodiversity at most risk of loss. They are classified as follows:

- 1. Acutely threatened: <10% indigenous cover remaining
- 2. Chronically threatened: 10-20% indigenous cover remaining
- 3. At risk: 20-30% indigenous cover remaining

- 4. **Critically underprotected:** >30% indigenous cover remaining and <10% protected
- 5 **Underprotected:** >30% indigenous cover remaining and 10-20% protected
- 6. **No Threat:** >30% indigenous cover remaining and >20% protected

Refer to plan 4.2.5 for the LENZ map.

Level 4	% Indigenous cover remaining nationally	%Protected nationally	Indigenous Cover Change 97- 02 nationally	Threat Category nationally	Approx. Area (ha) on lease	Approx. % of lease
Q1.1a	98.4	24.8	No change	No threat category	276	8
Q1.1b	77	8.4	Decrease	Critically underprotected	621	17.3
Q1.1c	91	17.7	No change	Underprotected	624	17.3
Q1.1d	84.7	34.8	No change	No threat category	497	14
Q2.2a	34.9	3.9	Decrease	Critically underprotected	120	3.3
Q3.1a	66.6	35.8	No change	No threat category	60	1.7
Q3.3a	96.9	25.6	No change	No threat category	894	24.9
Q3.3c	90	17.2	Decrease	Underprotected	482	13.4
Q4.3a	23.4	7.8	Decrease	At risk	0.29	Insignificant

 Table 1: LENZ Level IV Breakdown

# 2.4.2 Significance of LENZ

The lease has the following land environments that are significant because on a national level the indigenous vegetation has largely been removed, and/or little of the environment is represented in lands protected primarily for conservation purposes.

- ~21% of the lease contains 2 Level IV LENZ units (Q1.1b and Q2.2a) that have 30% or more of their land area still in indigenous cover and <10% is protected. These are 'Critically Underprotected' environments.
- ~31% of the lease contains 2 Level IV LENZ units (Q1.1c and Q3.3c) that have >30% of their land area still indigenous cover and 10-20% protected. These are 'Underprotected' environments.

# 2.5 Vegetation

### 2.5.1 Introduction

Context

The lease is located near the northeastern boundary of the ED (Mc Ewan, 1989). A Protected Natural Areas Programme (PNAP) survey was undertaken in 1985-86 (Dickinson, 1988). This PNAP survey identified twenty Recommended Areas for Protection (RAPs), of which the following five are in close proximity to the lease.

- RAP UMB 5 Timber Creek headwaters (c. 355 ha) is located adjacent to the southeastern boundary of the lease.
- RAP UMB 14 Coal Creek bluffs (c. 20 ha) is located 5 km to the northeast.
- RAP UMB 15 Little Pomahaka headwaters (c. 370 ha) is located 4 km to the northwest.
- RAP UMB 9 Pomahaka tributary (c. 50 ha)
- RAP UMB 9 Mckay Creek (c. 20 ha) both lie c. 5 km to the southwest.

The nearest extensive areas of DOC administered conservation land within the ED are:

- Mt Benger Scenic Reserve: This reserve includes the headwaters of Timber Creek and a tributary of Bullock Creek. The reserve adjoins the lease along its southeastern boundary and includes RAP UMB 5 Timber Creek headwaters.
- Bains Block Conservation Area: This large block of land is located to the north on the southern slopes of the Old Man Range, within the Pomahaka catchment and includes RAP UMB 15 Little Pomahaka headwaters.
- Pomahaka Faces Conservation Area: This block of land includes hillslopes adjacent to the Pomahaka River and includes RAP UMB 9 – Pomahaka Tributary and RAP UMB 9 – McKay Creek.

#### Methodology

Most of the farm tracks on the lease were traversed by vehicle and these provided a good overview of much of the lease. In addition the lower Bullock Creek, the Pomahaka Faces, the northwestern summit ridge and a Bullock Creek tributary in the southeast of the lease were walked. A plant species list was compiled, photographs taken and extensive notes were made on the vegetation encountered. Topographical, Land Resource Inventory (LRI), soil, geology and LENZ maps were all examined.

#### **Vegetation Description**

The lease has been divided into five major units for the purposes of vegetation description, which correspond with the lease's farm blocks.

### 2.5.2 Pommy Faces Block

#### A Northern Pomahaka River Faces

<u>Tussock grassland</u>: Narrow-leaved snow tussock grassland is the major community occurring on the mid-upper Pomahaka River faces. Narrow-leaved snow tussock grassland (*Chionochloa rigida*) generally occurs above 850 m, with a decreasing cover extending down to the river. On the lower sunny faces exotic grasses dominate with only a low density of narrow-leaved snow tussock and fescue tussock (*Festuca novae-zelandiae*), with much catsear (*Hypochaeris radicata*). King devil (*Hieracium praealtum*) is locally co-dominant. Other native species present include harebell (*Wahlenbergia albomarginata*), *Raoulia subsericea* and *Leucopogon fraseri*.

Lower shady faces contain a light to moderate cover of narrow-leaved snow tussock, with much browntop (*Agrostis capillaris*). These areas retain a greater native composition and include fescue tussock, blue tussock (*Poa colensoi*), little hard fern (*Blechnum penna-marina*), *Brachyglottis bellidioides*, snowberry (*Gaultheria depressa* var. *novae-zelandiae*), the clubrush (*Lycopodium fastigiatum*), Maori onion (*Bulbinella angustifolia*) and harebell. Also found are king devil, catsear, and other species. Along side streams the vegetation includes scattered *Aciphylla glaucescens*, *Ourisia caespitosa*, *Grammitis patagonica* (on rock outcrops), *Coriaria plumosa, Carmichaelia petriei*, *Gaultheria crassa, Dolichoglottis lyallii* and prickly shield fern (*Polystichum vestitum*).

Upper altitude slopes contain relatively dense good condition narrow-leaved snow tussock grassland. Associated species include browntop, tussock hawkweed, catsear, *Leucopogon fraseri, Celmisia gracilenta*, harebell and *Lycopodium fastigiatum*.

The broad summit plateau extends across the block boundary into the Snowy block and contains a mosaic of tall, narrow-leaved snow tussock and wetlands. These communities are more extensive in the Snowy block and are described in section 2.5.3.

<u>Wetlands</u>: There are many small-scale (generally) wetlands present, most of which are seepages. Two examples were inspected within the block. Firstly, a *Carex* seepage at the toe of a terrace along a tributary (centred on G43 114 104, 740 m). This community is of limited extent being found typically on the toe slopes of side valleys and contains *Carex* species with some Yorkshire fog (*Holcus lanatus*), sweet vernal (*Anthoxanthum odoratum*), jointed rush (*Juncus articulatus*), Maori onion, white clover (*Trifolium repens*) and *Lagenifera petiolata*.

A second example was adjacent to the stream nearby. This type is small scale and discontinuous, being found in the lower section of side streams. The community is dominated by sweet vernal and white clover, with Maori onion, *Epilobium brunescens* ssp. *minutifolium, Acaena inermis, A. saccaticupula, Hydrocotyle novae-zelandiae* var. *montana,* and *Rumex flexuosa*.

#### B Southern Pomahaka faces

This area is mostly south facing and has slumpy colluvial slopes with scattered rock outcropping. Narrow-leaved snow tussock grassland generally occurs above 850 m, with a decreasing narrow-leaved snow tussock cover extending down to the river. The lower gullies contain scattered mountain ribbonwood (*Hoheria lyallii*), mountain flax (*Phormium cookianum*), prickly shield fern and tutu (*Coriaria sarmentosa*). Along the Pomahaka River is a narrow ribbon of silver beech forest, fragmented in parts but with some regeneration present.

# 2.5.3 Snowy Block

#### A <u>Summit plateau</u>

<u>Tussock grasslands</u>: Narrow-leaved snow tussock grassland is the major community on the broad, summit area and upper slopes, especially on slopes and other areas with good drainage. Associated species include *Leucopogon fraseri*, snowberry, blue tussock, *Lycopodium fastigiatum* and *Gentiana bellidifolia*.

<u>Wetlands</u>: The summit plateau area contains diversity of wetland communities present. Theses wetlands include upland bogs, fens and seepage systems (as described in Johnson and Gerbeaux, 2004) and contribute significantly to the distinctive character of the summit area.

In saturated areas where tussock grasslands merge into wetlands there is generally much sphagnum moss (*Sphagnum cristatum*), with a light – moderate cover of narrow-leaved snow tussock, along with *Carex sinclairii*, leaf litter, *Carex gaudichaudiana*, Maori onion, *Celmisia* sp. "gracilenta rhizomatous", the sundew *Drosera arcturi*, and little hard fern. There are small areas of red tussock (*Chionochloa rubra*) and narrow-leaved snow tussock/red tussock hybrids. These areas contain much sphagnum moss or *Polytrichum* sp moss, with some *Carex sinclairii*, little hard fern and *Celmisia* sp. "gracilenta rhizomatous".

Cushionfield communities are scattered across the broad gentle summit surfaces and are generally dominated by comb sedge (*Oreobolus pectinatus*), with *Drosera arcturi*, *Carex gaudichaudiana*, bryophytes, *Celmisia* sp. "gracilenta rhizomatous", *Ranunculus gracilipes*, cutty grass (*Carex coriacea*), and *Juncus antarcticus*. Locally common are *Phyllachne colensoi*, *Dracophyllum prostratum*, *Pentachondra pumila* and the moss *Rhacomitrium lanuginosum*.

Another large bog system (at approximately G43 134 124, 1110 m) was dominated by sphagnum moss, with much *Abrotanella caespitosa* and other bryophytes, comb sedge, *Carex gaudichaudiana*, *Carex sinclairii*, *Celmisia* sp. "gracilenta rhizomatous", *Phyllachne colensoi*, *Drosera arcturi*, *Juncus antarcticus*, *Isolepis aucklandicus* and *Gentiana amabilis*.

Cushionfields merge into mossy seepage communities in wet sites and onto slopes. These seepage communities are dominated by bryophytes with *Carex gaudichaudiana*, *Celmisia* sp. "gracilenta rhizomatous", *Ranunculus gracilipes*, *Hydrocotyle microphylla*, *Epilobium komarovianum*, *Leptinella squalida* ssp. *mediana*, *Plantago uniflora*, *Coprosma perpusilla* and *Luzula leptophylla*.

One of the larger seepage systems examined (c. 100m x 25m) was located at approximately G43 128 124, 1125 m. This seepage is dominated by sphagnum moss, with *Carex echinata*, *Carex gaudichaudiana*, sweet vernal, *Rytidosperma australe*, *Epilobium brunnescens*, *Neopaxia sessiliflora* and other species. The margin of this seepage contained a *Carex sinclairii* community with some cutty grass and narrow-leaved snow tussock.

<u>Rock tors</u>: The tors on the summit area form a distinctive landscape feature and have an associated characteristic flora. Species that are commonly found on the tors include *Anisotome cauticola, Luzula banksiana, Myrsine nummularia, Celmisia lyallii;* less common species include *Gaultheria crassa, Pachycladon novae-zelandiae, Anisotome flexuosa, Schizeilema cyanopetalum* and *Koeleria cheesemanii.* 

Common at the base of the tors on shady aspects is a herb community that includes *Ranunculus royi, R. ensyii, R, reflexus, Oreomyrrhis colensoi, Leptinella serrulata, Anisotome aromatica* var. *flabellifolia, Geum leiospermum, Neopaxia sessiliflora, Galium perpusillum, Hydrocotyle novae-zelandiae* and *Poa breviglumis.* Also around many tors are stock camps, dominated by sweet vernal and smooth meadow grass (*Poa pratensis*), with some rye grass (*Lolium perenne*), white clover and Maori onion.

### 2.5.4 Wilsons Swamp Block

<u>Tussock grassland</u>: Narrow-leaved snow tussock grassland is the major community at higher altitudes within this block and is generally only of moderate condition and density at these altitudes and poorer condition below. An area examined adjacent to the summit track (approximately G43 173 127, 930 m) is dominated by a moderate cover of narrow-leaved snow tussock, with much browntop and some *Brachyglottis bellidioides*, Maori onion, *Celmisia gracilenta*, snowberry, little hard fern, catsear and bryophytes.

An area of red tussock grassland was recorded on a broad, gentle, valley floor area below a saddle point at approximately G43 172 126, 910 m. This red tussock grassland is restricted in extent, but represents the best condition and largest observed on the lease. Generally the community consists of a light cover of red tussock, with much bryophyte (mainly *Polytrichum* sp.) and some *Schoenus pauciflorus*, Maori onion, soft rush, cutty grass, *Celmisia* sp. "rhizomatous gracilenta", *Uncinia rubra, Hydrocotyle novae-zelandiae* var. *montana*, native violet *Viola cunninghamii* and other species. Locally the community contains patches of dense red tussock with some *Hydrocotyle novae-zelandiae* var. *novae-zelandiae* and native geranium *Geranium microphyllum*.

<u>Wetlands</u>: A valley floor seepage system centred at approximately G43 172 126, 920-940 m contains several different associations. The first association is dominated by bryophytes, with much *Ranunculus cheesemanii*, also *Hydrocotyle microphylla*, *Carex gaudichaudiana*, *Epilobium brunnescens*, *Epilobiujm komarovianum*, *Plantago uniflora* and *Celmisia* sp. "rhizomatous gracilenta". The exotic species jointed rush, white clover and sweet vernal were also present. This association merges into a second association also dominated by bryophytes with *Epilobium komarovianum*, *Hydrocotyle novae-zelandiae* var. *montana*, *Leptinella squalida* var. *mediana*, *Plantago uniflora*, comb sedge, *Euchiton lateralis* and *Celmisia* sp. "rhizomatous gracilenta". A third association is found along a wet channel and is dominated by *Carex gaudichaudiana* and bryophytes, with *Hydrocotyle microphylla* and *Euchiton lateralis*. *Carex echinata*, the spike rush *Eleocharis acuta* and *Montia fontana* are each locally important.

There are several hill slope seepages within the block, of which one was examined. This community is dominated by bryophytes, *Rytidosperma* sp., *Carex gaudichaudiana*, *Viola cunninghamii*, *Euchiton traversii*, *Epilobium komarovianum*, *Ranunculus cheesemanii*, *Hydrocotyle microphylla*, *Plantago uniflora*, *Schoenus pauciflorus* and white clover.

# 2.5.5 Ewe Block

<u>Tussock grasslands</u>: The vegetation of this block is dominated by narrow-leaved snow tussock grassland similar to that found on mid to upper altitudes elsewhere on the lease. Most of the area has a moderate density of narrow-leaved snow tussock grassland tending

into exotic grassland at lower altitude. Associated species recorded include much browntop and catsear, along with some *Raoulia subsericea*, *Celmisia gracilenta*, *Lycopodium fastigiatum*, snowberry, *Pentachondra pumila*, sky lily (*Herpolirion novae-zelandiae*), *Celmisia prorepens*, *Craspedia* sp. and golden spaniard (*Aciphylla aurea*).

Along the ridge between the two tributaries of Bullock Creek (G43 c. 172 097) a few upland plant species were recorded. These include *Celmisia sessiliflora, Kelleria villosa* and *Aciphylla hectorii* and are either uncommon on the lease and/or only observed in this area.

In the southeast of the lease were extensive areas of good quality tussock grassland. This community was dominated by narrow-leaved snow tussock grassland, with much of the moss *Polythrichum* sp., blue tussock, *Cyathodes pumila*, cutty grass, *Hebe odora* and *Aciphylla hectorii*.

Along shady faces above tributary streams were some diverse communities. These contain prickly shield fern, alpine shield fern (*Polystichum cystostegia*), *Aciphylla scott-thomsonii*, *Coprosma cheesemanii*, *Hebe anomala*, *Brachyglottis bellidioides*, *Dolichoglottis lyallii*, *Ourisia caespitosa*, *Celmisia prorepens*, *Anemone tenuicaulis*, *Acaena profundiinsica*, *Epilobium chloraefolium*, *Uncinia divaricata* and *Hydrocotyle novae-zelandiae* var. *novaezelandiae*.

<u>Shrublands</u>: A feature of this block is the remnant shrubland communities. Of particular importance is the presence of a large shrubland area on a steep, rocky face within the southern tributary within the block (approximately G43 165 095, 980-1000 m). This shrubland contains much *Hebe anomala*, cottonwood (*Ozothamnus vauvilliersii*), narrow-leaved snow tussock grassland, *Dracophyllum uniflorum* and *Coprosma cheesemanii*. Other associated species include *Hebe rakaiensis*, *Coprosma ciliata*, mountain flax, inaka (*Dracophyllum longifolium* – locally common), matagouri (*Discaria toumatou*), *Olearia bullata*, *Gaultheria crassa*, *Anemone tenuicaulis*, *Brachyglottis bellidioides*, *Oreomrryhis ramosa*, *Dolichoglottis lyallii* and *Astelia nervosa*. This shrubland represents a large and healthy fire refuge community.

Within the shrubland are many rock faces/outcrop systems which contain a rich flora, including *Cystopteris tasmanica, Geum cockaynei, Celmisia semicordata, Grammitis patagonica, Ourisia caespitosa, Hymenophyllum multifidum, Epilobium glabellum, Anaphalioides bellidioides, Forstera tenella, Myosotis macrantha, Brachyscome radicata* and *Stellaria parviflora.* 

In areas more accessible to stock and/or fire the shrubland is less diverse and generally restricted to moist shady areas. There are areas of outlying shrubland that have been recently burnt and also a few patches of *Dracophyllum uniflorum* scattered on higher altitude, shady faces elsewhere within the block.

<u>Wetlands</u>: There were a number of seepages found both along gentle gradient streams especially along the headwaters of the northern tributary of Bullock Creek and along minor side gullies. The valley floor wetlands are dominated by *Carex coriacea* and/or *C. sinclairii*, with *C. echinata*, *Hydrocotyle novae-zelandiae* var. *montana*, *Rytidosperma australe*, *Epilobium brunnescens* and *Drosera acturi*. Along the valley floor of the southern tributary of Bullock Creek (centred on G43 72 088, 950 m) is a meandering creek with wetland areas. These wetland areas contain bryophytes, *Carex gaudichaudiana, C. echinata, Eleocharis gracilis, Euchiton lateralis, Epilobium komarovianum*, along with the exotic species Yorkshire fog, sweet vernal, soft rush (*Juncus effusus*) and jointed rush. Pools contain the spike rush (*Eleocharis acuta*).

### 2.5.6 Station Corner

<u>Forest</u>: There is a narrow stand of silver beech (*Nothofagus menziesii*) scattered along the lower section of Bullock Creek (G43 c.134 088, c. 600 m). Forest also continues up and down stream along the Pomahaka River to c. 650 m and 580 m respectively, however much of this is within the marginal strip. This stand of beech forms the currently known upper limit of silver beech remaining along the Pomahaka River and retains a range of plants that were typical of the original forest of the area. These include mountain ribbonwood, broadleaf (*Griselinia littoralis*), three finger (*Pseudopanax colensoi* var. *ternatus*), *Coprosma ciliata*, and the ferns hounds tongue fern (*Microsorum pustulatum*), *Blechnum fluviatile*, *Hymenophyllum sanguinoletum*, *Asplenium flaccidum*, *A. richardii*, *Hypolepis millefolium* and prickly shield fern.

<u>Shrublands</u>: Upstream of the silver beech stand in Bullock Creek are discontinuous mixed shrubland areas. Some of these are dense while others are semi-open. The major species found include *Coprosma ciliata*, *C*. sp. aff. *parviflora*, mingimingi (*C. propinqua*), inaka, *Hebe anomala, Carmichaelia virgata, Olearia bullata*, narrow-leaved snow tussock, mountain flax, prickly shield fern and other species. Along stream margins are mountain ribbonwood, mountain wineberry (*Arisotelia fruticosa*), koromiko (*Hebe salicifolia*) and *H. rakaiensis*.

Flanking the forest and extending onto the lower-most Pomahaka faces are shrublands on steep rocky faces. These "grey" shrubland communities contain much mingimingi, *Corokia cotoneaster*, *Olearia fimbriata*, *Carmichaelia virgata* and mountain flax, along with scattered broadleaf, black mapou, inaka, koromiko and *Hebe rakaiensis*.

<u>Tussock grassland</u>: There is a moderate cover of narrow-leaved snow tussock grassland along the track adjacent to the block's eastern boundary. Other common species include exotic grasses (mainly sweet vernal and browntop), while less common are catsear, *Pentachondra pumila* (locally common), sky lily (locally common), blue tussock, *Leucopogon fraseri*, *Raoulia subsericea*, *Celmisia gracilenta*, *Ranunculus multiscapus*, harebell, snowberry, *Lagenifera cuneata*, *Pimelea oreophila*, *Helichrysum filicaule* and other species. Comb sedge is found in moist areas.

On shady faces in a tributary of Bullock Creek the narrow-leaved snow tussock grassland retains a dense cover, with *Rhacomitrium lanuginosum*, *Pentachondra pumila*, *Leucopogon fraseri*, *Raoulia subsericea* and *Celmisia gracilenta* present. On damp, shady faces the narrow-leaved snow tussock cover increases, with *Schoenus pauciflorus*, comb sedge, Maori onion and other species. Along a rocky gully area prickly shield fern, *Dolichoglottis lyallii*, *Coprosma ciliata*, inaka, mountain flax and *Astelia nervosa* were present within the tussock grassland.

<u>Rock faces</u>: Rock outcrops/faces and associated rubblefields form a fire refuge site and retain many characteristic or distinctive plant species. The flora includes inaka, *Melicytus alpinus*,

Gaultheria crassa, false beech (G. antipoda), mountain flax, Astelia nervosa, Celmisia lyallii, Celmisia semicordata var. aurigans, Anisotome cauticola, Brachyglottis haastii, Geum cockaynei, Luzula banksiana, Anaphalioides bellidioides, Stellaria parviflora, Ranunculus royi and Urtica aspera.

<u>Wetlands</u>: There are seepages present along gullies. These are dominated by bryophytes with *Carex sinclairii, Schoenus pauciflorus*, Maori onion, *Uncinia divaricata, Ranunculus cheesemanii, Pratia angulata, Montia fontana, Hydrocotyla microphylla, Schizeilema cockaynei*, along with the exotic species white clover, sweet vernal, Yorkshire fog and smooth meadow grass.

# 2.5.7 Significance of Vegetation

Significant features of the vegetation are as follows and the combined extent of these is described on plan 4.2.3.

1) Extensive narrow-leaved snow tussock grasslands; most of the lease above c. 900 m retains moderate to good condition narrow-leaved snow tussock grasslands. These are dominated by healthy, tall narrow-leaved snow tussock and retain a rich assemblage of associated native inter-tussock species and generally have only a modest component of exotic species.

2) Northwestern, broad summit plateau area; this area contains an extensive wetland mosaic and healthy, tall snow tussock. The wetlands include upland bogs, fens and seepage systems (Johnson & Gerbeaux, 2004). The area contains vegetation which is highly representative of the ED.

3) Upper montane mixed shrublands; this is a fire refuge area on a steep and rocky gorge area. The vegetation includes *Dracophyllum-Hebe-Ozothamnus-Coprosma* shrubland. This is the best example of mixed montane vegetation on the lease and within the eastern portion of the ED. Shrublands like these would once have been extensive in the ED.

4) Montane forest/tall shrubland; this vegetation is highly representative of the original woody vegetation of the area. Particular features are:

- diverse "grey scrub" shrublands containing *Olearia fimbriata*.
- beech forest at its (currently known) upper limit along the Pomahaka River.
- gorge vegetation

5) Meandering stream/valley floor; the upper southern tributary of Bullock Creek area has a riverine/wetland complex extending downstream from the lease boundary (c. 950-960 m). This stream complex is distinct from other parts of the Bullock Creek catchment and such systems are uncommon in the ED.

6) Wilsons swamp; red tussock /fen/seepage/snow tussock grassland complex. This is the largest remnant of red tussock grassland on the lease.

7) Flora; a flora of 286 taxa (including 246 native species) were recorded during the inspection (refer to Appendix 1 for the full species list). The flora is considered rich for a moderately sized lease with a limited altitudinal range and paucity of alpine communities and

is highly representative of montane and sub-alpine bioclimatic zones of the ED. The following five threatened and uncommon species (de Lange et al, 2004) were also recorded.

- Olearia fimbriata "serious decline"
- Anemone tenuicaulis "sparse"
- Carex berggrenii "sparse"
- Urtica aspera "sparse"
- Acaena tesca "range restricted"

#### 2.5.8 Problem Plants

Of the 38 exotic species recorded on the lease, only the seven discussed below are considered to be of potential conservation concern. Of these seven species; contorta pine (*Pinus contorta*) and broom (*Cytisus scoparius*)) are considered serious weeds of concern. At present levels they do not represent a major management issue. Overall the lack of weed species is a valuable feature of the lease.

- Contorta pine (*Pinus contorta*): A single seedling was observed and removed.
- Broom (*Cytisus scoparius*): A few plants were recorded along tracks in the east of the lease. A larger infestation is found along the Pomahaka River, most of which is on Gem Lake pastoral lease (on opposite side of the valley) or on the marginal strip.
- Gooseberry (*Ribes uva-crispa*): A few plants were observed in the lower most section of Bullock Creek.
- Hawkweeds: Three species of hawkweeds are found on the lease. Mouse-ear hawkweed (*Hieracium pilosella*) is widespread but not common and does not significantly compete with or exclude native vegetation. Tussock hawkweed (*H. lepidulum*) and king devil (*Hieracium praealtum*) are currently uncommon.
- Ragwort (Senecio jacobaea): A few plants were recorded.

# 2.6 Fauna

# 2.6.1 Invertebrate Fauna

#### Introduction

The landforms and biota of the lease form a highly representative part of the ED. The invertebrates of the Mt Benger area and associated intermountain areas have been reported by Dickinson (1988) and Dickinson et al. (1998). Moth fauna of small leaved *Olearia* shrubland from the region and broadly in New Zealand is described by Patrick (2000). The invertebrates fauna has also been described in tenure review reports for Glenaray, Gem Lake and Whitecoomb Pastoral Leases (E. Edwards unpublished).

#### Methods

During the inspection the weather was mild and partly cloudy with gentle winds. Evenings were partly cloudy and with a near full moon. Invertebrates were hand collected or collected at night by ultraviolet light (located G43 147 094, 970 m). Sites throughout the lease were accessed by driving ridgelines and walking slopes, wetlands and streams.

#### Invertebrate fauna description

On the lease an inventory of 100 species of invertebrates was recorded including 78 moths that characterise a range of habitat and host plant associations (refer to Appendix 2 for a full species list).

The fauna of upland grasslands and extensive wetland sequences is typical of the extensive moderately dissected plateaux/ancient uplifted erosion surface of the Umbrella, Old Man and Garvie Mountains. It includes insects endemic to those uplands as well as invertebrates endemic to Central Otago and/or the eastern lower South Island. Woody vegetation has been removed from much of the lease. However, important remnant wooded faunal habitats remain. The extensive representation of low to moderate altitude schist tors and bluffs is also a feature habitat for Otago invertebrates. While the ecosystems of the lease are clearly Central Otago-northern Southland in their composition, the geography, persistence of some forest and extensive wetland coverage suggest an upland climate, wetter with perhaps more frequent cloud cover than found in intermountain basins and their flanks of Central Otago. The significant habitat associations within the following five farm blocks are elaborated on below.

- Pommy (Pomahaka R.) faces block
- Snowy block
- Wilson's Swamp block
- Ewe block
- Station Corner block

# Pommy (Pomahaka R.) Faces block

Between this and the Station Corner block is ~8 kilometres of riparian corridor along the true left margin of the Pomahaka River (a major fourth order river). Vegetation, wetlands and side streams contribute to and influence aquatic fauna and ecosystem character of the river. In the integration and exchange of biota at different scales, riverine/stream insects have adult stages that migrate and use adjacent vegetation. Common in streams here are giant darning needle dragonflies *Uropetala chiltoni*. Dragonfly nymphs inhabit nearby flushes and stream margins. Also frequently recorded in small, well vegetated streams and elsewhere in the region are scorpionflies *Nannochorista philpotti*, toebiter *Archicaulioides diversus* and stonefly *Zealandobius uniramous*.

Tors in this and all the other blocks are significant habitats of insects. Tors feature five known moths with larvae feeding in crusting mosses, algae and lichens. The shelter and basking sites provided are also significant for grasshoppers, day active moths and flies. Cryptic green and grey moth *Dichromodes* n. sp. has larvae on lichens, and moths *Helastia plumbea* and *Eudonia critica* have larvae on rock mosses. The moth *Scoparia siderapsis*, which has silver with orange hind wings, is common basking around upland tor habitat. At lower altitude on the faces and in the Station Corner block, moths *Scoparia torodes* and *Phaeosaces apocrypta* inhabit tors and rocky areas. Recorded under stones in the region is the notable locally endemic black cockroach *Cellatoblatta* n.sp.

Solifluction and landslip on the lease are best represented on parts of the Pomahaka River faces and are common features in this region. The rippled landform with remnant shrub and native grassland elements and presence of many flushes and some bared areas and rock particles add physical diversity. This also provides faunal reservoirs on the lower slopes which in many parts are dominated by exotic grasses and short tussock. Flushes particularly,

while modified by exotic vegetation, continue to support a typical indigenous invertebrate fauna.

#### Snowy block

The upland habitat mosaic is highly representative of the ED. The abundant flushes here are habitats of note for the region. Several tor fields and some cushion bog among extensive wet grassland are important habitats. There is very good integration of ecosystems within the block and across boundaries to neighbouring areas within and beyond the lease. Tor fauna and inhabitants of fen and flush, with the exception of the following two species, are discussed elsewhere.

Two insects of limited distribution were not recorded here but are likely present. Firstly, flushes here are ideal habitat for larvae of the bright orange and yellow moth *Asaphodes cinnabari* which has its nearest record at Mt Benger (B.H. Patrick pers comm.). Its distribution is from western Southland across northern Southland ranges and the Lammermor/Rock and Pillar Range. Secondly, there is extensive suitable habitat for the fen stonefly *Vesicaperla celmisia*, known from Bains Block nearby and is endemic to the uplands of Garvie, Old Man and Umbrella Ranges.

Extensive grasslands include a rich fauna. For example, feeding on *Chionochloa rigida* are large weevil *Anagotis lewisi*, moth *Aponotoreas insignis*, moth *Ichneutica ceranias* and two tussock butterflies *Argyrophenga antipodum* and *A. janitae*. The fauna is typical of Otago grasslands and retains much natural character above 900 m and on shaded slopes.

Cushion bog invertebrates include species of open areas such as grasshoppers, several species of spider and small predatory black carabid beetles. Flying low over cushions and wet moss field are at least five species of day-active moths being *Glaucocharis helioctypa*, *Orocrambus helotes, Orocrambus scoparioides, Eudonia xysmatias* and *Scoparia pascoella*. The last two are not commonly encountered. *E. xysmatias* is endemic to Old Man Range and the Lammermor/Rock and Pillar Range, and *S. pascoella* is at its eastern limit on the lease. Its range extends across to the Eyre Mountains.

#### Wilsons Swamp block

The feature of this block is the swamp and red tussock fen on the ridgeline saddle point south of the yards. The sequences of gully flushes and seepages and broad slopes of red tussock, moss and sedgeland are rich in invertebrates of wetlands. Fourteen wetland moth species are recorded here. Some moths noted are endemic to northern Southland –southeast Otago Mountains (see Appendix 2). Many more wetland species are highly likely to be present including large upland porina *Aoraia* spp (*Aoraia rufivena* [with flightless females] are recorded nearby at Mt Benger). Two other species not recorded, but also probably present are moths *Aoraia flavida* and *A. aspina*. Their type locality is nearby at Gem Lake pastoral lease. Mosses, sedges (*Carex* species) and *Celmisia gracilenta* 'rhizomatous' are among many plants hosting a range of specialist moth caterpillars here.

Although the stream(s) that drains this site and many other wetland sequences on the lease were not surveyed, these may also contain species rich assemblages of upland stoneflies, flies and caddis many of which are characteristic of seepages and tussock streams of southeast South Island.

#### Ewe block

A good diversity of landforms and habitats are represented in this block. Faunal habitats of note include many small streams, gully flushes and seepages as well as damp grassland. A feature of the block is an in-filled valley landform that drains the adjacent Mt Benger Scenic Reserve. The stream here meanders across a broad swampy floodplain pock-marked with peaty sedgeland, rushland and mixed grassland. In its upland setting at around 960 m, this is similar to larger scale rich mosaic systems present in Campbell's Creek, Fraser Basin and in the Waikaia Catchment. This stream is at slightly lower altitude but a highly representative faunal habitat for the Waikaia Ecological Region. Although not surveyed, moss bog, sedge/rush and stream insect assemblages are highly likely to be well represented. Many such valley floor wetlands elsewhere at lower altitudes in the ED have been converted for farming.

In contrast to this site, the stream enters a gorge immediately downstream and steeplands, particularly south faces, harbour the most complex upland shrublands and grasslands on the lease. These, along with rock crusting vegetation, are faunal habitats of high natural character and complexity in contrast with more homogeneous sequences elsewhere on the lease. This is habitat suitable for the giant landsnail *Powelliphanta s. spedeni* "serious decline" which is known from the region nearby at both Timber Creek and Gem Lake pastoral lease, but was not found during the inspection. In shrubland here is the red and grey moth *Harmaloga sanguinea* with larvae on *Hebe odora* and moth *Aponotoreas incompta* with larvae on *Dracophyllum* spp. Matagouri is host to moth *Graphania phricias* and *Cassinia* (*Ozothamnus*) is host to moth *Asterivora fasciata* (recorded nearby at Mt Benger). The moth *Tingena siderodeta* has larvae on shrubland litter, while pill millipede *Prociliosoma leiosomum* inhabits dense tussock and shrub. The widespread loss and fragmentation of upland shrubland habitats elsewhere on both the lease and its surrounds increases the significance of this block.

Elsewhere in the block, faunal values persist in fragmented native vegetation at lower altitudes but above 850 m, are similar in character to habitats of tor, wetland, stream and grassland in other blocks.

#### Station Corner block

This block includes the lowest altitude lands of the lease and includes moderately steep slopes and many rocky sites and is naturally the most wooded block. The upper part of the vegetation sequences have tor, wetland and grassland habitat similar in character to the other blocks.

Remnant beech forest and montane shrubland, both communities much diminished in Central Otago, are present in the riverine corridors and bluffs of the Pomahaka River. Only a few invertebrates were noted in Lower Bullock Creek (see Appendix 2). However, reasonable inventories of invertebrates have been made from similar vegetation nearby but off the lease. Important elements that are therefore likely to be present include *Pianoa isolata* Piano flat spider "range restricted" endemic to forest remnants of the Waikaia Ecological Region and also rare moths whose larvae eat *Olearia fimbriata* and other local and fragmented small leaved *Olearia* spp (see Table 2). These include the "nationally endangered" moths *Protosynaema* sp. 'olearia' (Pomahaka Catchment) and *Graphania* cf. *tetrachroa* (known from Waikaia Catchment). Other rare moths likely to be present include *Pyrgotis* sp. 'olearia' "nationally vulnerable", *Meterana exquisita* and *M. grandiosa* (both "nationally declining").

# 2.6.2 Significance of Invertebrate Fauna

Significant habitats of invertebrate fauna occur across uplands, in valley floors in the southern part of the lease and some are associated with the Pomahaka River and lower Bullock Creek. The extent of these is shown on plan 4.2.3.

#### Species of conservation interest

No species listed as threatened on the DOC's most recent classification system were recorded on the lease.

However, the following species recorded on the lease are notable as either local endemics present on adjacent ranges or as species at the edge of their range:

- An alpine black cockroach *Celatoblatta* n.sp. (Peter Johns) is endemic to Umbrella and Garvie Mountains.
- Moth *Aponotoreas incompta*, an upland species of Fiordland, present as an outlier in the Old Man Range region and at its eastern limit on the lease.
- Moth *Orocrambus geminaus* is a wet tussock grassland species endemic to northern Southland Mountains and the Lammermor/Rock and Pillar Range.
- Moth *Eudonia xysmatias* is an open wetland species. Its type locality is Old Man Range and the moth is endemic to Garvie, Old Man Ranges, Umbrella Mountains and the Lammermor/Rock and Pillar Range.
- Moth *Orocrambus pascoella* is local in cushion bogs. It is endemic to Eyre Mountains and mountains across northern Southland to Mt. Benger. The eastern limit is the lease.

In addition, there are seven threatened species and one local endemic (stonefly) which are highly likely to be present the lease (see Table 2). These species have either been recorded close by in habitats similar to those on the lease, or are *Olearia* specialist moths which are flighted and would be expected to use the deep riverine corridor of the Pomahaka River and lower Bullock Creek to access *Olearia* shrublands present on the lease.

Table 2: List of threatened or significant local invertebrates likely to be present on the	he
lease.	

Threat of extinction status from species listed in Hitchmough (2004).				
Taxon	Habitat	Elevation	Comment	
		( <b>m</b> )		
Piano Flat	Forest	<1000	"Range restricted". Piano Flat spider,	
spider			inhabits forest patches from valley	
Pianoa			floor to bushline. Type locality Piano	
isolata			Flat. Endemic to forest of Waikaia	
			Ecological Region. Recorded nearby	
			in the Pomahaka catchment at forest	
			north of McEwan's Bush.	
Giant	Shrub &	>800	"Serious decline". Endemic to	
landsnail	tussock		mountains spanning from southern	
Powelliphanta			Eyre Mountains south-eastwards to	
spedeni			Mt Benger. Likely present, recorded	
spedeni			nearby in Timber Creek catchment	
			and at Gem Lake.	

Moth	Olearia	<900	"Nationally endangered". Larvae eat
<i>Graphania</i> cf.	shrubland		O. fimbriata, O. bullata and other
tetrachroa			small leaved Olearia spp. Host plants
			present and moth recorded nearby at
			Waikaia River.
Moth	Olearia	<900	"Gradual decline". Larvae eat small
Meterana	shrubland		leaved Olearia spp. Host plants
exquisita			present and moth recorded nearby at
•			Pomahaka River.
Moth	Olearia	<900	"Gradual decline". Larvae eat small
Meterana	shrubland		leaved Olearia spp. Host plants
grandiosa			present and moth recorded nearby at
-			Pomahaka River.
Moth	Olearia	<900	"Nationally endangered". Larvae eat
Protosynaema	shrubland		Olearia fimbriata, O. odorata & O.
sp. 'olearia'			hectori. Several host plants present
			and moth recorded nearby at
			Pomahaka River.
Moth	Olearia	<900	Nationally vulnerable. Larvae eat
Pyrgotis sp.	shrubland		Olearia fimbriata, O. odorata. Host
'olearia'			plants present and moth recorded
			nearby at Pomahaka River.
Fen stonefly	spur top	>800	Not threatened. Wet fen stonefly. A
Vesicaperla	fen		flightless species endemic to summit
celmisia			grass and herb fen wetlands of Old
			Man, Garvie and Umbrella
			Mountains. Extensive habitat present
			and stonefly recorded nearby in Bain's
			Block.

# 2.6.3 Herpetofauna

"Site locations of rare and endangered herpetofauna are recorded in the original report. Herpetofauna of this nature is at risk of illegal activities including damage and removal through unlawful interference and disturbance. Accordingly, information regarding the locations of any such herpetofauna has been deleted from this version of the report. The Department of Conservation has put in place mechanisms to ensure that such information can be released for genuine scientific and research purposes. Please contact the Department of Conservation directly to determine whether the information can be released."

No previous survey of the lease has been reported, although Whitaker et al. (2002) refers to *Hoplodactylus maculatus s.l.* and *Oligosoma nigriplantare maccanni* sensu Hardy 1977 (McCanns skink) are mapped between Mt Benger and the Pomahaka River. Surveys have been carried out to the west and south, across the Pomahaka River from Moa Hills, on Gem

Lakes and Whitecomb pastoral leases and the only lizard found was the gecko *H*. aff. *maculatus* "Otago/Southland large".

#### Method

Rock tors and outcrops were searched for lizards from the road through Wilsons Swamp and Ewe blocks, in tors within Snowy and the Pommy Faces block and upstream of the musterer's huts along Bullock Creek

McCanns skinks were found at two locations on Bullock Creek in rock outcrops near the stream.

Geckos were found on isolated rock tors, and are most likely to be *H*. aff. *maculatus* "Otago/Southland large" (Hitchmough 1997).

Overall there was little suitable habitat for lizards as there were few rock outcrops and tors were widely spaced. Tors in the east and north were generally not fractured horizontally and provide few refuges for lizards. Those in the southwestern corner above the Pomahaka River had more fractures suitable as lizard refuges. However, the uniform lack of woody vegetation for cover and foraging would make survival difficult for most lizard species, apart from shrublands near the Pomahaka River.

# 2.6.4 Significance of Herpetofauna

*H.* aff. *maculatus* "Otago/Southland large" has a threat status of "gradual decline" with the qualifier 'data poor'. This gecko, found throughout rocky alpine areas of inland Southland and Otago, is locally abundant and occupies a wide range of habitats (Whitaker et al., 2002). The southwest part of the lease where this gecko was found could contribute to habitat linkages for populations of the species between northern Southland and Central Otago.

McCanns skinks are not considered to be threatened and are widespread and common in Otago (Hitchmough 2002, Whitaker et al., 2002).

# 2.6.5 Avifauna

Birds recorded on the lease during the inspection were the black backed gull (*Larus dominicaunus*), Australasian harrier (*Circus approximans*), skylark (*Alauda arvensis*), pipit (*Anthus novaeseelandia*), paradise shelduck (*Tadorna variegata*), New Zealand (Eastern) falcon (*Falco novaeseelandia*), tomtit (*Petroica macrocephala*), South Island rifleman (*Acanthisitta chloris chloris*) [both in the isolated shrubland near the Pomahaka River], South Island pied oystercatcher (*Haematopus fincshi*), little shag (*Phalacrocorax melanoleucos*) and the swallow (*Hirundo neoxena*).

# 2.6.6 Significance of Avifauna

Of the bird species recorded, only falcon has a current threat status, being "gradual decline". Falcons were seen at two locations in Bullock Creek and significantly one of these locations was an occupied nest.

Due to widespread range contraction and loss of habitat in the region the records for rifleman and tomtit are also notable. South Island rifleman has a tentative threat status of "gradual decline".

# 2.6.7 Aquatic Fauna

#### Methods

All sampling was undertaken during fine and sunny weather. Waterways on the lease showed evidence of recent high flows that followed thunderstorms in the region.

Streams within the lease's likely to have aquatic life were identified from 1:50,000 topographical maps. Due to the lease's position in relation to the waterways and the need to obtain a clear understanding of the fish resources, sampling was also carried out at five locations within the same catchment but off the lease. Refer to Appendix 3 for all the survey results. The terrain is often steep, so stream access was often gained by walking to the fishing sites. The position of each sampling site was determined with a Garmin GPS. General observations of the terrain, riparian vegetation, stream substrate, stream widths and depths, and fish habitat type were made and recorded for each site in the format used for the NZ Freshwater Fisheries data forms. Water temperature was measured to the nearest 0.5 degree Celsius.

Fish and aquatic invertebrates were collected at each site by electric fishing along 20-50 m of stream (measured with surveyor's tape). At each site, a "Kainga" backpack electric fishing machine and stop-net were used by two people to sample the aquatic fauna by repeated, continuous "sub-sample" sweeps approximately 5 m in length. Where the stream was wider than 1.5 m, each margin of the stream was fished separately. The machine voltage and the start and finish times of sampling were recorded.

Captured fish were held in a bucket filled with stream water. Species were identified and measured (either fork or total length, as appropriate) to the nearest 1mm. All fish were returned unharmed to the water at the sampling location following data recording.

Aquatic insects found on the stop-net during fishing were identified after each sub-sample sweep, and their abundance visually estimated as "low, moderate, or abundant".

#### **Results**

Four major gullies on the lease are highly likely to contain permanent water. All were tributaries of Bullock Creek. Streamflow in the gullies at the time of sampling were visually assessed as being slightly higher than normal (slightly higher than bank-full) to normal (bank-full).

Seven sites were sampled on the lease in order to gain an understanding of the fish resources (Appendix 3).

Only brown trout (*Salmo trutta*) was found at the locations sampled on and off the lease while no fish were caught at a number of sites.

Aquatic insects were present at all sampling locations and were most abundant at Bullock Creek tributary sites 8 and 11, and most diverse at Bullock Creek tributary site 12. Insect

abundance and diversity were poorest at the Bullock Creek site1 and Bullock Creek tributary site 2.

Instream aquatic plants were observed at all of the sites. Species noted included green filamentous algae, brown tufted algae, *Nostoc* and substantial in-stream moss at sites 3 (Bullock Creek) and 12 (Bullock Creek tributary).

# 2.6.8 Significance of Aquatic Fauna

Most waterways are derived from mossy swamps on the upper catchment flatter ridge tops, several of which are showing evidence of cattle damage (i.e. pugging). Riparian margins were generally in good condition, with full tussock banks.

Based on the aquatic insects found during the survey the water quality in all streams on the lease is of high quality. Sandy-cased caddis were seen walking around on the stream substrate at site 8; this behaviour suggests a lack of predators in the stream.

Although Bullock Creek sites 2 (above culvert barrier), 6, 7, 8 and 11 had habitats which seemed suitable for galaxiids, and sometimes trout, no fish were present. It is possible that significant barriers to fish movement occur in the lower reaches of these streams, although no obvious barriers were seen from the access tracks or while on foot.

The lack of fish indicates that these 5 sites maybe have potential for relocating endangered native freshwater fish species.

# 2.6.9 Problem Animals

Pigs and red deer are present on the lease and at their present low numbers are having little adverse impact on indigenous flora and fauna. Hares, feral cats, ferrets, stoats, hedgehogs, and rats are also probably present throughout the lease.

# 2.7 Historic

# 2.7.1 Introduction

The lease is an example of one of a handful of runs where the history of the run itself is patchy. Beattie's (1979) thorough history of the Otago and Southland Runs notes that lessee records for runs 479 and 480 (which make up the current run 751 Moa Hills pastoral lease) are missing. A search for the *Runs Register* for the lease at Archives New Zealand found that this register, which would have contained a listing of the various lessees of the run since 1884, is missing. What can be deduced from other sources is that the land encompassing the present lease, back in 1867, 1871 and 1875 (Thomson and Spreat 1867, Beattie 1979, Sinclair 2003), lay across part of the original and extensive run 368 (known as the "Umbrella Range" run) and possibly 369 (the "Obelisk" run). Webster (1948:16) notes that part of run 368 seemed to have been included at some time in the extensive Moa Flat (run 215) pastoral lease which lay to the south of the current lease. At some date between 1875 and 1882, runs 368 and 369 had areas subdivided off into smaller runs with the remaining area of run 368 possibly covering the area of today's run 751.

During the public auction of leases in 1898, run 368 was still in existence, but in the 1900 auctions, run 368 was subdivided into runs 479 and 480 for sale. These runs were sold as one lease-hold, and were still identified as runs 479 and 480 until at least 1937, when the lease was held by John Donaldson. Later deeds identify the run as 751.

There are two 19<sup>th</sup> century historic features of note for the lease. A cadastral map from 1882 shows the existence of the "Benger Commonage" which lay directly across the centre of the lease. This Commonage was created so that gold-miners in the Pomahaka could freely graze their stock; although it was "unsatisfactory to them" (Hamel 1988:2). An exact date for the creation of the commonage has not been determined as yet, but it was probably created during the 1870s when gold-miners were travelling between Roxburgh and the Pomahaka gold-fields. In addition, Beattie (1979:318) records that the southern boundary of the lease follows the fenceline known as 'Kitchen's Boundary' built by James Steel in 1874 for the manager of the Moa Flat lease, John Kitchen. No evidence of this fence was recorded during the tenure review inspection.

Central Otago's well known 19<sup>th</sup> century gold-mining history is documented in a variety of resources such as 19<sup>th</sup> century reports to the Government of the day from local Warden's who reported on gold-mining in their area of administration and locally written histories. However, such sources often focus on the larger gold-mining projects, such as sluicing, dredging and quartz mining, the building of water races, reservoirs and dams, while the records from individuals or smaller groups of miners are often patchy, even though these miners were numbered in the thousands. When considering the gold-mining history of the lease therefore, little historic detail exists on the 19<sup>th</sup> century gold-mining in and around it other than a few reports on gold-mining from the Pomahaka in the Clyde Warden's Reports (the Warden of Clyde reported on gold-mining from the Pomahaka over to Roxburgh [e.g. AJHR 1876; 1880 H-26, 28; 1883 H-5, 39]) and records of the men who supplied provisions to the miners in the Pomahaka and who may have crossed through the lease, such as William Gunn who perished on a pack track in the Old Man Range during a snowstorm in 1897.

#### Previous Archaeological Surveys

A previous archaeological survey along the Pomahaka River identified archaeological sites on the western boundary of the lease. This survey was undertaken by Hamel (1989) who, as part of another historic resources project on Gem Lake pastoral lease, recorded 11 gold-mining sites on the true left of the Pomahaka River. These archaeological sites are described below and their location is described on plan 4.2.4.

Site 1 was an area of sluicings measuring 200 m x 250 m which were resting on the shoulder of a spur above the river. Also present at this location was a miner's hut (4 m x 4 m in dimension) with the ruined walls measuring 0.3 to 0.4 m high. At various locations on the true left of the river from site 1 through to site 5, Hamel (1989) noted two areas of turned over mined ground and small sluicing hollows (sites 2, 4 and 5) and winged dams (site 3). Site 6 was a winged dam in the middle of the river made from a double row of stones rather than the usual single row, while site 7 was described as a "mysterious length of revetment in a slip face" (Hamel 1989:9). Site 8 consisted of tailings in a sluiced out area by the river, with site 9 having tailings, sluiced hollows and a "massively riveted tail race" (Hamel 1989:10). Site 10 contained a large area of sluicings and tailings as well as a large house measuring 9 m x 3 m with possibly the remains of a chimney on its northeastern side. The remains of the walls of the hut were still *c*. 1 m high. Site 11 was a short section of revetment. The remains of two

huts were recorded at site **12** amongst tailings with one measuring 2 m x 4 m, and the other marked only by the remains of a chimney and some aligned stones. Site **13** on Deer Flat consisted of the remains of pipes and nozzles packed in during the 1920s lying amongst possible earlier tailings. Hamel (1989:10) notes that local man Jim Williamson helped carry in this mining gear in the 1920s. Williamson recalled that the owner of the equipment tried twice to set up the hydraulic sluicing gear to mine the flat but was washed out by floods each time, eventually abandoning the equipment. From site **13** onwards, Hamel (1989:10) observes that the Pomahaka River runs into a steep gorge where the lack of river flats or terraces for mining meant that only one site, a short section of revetment, was recorded between Deer Flat and McEwen's Bush.

#### Methods

As only one archaeological survey has been previously undertaken on the lease, making judgments on the historic importance of lease required more data on the archaeological evidence present to be collected.

To obtain these additional data, locations likely to contain archaeological evidence of past gold-mining or pastoral activity were identified by using historic records. Areas were then chosen which could be surveyed within the timeframe allocated for the inspection. Finally the eastern boundary and central section of the lease was selected as the focus of the inspection. The main limitation was the time available to inventory the lease in detail.

# 2.7.2 Sites

The archaeological survey identified eight archaeological/historic sites on the lease. No Maori archaeological sites were found during the survey.

Site **14** was a water race which ran along the 940 m contour on the south side of a gully above a tributary of Bullock Creek. This race moved from inside the lease, probably originating from the first creek met along the 940 m contour to the west of where the water race was recorded, eastward to the eastern boundary of the lease. From here it would have possibly continued south along the hillside above Roxburgh-Ettrick Road. This race measured 0.8 m wide, 0.15 m deep and was dry. Without following this race it is difficult to determine whether it was originally used for gold-mining or irrigation. Site **15** was a find-spot of a Baby-Brownie camera which still contained film. This camera was manufactured in London by Kodak between 1948 and 1952 and was found on a small outcrop in a steep gully in Bullock Creek. The camera was probably lost while this comfortable outcrop was being used as a rest stop along the gorge.

Site **16** is the musterers' huts, outside latrine and dog kennels located at GR G43 152 116. These structures appear to be 1940s or 1950s in origin and consist of what may have been two old Ministry of Works huts, perhaps used during the building of the Roxburgh Dam and a railway carriage. These structures have been significantly modified since they were moved or rebuilt on this site with the railway carriage being clad in corrugated iron. The huts are still in use and are in excellent condition. Although these structures are mid-to late 20<sup>th</sup> century in origin, they represent a piece of pastoral history on the lease. It is quite probable this same

location was used in the late 19<sup>th</sup> century as a building site, especially when considering its location in the middle of the lease, the earlier Benger Commonage and established track.

A possible prospector's trench was observed at site **17** on a small terrace along Bullock Creek. The workings must have been on a small scale as other than the trench, no other obvious evidence of gold-mining was present (an area of erosion on the hillside on opposite side of the creek may be natural in origin).

Site 18 consisted of three huts forming an occupation complex on a wide terrace on the true left of Bullock Creek. The largest hut (Hut 1) was made of schist, measured c. 9 m x 5 m and was divided into two rooms with the first room by the doorway 3.8 m long and wide, and the back room 3.8 m wide and 2.6 m long. This substantial structure had much of the stone remaining with the back wall 1.2 m high and the front wall 0.8 m high. Lying inside the hut was a 'billy' made from an old tin drum and outside the hut a hand-stamper made from fixing an iron handle onto an iron stamper possibly originating from a gold battery. This item is unusual and may have been used to test rock for gold bearing ore, indicating that gold bearing alluvium was not the only gold source being prospected for along the creek. Such items are rarely recorded in the field. All that remained of Hut 2 was its schist chimney and the outline of the original hut marked by a few stones. This hut would have measured c. 4 m x 3 m and was located next to a small stream flowing into Bullock Creek. Hut 3 was barely noticeable on the terrace, but appeared to be a sod-walled structure built on a mound near the creek. The remains implied a structure 3.3 m x 2.6 m in area with a possible drain dug around its eastern side leading back to the creek. All these huts are of an early style in the gold-mining history of Otago probably dating from the 1870s onwards when gold is recorded as being sought in the Pomahaka area. Unusually, no obvious gold-mining appeared to be associated with this hut complex. No obvious tailings or water races on either side of the creek could be seen, nor prospector's pits nearby or up the stream which runs past Hut 2.

Sites **19** and **20** were prospector's pits found on small terraces on the true left and true right of Bullock Creek respectively. The presence of these pits confirms that gold was being sought at these locations along the creek.

The stone hut at site **21** is in superb condition and is still in use today. This roomy schist structure measures internally 3.6 m x 2.95 m and contains a sprung bed-base, chest and table. Also found inside were a pick and shovel and an old 'billy'. A visitor's card in the hut shows that walkers still occasionally use the hut for over-night stays. On the hut's exterior the substantial chimney is in good condition and some of the original white washed plastering can be seen. Near the hut are what appear to be prospector's pits where two have also been used as bottle dumps. Found in one pit was a section of riveted iron pipe. The lessee believes that the hut was used in the mid to late  $20^{th}$  century by a local man who undertook some goldmining nearby using a small suction device in the creek. This hut would most probably have been a gold-miners residence, possibly dating from as early as the 1870s, and later used by musterer's in the early  $20^{th}$  century bullock track that provided communication for miners and pastoralists between the Pomahaka River, Benger Commonage and Roxburgh.

Sites 22 and 23 were recorded during the inspection by two DOC ecologists surveying along the Pomahaka. Site 22 was an area of sluiced hollows on a terrace near the river on the true left side. Site 23 appeared to be the remains of a stone walled hut built on a small terrace on

the true left of a small stream feeding into the true left of the Pomahaka. This  $19^{th}$  century hut would have possibly been *c*. 3m x 3m in size with the original walls possibly 0.6 m in height.

# 2.7.3 Significance of the Historic Sites

Sites 1-13, 22 and 24 and are well preserved examples of small scale gold-mining in an isolated location where a general history is associated with them

The gold-mining hut complex of site **18** is significant due its apparent early age, isolated nature and in particular, the size and good preservation of the main hut. Such large huts are uncommon locally with Hamel (1988, 1989a, 1989b, 1994) having recorded three from her surveys of the ED, Southern Old Man Range, Bain's Block, the Pomahaka, the Upper Waikaia and Earnscleugh. In addition, the hand stamper is unusual and indicates that gold prospecting was not limited to alluvial gold, but also possibly gold bearing rock.

The hut site **21** is highly significant as it is in superb preservation. The excellent preservation of such huts from the mid to late  $19^{\text{th}}$  century is not common and this example can be compared in intactness to the Green Gate Creek Hut (site E41/233) on the Coronet Peak pastoral lease. It is clear the various lessee's of Moa Hills have maintained this structure over the years.

#### 2.8 Public Recreation

### 2.8.1 Physical Characteristics

The lease comprises the Bullock Creek and part of the Pomahaka River catchments and is characterised by gentle rolling tall tussock lands of the southern Old Man Range.

There are important opportunities for public recreation on the lease due to:

- The large and seemingly remote nature of the lease.
- Great views of the Clutha and Pomahaka Valleys.
- Linkages to a network of formed tracks in the Roxburgh area which provide outstanding mountain biking, horse riding and walking opportunities.
- Open expansive tussock land.
- Access to the adjoining Mt Benger Scenic Reserve

The lease was not, however, classified in the Federated Mountain Clubs outdoor recreation plan for Central Otago's Block Mountains (Mason, 1988).

In 1992 DOC compiled a Recreation Opportunity Spectrum (Harper, 1992) for the Otago Conservancy in which all areas were classified and mapped according to setting, activity and recreational experience characteristics. The lease is zoned *Backcountry 4WD Drive In* which "is characterised by a feeling of relative remoteness from populated areas". "The highly natural setting is a valued part of the experience and may be associated with motivations of 'escape from town', education and nature appreciation. Four wheel drive vehicles are desirable to give access to high country tussock grasslands and block mountains and more rugged remote areas" (Harper, 1992). The limited network of tracks on the lease provides limited opportunity for 4WD access.

### 2.8.2 Legal Access

Legal access to the lease is by two formed legal roads, being the Mt Benger Road and the Pomahaka Road. The Mt Benger Road enters the southern boundary at approximately GR 43 182 071, the Pomahaka Road enters the northern boundary at approximately GR 170 137 and connects with the lease boundary again at GR G43 134 143.

The lease's entire eastern boundary corresponds to a legal road. Several small portions of this legal road are aligned with a rough formation with the remainder being off it.

Two marginal strips provide practical legal access to the lease. The first, conservation unit G43002, runs along the true right bank of the Pomahaka River providing access to the lease's western boundary. The second, conservation unit G43001, runs along both banks of Bullock Creek and connects with the lease boundary at GR G43 163 137.

#### 2.8.3 Activities

Existing recreational use of the lease is limited to low level's of tramping, mountain biking, horse trekking and 4WD travel on formed tracks. The majority of this existing use occurs on the track running along the lease's eastern boundary.

Low numbers of pigs and deer occur throughout the lease and a corresponding low level of hunting occurs with the landowner's permission.

# 2.8.4 Significance of Recreation

The 4WD drive track that runs along the eastern boundary is significant as it provides an access route to the Mt Benger Scenic Reserve from the Mt Benger Road through to the Pomahaka Road.

The farm track which runs from the previously mentioned route provides good access to Bullock Creek.

The historic resources adjoining both the Pomahaka River and Bullock Creek have the potential to be an interesting recreational resource.

#### PART 3

OTHER RELEVANT MATTERS & PLANS

#### 3.1 Consultation

The lease was discussed at an NGO early warning meeting on 23<sup>rd</sup> September 2004 and the following points were made.

• Prof. Alan Mark

Envisage the lease's designations should match those on Gem Lake pastoral lease to the west and also commented that the lease contains a good cover of snow tussock.

- Federated Mountain Clubs (FMC)
  - The lease is largely unknown to them and they don't envisage it being a core part of the Kopuwai Conservation Park.
  - Commented that Jill Hamel has reported on the historic SIVs in this area and that the Pomahaka does contain historic relicts.
- Public Access New Zealand (PANZ)
  - A local group in Teviot have marked a legal road which leads to the eastern boundary of the lease and there is significant local interest in this walkway.
  - The lease has comparable SIVs to those on the higher Old Man Range, but has a more benign climate. It therefore offers a more accessible experience to those wishing to experience these SIVs.
- <u>Upper Clutha Forest &Bird (F&B)</u> The Mt Benger Road enables easy access to this area and the tussock landscape is intact.
- <u>Sue Mautrin (F&B)</u>

As the Pomahaka has a Water Conservation Order over it is questionable whether farming in this area is sustainable.

The lease was again discussed at an NGO report-back meeting held 12<sup>th</sup> April 2005 in Alexandra and the following additional points were made.

• Sue Mautrin (F&B)

There is a bio-diversity issue, as the Pomahaka River is not fenced and therefore cattle having access to this waterway. Consequently fencing of the Pomahaka's riparian margin should be considered as an outcome of the tenure review.

In addition to these comments, several NGOs submitted written reports. Southern Lakes Branch NZDA has the following generic concern about all tenure reviews, being *the lack of recognition given to hunting as a recreational activity. Access with firearms and dogs is still often being put in the to hard basket.* They would also like *more recognition given to Hunting as a recreational activity and provision made where it is appropriate for access with firearms and or dogs.* Refer to section 4.4.1 for a full copy of their report.

Central Otago Deerstalkers Club also has generic concern about all tenure reviews and wish that the department note their request for:

- a) good public four wheel drive access be a result of tenure reviews;
- b) permission to carry guns be met by DOC permit only; and
- c) securing access for hunting dogs be a result of tenure reviews.

A copy of their full report is attached in section 4.4.2.

FMC and the Upper Clutha F&B also supplied written reports (refer to sections 4.4.3. and 4.4.4 respectively). Their respective major recommendations are below:

<u>FMC</u>

- Most of the lease is classed LUC Class VII and therefore has severe limitations for pastoral use. Return of the entire lease to full Crown ownership would enable it to be managed for conservation and recreation purposes, added to the Mt Benger Scenic Reserve and possibly incorporated into the developing Kopuwai Conservation Park.
- Alternately designating the entire lease as a Sustainable Management covenant might be successful in protecting the SIVs, as long as sufficiently rigorous conditions were imposed. Both these options would protect the integrity of the landscape.
- There is considerable scope for increased recreational use of the area contained within the lease. The existing road formation on the eastern boundary should therefore be either formalised or a suitable easement created over the formation. A legal road would allow for foot, bike, horse and vehicle traffic, whilst an easement should allow for unrestricted access by the first three transport modes and motorised vehicle access should be regulated so to minimise the extent of damage.
- Historic features in the Pomahaka Valley that are within the lease and the stone hut beside Bullock Creek should be designated as respective Historic Reserves and public foot access to these areas secured via an easement.

#### Upper Clutha F&B

The following recommendations are taken from the two reports submitted by Upper Clutha Branch F&B.

- In view of the fact that Bain's Block, which is already part of Kopuwai, is to the north and the Mt Benger Scenic Reserve is to the south, consideration must be given to returning the entire lease to Crown control to complete the Kopuwai Conservation Area, as the Objectives and Priorities subscribed to in the CMS for Otago.
- In view of the fact that the land is mostly class VII c and e, they cannot see that even if regularly supplied with fertiliser the land will be able to support pastoral farming, mainly because it will not be economically viable. For this reason they see again that the land should be returned to full Crown ownership and control.
- Upper Clutha Branch F&B note however that alternatives like the continuation of a lease of some type over the area should be considered.
- Upper Clutha Branch F&B also commented that secure public access, including motorised vehicle access, should be secured along the track on the lease's eastern boundary. If this was realised, they recommended that due to the risk of fires in summer the present formation should be upgraded so to act as a fire break.
- Upper Clutha Branch F&B see that the recreational uses of the lease have not yet been realised and these uses are attractive given the proximity of the lease to SH8.

# 3.2 Regional Policy Statements & Plans

The entire lease is subject to the Otago Regional Plan: Water rule which requires resource consent for suction dredge mining.

# 3.3 District Plan

The lease is located within the Rural Resource Area of the Central Otago District Plan.

As at 22 February 2005, the proposed Central Otago District Plan (amended to incorporate Council decisions) requires resource consent (with certain exemptions) for the clearance of areas of indigenous vegetation greater than 0.5 ha or in the case of snow tussock grassland 10 ha, or above 1080 m, or areas containing any threatened plants listed in a schedule. This requirement does not apply to land that has been freeholded under the Crown Pastoral land Act 1998.

Resource consent is required for tree planting using certain tree species with wilding potential, subject to certain criteria. Resource consent is required for excavations or tree planting within specified distances of a water race or irrigation pipeline, and for development work within 10 m of any water body. There are no registered historic sites or areas of significant indigenous vegetation and habitats of significant indigenous fauna and wetlands as set out in the schedules of the plan.

The northwestern part of the lease is within an Area of Outstanding Landscape (AOL). The protected landscape provisions of the Plan require resource consent for development of land within an AOL and also land over 900 m, with an exclusion for land that has been freeholded under the Crown Pastoral land Act 1998.

The western boundary of the lease that adjoins the Pomahaka River is subject to a requirement for esplanade provisions upon subdivision.

#### 3.4 Conservation Management Strategy & Plans

Otago Conservancy has prepared a Conservation Management Strategy (CMS) which was approved by the New Zealand Conservation Authority in August 1998.

Although the lease does not fall within one of the 41 Special Areas identified in the CMS the following five General Objectives for Central Otago (GOCOs) are relevant.

#### GOCOs Landscape

To encourage the retention of the special character of Central Otago's landscape as an open, predominantly non-forest area on mountain slopes, crests and high valleys with oases of intensive cultivation on the intermontane valley floors.

#### **GOCOs Ecosystems**

To recognise the distinctive contribution the ecosystems of Central Otago make to the diversity of New Zealand's flora, fauna and ecological communities and processes and to retain representative examples through protection at lower altitudes and more extensive protected areas at higher altitudes.

#### **GOCOs Species**

To establish the presence of status of rare and vulnerable plant and animal species of Central Otago and to ensure their continued survival.

#### **GOCOs Historic**

The significance of traditional and historic sites in Central Otago will be ascertained (in consultation for sites of significance to them) and protection negotiated where warranted.

#### **GOCOs Recreation**

To assist in maximising the potential of Central Otago for outdoor recreation through identification of areas offering opportunities, further development (including facilities) of opportunities on land administered by the department and by facilitating public access elsewhere.

# 3.5 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 which is a blueprint for managing the country's diversity of species and habits and sets a number of goals to achieve this aim. Of particular relevance to tenure review, is goal three 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 ecosystems 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.

The strategy outlines action plans to achieve this goal covering terrestrial and freshwater habitat and ecosystem protection, sympathetic management, pest management, terrestrial and freshwater habitat restoration, threatened terrestrial and freshwater species management, etc.

#### PART 4

MAPS ETC.

# 4.1 Additional information

# 4.1.1 References

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#### 4.1.2 Appendices

**Appendix 1:** Vascular plant list

Appendix 2: Invertebrate species list

Appendix 3: Fish records

Appendix 1: Vascular plant list

#### Moa Hills Station - Plant list

F	forest
S	shruband
St	streamside
Т	tussockland
W	wetland
R	rock outcrop/face
Ru	rubblefield

#### Ferns

(

Asplenium flaccidum	hanging spleenwort	f
Asplenium richardii	Richards spleenwort	f,r
Blechnum fluviatile	a fern	f
Blechnum montanum	a fern	S
Blechnum penna-marina	little hard fern	t
Cystopteris tasmanica	bladder fern	r
Grammitis patigonica	a fern	r
Grammitis poepigiana	a fern	r
Hymenophyllum multifidum	a filmy fern	r
Hymenophyllum sanguinolentum	a filmy fern	f
Hypolepis millefolium	a fern	f,r
Lycopodium austalianum	a club moss	t,r
Lycopodium fastigatum	a club moss	t
Lycopodium scariosum	a club moss	t
Lycopodium varium	a club moss	r
Ophioglossum coriaceum	adders tongue fern	t
Phymatasorus diversifolius	hounds tongue fern	f
Polystichum cystostegia	alpine shield fern	r
Polystichum vestitum	prickly shield fern	f,s,t
Pteridium esculentum	bracken	t
Trees Griaolinia littoralia	hundlast	£
Unisemina intorans	broadleal	l fa
Nothofogua mongiosii	niluan haash	1,5 £
Ologria fimbriata		1
*Dinus contorta	a lice dasiy	5
Pittosporum tenuifolium	black manou	l F
Pseudopanay colensoi yar, ternatus	three finger	5 f
r soudopaniax colonsor var. ternatus	three miger	1
Shrubs		
Arisotelia fruticosa	mountain wineberry	S
Carmichaelia petrieii	native broom	S
Coprosma cheesemanii	a shrub	t,s
Coprosma ciliata	a shrub	f,r,s
Coprosma sp. aff. parviflora	a shrub	S
Coprosma perpusilla	a sub shrub	w,t
Coprosma petrieii	a sub shrub	t
Coprosma propinqua	mingmingi	S
Coprosma rugosa	a shrub	st
Coriaria plumosa	a tutu	st
Corokia cotoneaster	a shrub	s,r
Cyathodes pumila	a sub shrub	t
*Cytasus scoparius	broom	S
Discaria toumatou	matagouri	t,st
Dracophyllum longifolium	turpentine shrub	s,t
Dracophyllum prostratum	a sub shrub	W
Dracophyllum uniflorum	a shrub	t,s

Gaultheria antipoda	false beech	r
Gaultheria crassa	a shrub	r,t
Gaultheria depressa var. novae-zelandiae	snowberry	t
Gaultheria macrostigma	a sub shrub	t
Hebe anomala	a hebe	t,s
Hebe pauciramosa	a hebe	st
Hebe propinqua	a whipcord hebe	t
Hebe rakiensis	a hebe	s,st
Hebe salicifolia	koromiko	st,r
Kelleria dieffenbachii	a sub shrub	t
Kelleria villosa	a sub shrub	t
Leucopogon colensoi	a sub shrub	t
Leucopogon fraserii	a sub shrub	t
Melicytus aff alpinus	porcupine shrub	t,r
Myrsine nummularia	a sub shrub	r
Oleania bullata	a shrub daisy	t,s
Oleania edente	a shrub daisy	r
	a shrub daisy	S
Ozomannius vauvimersn Denteehendre nymile		t L
Pimelia oreophila	a sub shrub	ι ≁
*Pibes uva crispa	a sub shrub	1
Ribes uva-erispa	gooseberry	5
Climbers /Vines		
Clematis marata	a clematic	c
Muehlenbeckia australis	nobuebue	3 C
Muehlenbeckia avillaris	a creening shrub	o et
Muehlenbechia complexa	a vine	S
Rubus schmelidioides	a bush lawyer	S
		5
Herbs		
Abrotanella caespitosa	a dwarf daisy	w
Acaena caesiglauca	a biddibid	t
Acaena fissistipula	a biddibid	t,st
Acaena inermis	a biddibid	st
Acaena juvenca	a biddibid	f
Acaena profundiincisa	a biddibid	t
Acaena saccaticupula	a biddibid	st
Acaena tesca	a biddibid	t
Aciphylla aurea	golden speargrass	t
Aciphylla glaucescens	a speargrass	st
Aciphylla hectorii	a dwarf speargrass	t
Aciphylla scott-thomsonii	a speargrass	st
Anaphalis bellidioides	an ever lasting daisy	st,r
Anemone tenuicaulis	a herb	t
Anisotome aromatica var. aromatica	a herb	t
Anisotome aromatica var. flabellifolia	a herb	t
Anisotome cauticola	a herb	r
Anisotome flexuosa	a herb	t,r
Brachyscome radicata	a daisy	r
Brachyglottis bellidioides	a daisy	t,r
Brachyglottis haastii	a daisy	r
Calmine debilis agg.	a nerb	st
Celmisia densifiora (including prorepens for	rm ja daisy	T t
Celmisia gracilenta	a dalsy	T.
Celmisia sp gracilenta rnizomatous"	a daisy	W
Celmisia semicordete sen curicore	naise speargrass	Г 1*
Celmisia semicordata ssp. aurigans	a uaisy a daisy	1 +
Connisia sessimiliora	a uaisy	L f
Cerastium iomanum	mouse –ear chickweed	ι

.

*Cirsium arvense	Californian thistle	t
*Cirsium vulgare	Scotch thistle	t
Colobanthus apetalus	a herb	st
Colobanthus strictus	a herb	t
Craspedia sp.	a woolly head	t
Crassula tetramera/sieberiana	a herb	r
Dichondra brevifolia	a creeping herb	s
*Digitalis purpurea	foxglove	s
Dolychoglottis Ivallii	snow margaret	st.r
Drosera arcturii	a sundew	w
Epilobium alsinoides	a willowherb	t
Epilobium brunnescens	a willowherb	W
Epilobium chloraefolium	a willowherb	t
		•
Epilobium glabellum?	a willowherb	st
Epilobium komarovianum	a willowherb	w
Epilobium macropus	a willowherb	st
Epilobium melanocaulon	a willowherb	SC
Epilobium sp. "minutiflorum"	a willowherb	st
Epilobium pedunculare	a willowherb	f.
Epilobium nubens	a willowherb	r
Enilobium tenuines	a willowherb	t.
*Eunhrasia nemorosa	an evebright	t
Euphrasia zelandica?	an evebright	c
Forstera tenella	a herb	st
Galium pernusillum	a herb	t t
Galium propinguum	a herb	c c
Gentiana amabilis	a nero	
Gentiana bellidifolia	a native gentian	t t
Gentiana grisebachii	a native gentian	1
Geranium micronhyllum	a native gentian	t vi
Geum leiospermum	a harb	t t
Geum parviflorum	a herb	L ret
Gingidium deciniens	a herb	1,5L 1
Granhalium audov/mahiniaum	a deigu	1 +
Gnaphalium laterale	a daisy	ι 
Gnaphalium limoaum	a daisy	w
Gnaphalium mekavii	a daisy	w t
Gnaphalium traversii	a daisy	ι ,
Conocarpus aggregatus	a daisy	1
Gonocarpus montanus	a herb	w t
Gunnere dentete	a herb	L at
Gunnera meneira	a nero	SL
Haliahmuuna filiaanla	a creeping nero	SL ≁
*Hieroeium lonidulum	a nero	1 1
*Hieracium pilozolla	mouse car boulewood	L +
*Hieracium proceltum	hing davil	L +
Hieracium praeatum		ι 
Hydrocotyle microphylla?	a pennywort	W
Hydrocotyle novae-zelandiae var. montana	a pennywort	W
Hydrocotyle nz var. novae-zelandiae	a pennywort	t
riypochaeris radicata		l r
Lagenifera cuneata	a daisy	τ
Lagenitera petiolata	a daisy	W
Leptinella serrulata	a creeping daisy	ľ
Leptinella squalida var. mediana	a creeping daisy	W
*Linum cartharticum	purging flax	t
Microseris scapigera	a daisy	t
*Mimulus moschatus	musk	W
Montia fontana	a herb	st,w

*Mycelus muralis	wall lettuce	sf
Myosotis macrantha	a forget-me-not	r
Myosotis pygmea var. drucei	a forget-me-not	r
Neopaxia sessiliflora	a creeping herb	w
Nertera depressa	a creeping herb	w
Oreomyrrhis colensoi	a herb	t
Oreomyrrhis ramosa	a herb	s,t
Oreostylidium subulatum	a herb	t
Ourisia caespitosa	a creeping herb	st,r
Oxalis exilis	a herb	r
Oxalis magellanica	a herb	st
Pachycladon novae-zelandiae	a cress	r
Phyllachnce colensoi	a cushion plant	w,t
Plantago lanigera	a native plantain	t
Plantago uniflora	a native plantain	W
Pratia angulata	a creeping herb	W
*Prunella vulgaris	selfheal	t
Psycophylla obtusa	aherb	W
Ranunculus cheesemanii	a buttercup	W
Ranunculus ensyli	a buttercup	r,t
Ranunculus fonosus	a buttercup	Ŧ
Ranunculus gracilenes	a buttercup	w
Ranunculus grachepes	a buttercup	w t
Ranunculus reflexus	a buttercup	ι 2
Ranunculus rovii	a buttercup	5 r
Raoulia glabra	a mat daisy	t
Raoulia subsericea	a mat daisy	t
Raoulia tenuicaulis	a mat daisy	st
*Rumex acetosella	sheep's sorrel	t
*Rumex crispus	curled dock	t
Rumex flexuosus	a native dock	st
*Sagina procumbens	pearlwort	st
Schizeilema cyanopetalum	a creeping herb	г
Schizeilema cockaynei	a herb	w
Schizeilema trifoliolatum	a herb	S
Scleranthus brockei	a herb	t
Scleranthus uniflorus	a cushion plant	r,t
*Senecio jacobaea	ragwort	t
Senecio quadridentatus	a herb	r
*Stellaria alsine	bog stichwort	W
Stellaria gracilenta	a native chickweed	r
*Stellaria media	chickweed	r
Stellaria parviflora	a native chickweed	Г
l araxacum magellanica	native dandy hon	t/r
* l'araxicum officinale	dandylion	г
	sucking clover	t
	white clover	t 
*Listica uvens	a native nettle	r 
Viola cumpinghamii	a netive violet	1
Viola filicaulis	a native violet	ι, w
Wahlenbergia albomarginata	a harebell	s t
		t
Wahlenburgia gracilis	a harebell	l.
Monocots		
Grasses		
*Agrostis capillaries	browntop	t
Agrostis muscosa	a uwart grass	τ

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Agrostis pallescens?	a wetland grass	W
*Aira caryphylla	silvery hair-grass	ľ
*Anthoxanthum odoratum	sweet vernal	t,w
*Bromus mollis	soft brome	t
Chionochloa conspicua	a tussock	st
Chionochloa rigida	narrow-leaved snow tussock	t
Chionochloa rubra	red tussock	w
Chionochloa rubra x rigida	snow tussock x red tussock	ť
Cortadieria richardii	toetoe	st
*Cynosorus cristatus	crested dogs-tail	t
*Dactylis glomerata	cocksfoot	ť
Deveuxia avenoides	a grass	ť
Dichelachne crinita	a grass	r
Flymus solandri?	a wheatarass	r t
*Festuca arundinacea	tall fescue	ι +
Festuca novae-zelandiae	hard or fescue tussock	t t
Hierochloe redolens	holy grass	t N/
*Holeus lanatus	Norvehire for	w
Koaleria cheesemanii	n orrang	ι, νν
Koeleria povozelandica	a grass	1 
Lachnegreatic hellij?		1
*Lolium paranno	a grass	L
*Dec annus	ryegrass	l 1
Poa annua	annual poa	τ
Poa brevigiumis	a grass	r
Poa colensoi	blue tussock	t
Poa imbicilla	a grass	S
Poa maniototo	a grass	r
*Poa pratense	smooth meadow grass	t
Rytidosperma australe	a grass	W
Rytidosperma gracile	a grass	t
Rytidosperma pumila	a grass	t
Trisetum tenellum	a grass	W
Sedges		
Carex bergrennii	a dwarf sedge	st
Carex breviculmis	a sedge	t
Carex comans	a sedge	t
Carex coriacea	cutty grass	w
Carex echinata	a sedge	w
Carex gaudichaudiana	a sedge	w
Carex sinclairii	a sedge	w
Carex wakatipu	a sedge	t
Carpha alpina	a sedge	w
Eleocharis acuta	a spike rush	W
Eleocharis gracilis	a snike rush	w
Isolenis aucklandicus	a dwarf sedge	w
Isolenis caligenis?	a dwarf sedge	st
Oreobolus pectinatus	comb sedge	wt
Schoenus pauciflorus	a sedge	W
Uncinia clavata	a book grass	**
Uncinia divaricata	a hook grass	t 137
Uncinia purpurata	a hook grass	t, vv t
Uncinia rubra	a hook grass	t
Ruches		
Innone enteretions	a web	
suncus antarcticus	a rusn	W
*Juncus articulatus	jointea rusn	W
JUNCUS DUTONIUS	toad rush	W
"Juncus effusus?	soft rush	W
Juncus novae-zelandiae	a rush	W



Appendix 2: Invertebrate species list

Moa Hills PL Invertebrates from survey 24-26 Jan 2005, E. Edwards Determinations assisted by B. Patrick.

		By taxon	
Taxon Blattodea	Locality	Elevation(s)	Comment .
Blattidae Celattoblatta n. sp. (Peter Johns) Coleoptera	trib. Bullock Ck.	1050	An alpine black species only known in the umbrella Moutains and Mt Benger - endemic to the Umbrella Ecological District
Carabidae			
Megadromus sandageri	trib, Bullock Ck.	870	
<i>Megadromus sandageri</i> Curculionidae	trib. Bullock Ck.	1120	
Anagotis lewisi	trib. Bullock Ck.	1120	weevil, feed in Chionocloa tussocks
Eugnomis sp.	trib. Bullock Ck.	1050	Commonly inhabits speargrass flowers
Scarabaeidae			
Costelytra zealandica	trib. Bullock Ck.	1050	A grass grub
Pyronota sp.	trib. Bullock Ck.	870	
Pyronota sp.	trib. Bullock Ck.	1120	Manuka beetle widespread in native shrub and
Diplopoda Dalodesmidae <i>Prociliosoma leiosomum</i> Hemiptera	trib. Bullock Ck.	1050	Pill millipede
Pentatornidae			Predatory sheild
Oncacontius vittatus	trib. Bullock Ck.	870	bug
Hymenoptera Sphecidae			
Priocnemis monachus	trib. Bullock Ck.	870	Spider hunting
Lepidoptera Arctiidae			wasp
Metacrias sp.	trib. Bullock Ck.	1050	Native tiger moth, larvae eat grasses
Choreutidae			Larvae eat
Asterivora marmarea	trib. Bullock Ck.	870	Celmisia gracilenta 'rhyzomatous' in wetlands
Asterivora marmarea Elachistidae	trib. Bullock Ck.	1050	wettands
Cosmiotes ombrodoca	trib. Bullock Ck.	1050	Larvae mine grasses, common & widespread in lowland areas
Elachista sp.	Mt Benger tops	900	Larvae mine
Elachista sp.	trib. Bullock Ck.	1050	grasses .
Gelecnicae <i>Kiwaia ?schematica</i> Geometridae	Mt. Benger tops	900	Larvae eat Acaena

Aponotoreas incompta	trib. Bullock Ck.	1050	Larvae eat Dracophyllum, This is a Fiordland moth with some populations distributed in a belt across to the Old Man Ra. This is its eastern limit
Aponotoreas insignis	Bullock Ck.	870	Larvae eat
Aponotoreas insignis	trib. Bullock Ck	1050	Chionocloa
, ponetoro de maigine		1000	Larvae eat Ranunculus spp., widespread and
Asaphodes clarata	trib. Bullock Ck.	1050	common in montane to alpine; larvae on buttercups
Asaphodes dionysias	Mt Benger tops	900	Females are
Asaphodes dionysias	trib. Bullock Ck	1120	nightiess
Asaphodes prasinias	Bullock Ck.	870	Inhabits shrubland
Austrocidaria similata	Bullock Ck.	870	Larvae eat
		0.0	Coprosma Larvae feed in
Chloroclystis nereis	trib. Bullock Ck.	1050	Celmisia flowers
Dasyuris anceps	trib. Bullock Ck.	1050	Larvae eat Anisotome
Dasyuris partheniata	trib. Bullock Ck.	1050	Larvae eat Aciphylla
Dichromodes n. sp.	trib. Bullock Ck.	870	Larvae eat lichens on tors
Helastia corcularia	Bullock Ck.	770	Larvae eat mosses, common
Helastia plumbea	trib. Bullock Ck.	1050	Larvae eat mosses, uncommon in eastern areas
Hydriomena rixata	trib. Bullock Ck.	750	Larvae eat Gunnera
Pseudocoremia indistincta	Bullock Ck.	870	Larvae eat Muehlenbeckia
Sestra flexata	trib, Bullock Ck.	750	Larvae eat ferns
Xanthorhoe occulta Glyphipterigidae	Mt Benger tops	900	
Glyphipterix iocheaera	Bullock Ck.	1000	Larvae mine
Glyphipterix iocheaera	trib. Bullock Ck,	1050	0011000
Glyphipterix iocheaera	trib. Bullock Ck.	1120	
Glyphipterix iocheaera	tussock fen Bullock Ck.	920	
Glyphipterix rugata	tussock fen Bullock Ck.	920	
Gracillariidae			
Caloptilia selenitis	Bullock Ck.	870 m	Larvae feed within pouch of leaves of Nothofagus menziesii
Lycaenidae			
Antipidolycaena n. sp.	Bullock Ck.	870	Copper butterfly, larvae eat Muehlenbeckia complexa
Antipidolycaena n. sp.	trib. Bullock Ck.	800	
<i>Boldenaria</i> n. sp.	Bullock Ck.	770	
Boldenaria n. sp.	Bullock Ck.	900	Boulder butter®v
<i>Boldenaria</i> π. sp.	trib. Bullock Ck.	1120	larvae eat Muehlenbeckia axillaris
Mnesarchaeidae			

Mnesarchaea paracosma	trib. Bullock Ck.	1120	
Mnesarchaea paracosma	tussock fen Bullock	920	Larvae eat
Noctuidae	UK.		IIVerwons
Aletia moderata	Mt Benger tops	900	Larvae eat Raoulia
Aletia virescens	Mt Benger tops	900	Carvae car raouna
Graphania agorastis	Mt Benger tops	900	Inhahits wetlands
Graphania disiungens	Mt Benger tops	900	masto wetando
Graphania mollis	Mt Benger tops	900	
Graphania morosa	Mt Benger tops	900	
Graphania mutans	trib Bullock Ck	1120	
Graphania nullifera	Mt Benger tops	900	Larvae eat
Graphania omoplaca	Mt Benger tops	900	Aciphylla Larvae eat grasses
Graphania phricas	Mt Benger tops	900	Larvae eat
Graphania rubescens	Mt Benger tops	900	Larvae eat
Ichneutica ceranias	Mt Benger tops	900	Larvae eat
	Mit Dongor iono	000	Chionocloa
Tratalanhata agentiatia	Mt Benger tops	900	
Tmetolophota aconistis	Mt Denger tops	900	
Trastolophota atristriga	Nit Benger tops	900	
<i>i metolophota</i> n. sp.	BUIIOCK CK.	1000	A day antivo
Tmetolophota n. sp.	tussock fen Bullock Ck.	920	noctuid moth endemic to Otago
Tmetolophota propria	Mt Benger tops	900	Larvae eat grasses
Tmetolophota semivittata	Mt Benger tops	900	Larvae eat Carex
Tmetolophota steropastis	trib. Bullock Ck.	750	Larvae eat Phormium
Tmetolophota unica	Mt Benger tops	900	
Eutorna caryochroa	trib. Bullock Ck.	1120	Inhabits turfs
- Gymnobathra sp.	Bullock Ck.	1000	A case moth,
Phaenesenes annonunta	trib Bullock Ck	750	larvae eat litter
Tingena n. sp.	Mt Benger tops	900	Larvae on lichens
Tingena siderodeta	Bullock Ck.	900	Larvae on
- <i>Tingena</i> sp	trib, Bullock Ck	1120	shrubland litter
Pieridae	the Ballock CK.	1120	
Pieris rapae rapae	trib. Bullock Ck.	800	Cabbage white butterfly, an exotic species
			Native grassland
Orophora unicolor	trib. Bullock Ck.	800	casebearer
Pterophoridae			Longo opt
Stenoptilia orites	trib. Bullock Ck.	1050	Brachyglottis bellidioides flower heads
Pyralidae			
Eudonia critica	Bullock Ck.	1000	Diurnal small species inhabiting tors
Eudonia critica	trib. Bullock Ck.	870	
Eudonia critica	trib, Bullock Ck.	1050	
Eudonia critica	trib. Bullock Ck.	1120	
			Female has
Eudonia deltophora	trib. Bullock Ck.	1120	reduced wings, inhabits tussock grasslands
Eudonia diptheralis	Bullock Ck.	770	Înhabits open areas
Eudonia feredavi	Mt Benger tops	900	Inhabits open
Fudonia psammitis	trib Bullock Ck	1120	areas Inhabits ainine
		1120	

#### RELEASED UNDER THE OFFICIAL INFORMATION ACT

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			snowbank
Eudonia sabulosella	Bullock Ck.	770	
Glaucocharis helioctypa	trib. Bullock Ck.	870	Larvae likely eat mosses, inhabits wetlands
Glaucocharis helioctypa	trib. Bullock Ck.	1120	
Glaucocharis helioctypa	tussock fen Bullock	920	
Glaucocharis interrupta	trib. Bullock Ck.	870	
Orocrambus aethonellus	trib. Bullock Ck.	1120	Inhabit open
Orocrambus apicellus	Mt Benger tops	900	Common in bogs
Orocrambus apicellus	tussock fen Bullock	920	5
	Ck.		Endemic to Garvie
Orocrambus geminaus	Bullock Ck.	870	and Umbrella Mountains and Lammermore/Rock and Pillar ra.
Orocrambus geminaus	Bullock Ck.	900	
Orocrambus geminaus Orocrambus geminaus	Mt Benger tops	900	
Orocrambus geminaus Orocrambus geminaus	trib. Bullock Ck.	1050	
Orocrambus geminaus	tussock fen Bullock	920	
	Ck.	020	Inhabits moss
Orocrambus heliotes	Mt Benger tops	900	bogs
Orocrambus heliotes	tussock fen Bullock Ck.	920	( )
Orocrambus lectus	Bullock Ck.	870	damp areas
Orocrambus lectus	trib. Bullock Ck.	1120	
Orocrambus lectus	tussock fen Bullock Ck.	920	
Orocrambus melitastes	Bullock Ck.	1000	
Orocrambus philpotti	trib. Bułlock Ck.	1050	Day active in grassiands
Orocrambus philpotti	trib. Bullock Ck.	1120	9100000000
Orocrambus scoparioides	trib. Bullock Ck.	1120	Inhabits moss bog margins
Orocrambus scoparioides	tussock fen Bullock	920	
Orocrambus vitellus	tussock fen Bullock Ck.	920	Day active in grasslands
Orocrambus vulgaris	Bullock Ck.	900	Day active in grasslands Inhabits wetlands. Type locality Old Man Ra. and
Eudonia xysmatias	trib. Bullock Ck.	1120	endemic to Garvie, Old Man Ranges, Umbrella Mountains and Lammermore/Rock and Pillar Ra.
Scoparía autochroa	Mt Benger tops	900	Chionocloa grasslands
Scoparia autochroa	trib. Bullock Ck.	1120	
Scoparia epicremna	trib. Bullock Ck.	1120	
Scoparia epicremna	Ck.	920	
Scoparia exilis	Bullock Ck.	1000	Inhabits open areas
Scoparia n. sp. aff. panopla	trib. Bullock Ck.	1120	Local in damp grasslands
Scoparia n. sp. aff. panopla	tussock fen Bullock Ck.	920	<u> </u>

Scoparia pascoella	Bullock Ck.	770	Local in cushion bogs. Endemic to Eyre Mountains and mountains across northern Southland to Mt. Benger.
Scoparia pascoella	tussock fen Bullock Ck	920	
Scoparia periphanes	trib. Bullock Ck.	870	
Scoparia siderapsis	trib. Bullock Ck.	1050	Inhabits bare or rocky areas
Scoparia torodes	trib. Bullock Ck.	870	Inhabits tors and rocky areas
Tauroscopa trapezitis	trib. Bullock Ck.	1120	Inhabits alpine flush
Tauroscopa trapezitis	tussock fen Bullock Ck.	920	
Satyridae			
Argyrophenga antipodum	Bullock Ck.	900	
Argyrophenga antipodum	Bullock Ck.	1000	
Argyrophenga antipodum	trib. Bullock Ck.	750	A tussock butterfly
Argyrophenga antipodum	trib. Bullock Ck.	1120	larvae eat tussocks
Argyrophenga antipodum	tussock fen Bullock Ck.	920	
Argyrophenga janitae	trib. Bullock Ck.	750	
Argyrophenga janitae	trib. Bullock Ck.	870	
Argyrophenga janitae	trib. Bullock Ck.	1120	A tussock butterfly, larvae eat tussocks
Tortricidae			
Epichorista aspistana	trib. Bullock Ck.	870	Larvae eat Acaena
Epichorista siriana	Bullock Ck.	770	Larvae eat grasses
Epichorista siriana	Bullock Ck.	770	
Harmaloga sanguinea	trib. Bullock Ck.	1050	Larvae eat Hebe odora
Mecoptera			
Nannochoristidae			o
Nannochorista philpotti	Bullock Ck.	1060	Scorpionfly, Larvae inhabit small vegetated
Nannochorista philpotti	trib. Bullock Ck.	1050	Sileanis
Nannochorista philpotti Megaloptera Corialidae	trib. Bullock Ck.	1120	
Archicaulioides diversus	Bullock Ck.	880	Toebiter, inhabits
Odonata Potoluridao			streams
i Glaiunuae			Giant darning
Uropetala chiltoni	Mt Benger tops	900	nymphs inhabit wet banks
Plecoptera			
Antarctoperlidae			
Zealandobius uniramus	Bullock Ck.	770	Inhabits streams and flushes

Records from B. H. Patrick, in Dickinson et al. (1998) for Mt. Benger

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Some insects are also re	ecorded on the lease and all species	are likely present			
Order	Family	Taxon	Locality Mt	Elevation(s)	Comment
Plecoptera	Antarctoperlinae	Zealandobius patricki	Benger		grassland streams
Orthoptera	Acrididae	Alpinacris tumidicauda	Mt	>1000	

Orthoptera	Acrididae	Sigaus campestris	Mt Benger	,		
Orthoptera	Acrididae	Paprides dugdali	Benger	ł		
Hemiptera	Cicadidae	Kikiha angusta	Benger			l area math with fightland
Lepidoptera	Hepialidae	Aoraia rufivena	Benger	>670		females
Lepidoptera	Nepticulidae	Stigmella cassiniae	Benger		1100	Larvae mine Ozothamnus
Lepidoptera	Nepticulidae	Stigmella ilsea	Creek			fimbriata and O. bullata
Lepidoptera	Carposinidae	Heterocrossa cryodana	Benger			
Lepidoptera	Glyphipterigidae	Glyphipterix barbata	Benger Mt			
Lepidoptera	Choreutidae	Asterivora fasciata	Benger			Larvae eat Celmisia densiflora
Lepidoptera	Tortricidae	Eurythecta phaeoxyla	Benger			
Lepidoptera	Tortricidae	Harmologa petrias	Benger Mt	>950		Larvae eat Ozothamnus
Lepidoptera	Tortricidae	Pyrgotis consentiens	Benger Mt	>1000		Larvae eat Hebe odora buds
Lepidoptera	Psychidae	Reductoderces n.sp.1	Benger Mt	>1100		cases on tors
Lepidoptera	Elachistidae	Elachista thallophora	Benger Mt	>1100		
Lepidoptera	Oecophoridae	Tingena lassa	Benger			Larvae inhahit wet flushes. Al
						recorded at Mt Benger (B.H. Patrick pers Comm.) Its
Lepidoptera	Geometridae	Asaphodes cinnabari	Gem Lake	>500		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Piilar Ra.
Lepidoptera Lepidoptera	Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis	Gem Lake Mt Benger Mt	>500 >1000		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower
Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae	Gern Lake Mt Benger Mt Benger Mt	>500 >1000		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower Larvae eat lichens
Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata	Gem Lake Mt Benger Mt Benger Mt Benger Mt	>500 >1000		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower Larvae eat lichens Larvae eat Epilobium
Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha	Gem Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower Larvae eat lichens Larvae eat Epilobium
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower Larvae eat lichens Larvae eat Epilobium
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flower Larvae eat lichens Larvae eat Epilobium Larvae eat Epilobium
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis	Gem Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger	>500 >1000 >900		<ul> <li>distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra.</li> <li>Larvae feed in Celmisia flowei</li> <li>Larvae eat lichens</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to</li> </ul>
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger	>500 >1000 >900		<ul> <li>Larvae eat lichens on rocks</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to Lammermore/Rock and Pillar</li> </ul>
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas peromata Notoreas chioneres Dichromodes gypsotis	Gem Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger	>500 >1000 >900		distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flowei Larvae eat lichens Larvae eat Epilobium Larvae eat Epilobium Larvae eat Kellaria villosa Larvae eat Kellaria villosa Larvae eat lichens on rocks Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to Lammermore/Rock and Pillar
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae Hepialidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger	>500 >1000 >900		<ul> <li>Larvae eat lichens on rocks</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat lichens</li> <li>Larvae eat Pimelea</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to Lammermore/Rock and Pillar</li> <li>Larvae on Melicytus alpinus</li> </ul>
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae Hepialidae Noctuidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis Aoraia aspina Aoraia flavida Homohadena fortis Eudonia crypsinoa	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900	1150	<ul> <li>distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra.</li> <li>Larvae feed in Celmisia flowei</li> <li>Larvae eat lichens</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Pimelea</li> <li>Larvae eat Kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to</li> <li>Lammermore/Rock and Pillar</li> <li>Larvae on Melicytus alpinus</li> </ul>
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae Hepialidae Noctuidae Noctuidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis Aoraia aspina Aoraia flavida Homohadena fortis Eudonia crypsinoa	Gern Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Lake Gern Lake Gern Lake Gern Lake Gern Lake Gern Lake Mt Benger Mt	>500 >1000 >900	1150	I distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra. Larvae feed in Celmisia flowei Larvae eat lichens Larvae eat Epilobium Larvae eat Epilobium Larvae eat Pimelea Larvae eat Kellaria villosa Larvae eat Kellaria villosa Larvae eat lichens on rocks Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to Lammermore/Rock and Pillar Larvae on Melicytus alpinus Inhabits wetlands
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae Hepialidae Noctuidae Noctuidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis Aoraia flavida Homohadena fortis Eudonia crypsinoa Eudonia paltomacha	Gem Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900	1150	<ul> <li>I under procession is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra.</li> <li>Larvae feed in Celmisia flowei</li> <li>Larvae eat lichens</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Pimelea</li> <li>Larvae eat Kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to Lammermore/Rock and Pillar</li> <li>Larvae on Melicytus alpinus</li> <li>Inhabits wetlands</li> <li>Inhabits wetlands</li> </ul>
Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera Lepidoptera	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Hepialidae Hepialidae Noctuidae Noctuidae Noctuidae	Asaphodes cinnabari Chloroclystis nereis Helastia christinae Paranotoreas brephosata Notoreas paradelpha Notoreas perornata Notoreas chioneres Dichromodes gypsotis Dichromodes gypsotis Aoraia flavida Homohadena fortis Eudonia crypsinoa Eudonia paltomacha Eudonia sabulosella	Gem Lake Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt Benger Mt	>500 >1000 >900	1150	<ul> <li>distribution is western Southla across northern Southland ranges and Lammermore/Roc and Pillar Ra.</li> <li>Larvae feed in Celmisia flowei</li> <li>Larvae eat lichens</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Epilobium</li> <li>Larvae eat Kellaria villosa</li> <li>Larvae eat kellaria villosa</li> <li>Larvae eat lichens on rocks</li> <li>Inhabit damp grassland and wetland. Type locality Gem Lake. Distributed Northern Southland Mountains to</li> <li>Larvae on Melicytus alpinus</li> <li>Inhabits wetlands</li> <li>Inhabits wetlands</li> </ul>

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Final Moa Hills Pastoral Lease Conservation Resources Report. OTACO-42926

Appendix 3: Fish records

Sampling	NZ Map	Time	Distance	Average	Average
Site	Coordinates	of Day	Sampled	Stream	Stream Depth
	GPS	(h)	(m)	Width (m)	(m)
Bullock	E2215208	1325	27.6	4.40	0.237
Creek (1)	N5511465				
Bullock	E2215156	1345	40	0.37	0.068
Creek Trib.	N5511488				
(2)					
Bullock	E2215634	1500	20	2.8	0.152
Creek (3)	N5512037				
Bullock	E2215403	1545	25	2.41	0.209
Creek Trib.	N5512146				
(4)					
Bullock	E2214102	1300	50	0.93	0.138
Creek Trib.	N5514366				
(8)					
Bullock	E2217661	1620	30	1.13	0.216
Creek Trib.	N5510653				
(11)					
Bullock	E2217139	1740	26	2.67	0.150
Creek Trib.	N5508731				
(12)					

Table 1. Sampling Locations, Fishing Times and Distances, and Stream Characteristics Surveyed on Moa Hills PL, 24&25 January 2005.

	b Sarrejea raje	100110 10 11	104 111115 1 D, Z	10025 suntail y 20	0
Sampling	NZ Map	Time	Distance	Average	Average
Site	Coordinates	Fished	Sampled	Stream	Stream Depth
		(h)	(m)	Width (m)	(m)
Bullock	E2216445	0940	26	2.43	0.197
Creek (5)	N5514450				
Bullock	E2215557	1040	40	0.75	0.124
Creek Trib.	N5514676				
(6)					
Bullock	E2215557	1100	20	0.70	0.099
Creek Trib.	N5514676				
(7)					
Bullock	E2216171	1410	25	2.8	0.111
Creek Trib.	N5515417				
(9)					
Bullock	E2216257	1500	Visually	N/A	N/A
Creek Trib.	N5515466		sighted 50		
(10)					

Table 2. Sampling Locations, Fishing Times and Distances, and Stream Characteristics Surveyed Adjacent to Moa Hills PL, 24&25 January 2005.

Capture Location	Length mean and	Frequency
	range (mm)	
Bullock Creek (1)	105 (81-152)	6
Bullock Creek Trib. (2)	144.5(104-185)	2
Bullock Creek (3)	94(33-190)	5
Bullock Creek Trib. (4)	93(78-143)	16
Bullock Creek Trib. (8)	No fish	0
Bullock Creek Trib.	No fish	0
(11)		
Bullock Creek Trib.	No fish	0
(12)		

Table 3. Size, Frequency and Capture Location of Brown Trout.

# Table 4. Size, Frequency and Capture Location of Brown Trout at sites adjacent to Moa Hills PL but still within the Bullock Creek Catchment.

Capture Location	Length mean and	Frequency
	range (mm)	
Bullock Creek (5)	104 (32-149)	. 6
Bullock Creek Trib. (6)	No Fish	0
Bullock Creek Trib.(7)	No Fish	0
Bullock Creek Trib. (9)	92.5(72-122)	8
Bullock Creek Trib.(10)	Approx. 65(30-100)	Approx. 10

Table 5. Stream model Abundance, o December 200-	Table 5.	Stream	Insect	Abundance,	6	December	:2004
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Sampling Site	Major Insects Seen	Abundance Estimate
Bullock Creek (1)	Deleatidium	Moderate
	Zelandoperla	Low
	Nesameletus	Low
Bullock Creek Trib. (2)	Deleatidium	Moderate
	Zelandoperla	Low
	Nesameletus	Low
Bullock Creek (3)	Deleatidium	Moderate
	Nesameletus	Low
	Ameletopsis	Low
	Dobsonfly	Low
Bullock Creek Trib. (4)	Deleatidium	Moderate
	Zealandobius	Low
	Stenoperla	Low
	Zealandoperla	Low
	Ameletopsis	Low
Bullock Creek (5)	Deleatidium	Moderate
	Zealandoperla	Low
	Aoteapsyche	Low
Bullock Creek Trib. (6)	Zealandoperla	Moderate
	Deleatidium	Low
	Isopods	Abundant
Bullock Creek Trib. (7)	Zealandoperla	Moderate
	Deleatidium	Low
	Isopods	Moderate
Bullock Creek Trib. (8)	Zealandoperla	Low
	Deleatidium	Moderate
	Isopods	Moderate
Bullock Creek Trib. (9)	Deleatidium	Low
	Zealandoperla	Low
	Potamopyrgus	Low
Bullock Creek Trib.(10)	N/A	N/A
Bullock Creek Trib. (11)	Zealandoperla	Moderate
	Deleatidium	Moderate
	Nesameletus	Low
	Green Free-	Low
	Swimming Caddis	Low
	Isopods	Moderate
	DIA	<b>N K 1 C</b>
Bullock Creek Irib. (12)	Deleatidium	
	Zealandoperla	Moderate
	Zealandobius	LOW
	Nesameletus	LOW
	Stenoperla	Low
	Potamopyrgus	Low