

Crown Pastoral Land Tenure Review

Lease name : BERWEN

Lease number : PO 209

Conservation Resources Report

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.

August 05

BERWEN PASTORAL LEASE



CONSERVATION RESOURCES REPORT

PART 1

INTRODUCTION

This report describes the conservation resources of Berwen Station. The lease covers an area of 6969 hectares and the homestead is about 9kms southwest of Omarama on the Berwen Road. Half of the property is in the headwaters of the East Branch of the Manuherikia River and includes the summit and western flanks of the Hawkdun Range. The remainder is in the headwaters of Omarama Stream at the south end of the upper Waitaki Basin.

The eastern property boundary extends along the crest of the Ewe Range and the Hawkdun Range, and includes the upper cirque basins. The boundary continues westwards across the headwaters of the East Manuherikia River, and extends north up “Camp Creek Spur”, down Little Omarama Stream and along Broken Hut Road to the north end of the Ewe Range. The altitude ranges from about 500m on the flats to a high point of 1856m on the Hawkdun Range.

The adjacent pastoral properties are Tara Hills, Omarama, Otamatapaio, Clifton Downs, Dunstan Peaks, Twinburn, Two Mile and Michael Peak.

The property is entirely within the Hawkdun Ecological District except for a small area of flats, which are in the Omarama Ecological District. The Hawkdun PNAP survey identified one recommended area for protection (RAP) on the property, the Berwen Saddle RAP (Hawkdun 3).

PART 2

INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 LANDFORMS AND GEOLOGY

The Berwen Pastoral Lease (Berwen) is a 20km section along the west side of the Ewe and Hawkdun Ranges. These ranges descend from a central high point, the Ewe Range descending northwards to the Upper Waitaki Basin, and the Hawkdun Range southwards to Central Otago. The informally named Saddle Range adjoins these ranges at Little Omarama Saddle, which separates the Omarama Stream catchment from the East Manuherikia River catchment. A large spur extends southward from the Saddle Range, which is informally referred to as Camp Creek Spur.

The Ewe and Hawkdun Ranges and Camp Creek Spur are part of the distinctive fault-block mountain ranges that form the transition from Canterbury greywacke to Otago schist. Cirque glaciation and periglacial process have shaped the land at upper altitudes, while fluvial and slope processes have shaped the land at mid to lower altitudes.

2.1.1 Landforms

The property can be subdivided into geomorphic units as follows:

(i) *Hawkdun Range (West Side)*

This unit comprises 7kms of the west side of the Hawkdun Range, the high point being 1856m near Little Omarama Saddle. The Hawkdun Fault runs along the base of the range and through Little Omarama Saddle. The unit is composed of strongly indurated greywacke and black argillite of the Torlesse Group (Chlorite Sub-zone I). The western face is dissected by a series of valleys and basins, including four cirques. Periglacial processes have shaped the summit and upper slopes, resulting in extensive fellfield, scree, stone drains, nets and solifluction lobes. The mountain slopes are steep with frequent rock outcrops. Younger screes and older talus are common on middle and upper slopes, and active erosion is restricted to a few slips and gullies. The range is drained by the Manuherikia River (East Branch), which flows into Central Otago.

(ii) *Hawkdun Range (East Side)*

The upper east side of the range consists of part of a series of Pleistocene cirque basins. The range crest varies from a broadly rolling to a narrow rocky ridge with low peaks. It is thought to be the remains of an ancient uplifted peneplain, where periglacial weathering has reduced rock outcrops to a pavement of angular rock. Patterned ground such as stone drains, nets and stripes are present. Most are relict features, but some are still active.

The shallow cirque basins have steep and rocky sidewalls, which support summer snowbanks. The basin floors are flat to gently sloping, sometimes terraced and often contain small tarns. Adjacent side ridges are thin and sharp, due to past ice scouring.

(iii) *Higher Ewe Range*

The south end of this range is similar to the Hawkdun Range, but forms a distinctive basin landscape around Little Omarama Saddle. The Hawkdun Fault continues north from the Saddle along the base of the range. The summit is broader and smoother than that of the Hawkdun Range, and its height decreases northwards from 1800m to around 1400m. The Ewe Range drains into Little Omarama Stream, which flows into the Upper Waitaki Basin.

(iv) *Camp Creek Spur*

This spur separates Camp Creek and the Manuherikia River (East Branch), with its high point being 1534m near Little Omarama Saddle. The spur is broader near the top, but is more narrow and steep lower down. Side slopes are steep and dissected by several gullies. There are few screes, talus patches or rock outcrops. The unit includes two small greywacke spurs to the southeast of the Manuherikia River.

(v) *Lower Ewe Range*

This unit is a 7km portion of the northern Ewe Range, which descends from around 1400m to 900m. Its geology changes from Torlesse greywacke/argillite to Haast semi-schist about halfway along. Small patches of talus are associated with larger rock outcrops. Most of the range is dissected by side valleys. Small alluvial fans occur at valley mouths, and alluvium mantles lower slopes at the south end.

(vi) *Omarama Stream Flats*

The alluvial fans of the Ewe Range merge with the floodplains of Little Omarama and Omarama Streams. The fans slope west and northwards, with gradients being steepest at the head of Little Omarama Stream. Altitude ranges from around 700m to 500m. Streams follow narrow gravel beds roughly parallel to the range.

(vii) *Greywacke Hills and Valley Fill*

This small triangular area of valley floor occurs between the Hawkdun Range and Camp Creek Spur. It is comprised of a small greywacke/argillite spur, and an apron of gentle slopes along the base of the Range. It is underlain by old weathered gravels, quartz-conglomerate rock, sandstone, siltstone and mudstone. A red rock outcrop occurs here.

2.1.2 Significance of landforms

The Hawkdun and Ewe Ranges are two of the fault-block mountain Ranges between South Canterbury and Central Otago. They are a significant and contiguous part of a wider area encompassing the Dunstan, Wether, St Bathans and Mary Ranges. These form a special and distinctive area because of their fault-block structure, transitional geology, extensive cirque glaciation and periglacial features. The cirque basins on the Hawkdun Range are large and well developed.

2.2 LANDSCAPE

2.2.1 Landscape context

Berwen contains two main hydrological and visual catchments, the Omarama Stream catchment in the north and the Manuherikia River catchment in the south. The upper Otamatapaio River catchment is also within the property, east of the Hawkdun Range.

The property is comprised of two distinct blocks on either side of Little Omarama Saddle. The northern block includes the crest of the Ewe Range and its eastern flanks, and a portion of the Omarama Stream flats. This is the Ewe Range block. The southern block includes the crest of the Hawkdun Range and its western flanks, which are within the East Branch of the Manuherikia valley in Central Otago. This is the Manuherikia block.

The 4WD track over Camp Creek Saddle is immediately east of the property. This back-country route between Central Otago and South Canterbury is popular for recreational driving and mountain-biking.

The northern part of the property is part of the Upper Waitaki/Mackenzie Basin, one of the most extensive outstanding natural landscapes in the Canterbury Region and "one of the most investigated, painted, written about, visited, eulogised and argued over landscapes in New Zealand" (BMP and LA 1993).

Most of the Basin is seen as a highly "natural" landscape because of the overwhelming dominance of natural landforms, extensive short grassland and scattered shrublands. These communities retain a diversity of indigenous plants and support indigenous insects, lizards and birds. It is regarded as one of the region's, and arguably, the nation's, largest outstanding natural landscapes.

It is also a highly visible landscape. A major tourist highway (SH8) passes through the Basin and much of it can be viewed from the highway. The Basin is moderately to highly vulnerable to visual change through developments such as forestry and cultivation.

The Upper Manuherikia Valley is a distinctive and discrete part of Central Otago. It is enclosed between the St Bathans and Hawkdun Ranges, the dip-slope of the former contrasting with the steeper scarp of the latter. The Hawkdun Range has been identified as an outstanding natural landscape (Central Otago District Plan 2000). The valley is characterised by a sense of remoteness and relative naturalness, the road being little more than a farm track. A special feature is the tall tussock cover extending to the valley floor.

2.2.2 Significance of Berwen to the Landscapes of the Upper Waitaki Basin and Upper Manuherikia Valley

The Upper Waitaki Basin

The Ewe Range is one of the skyline ranges enclosing the Upper Waitaki Basin. It is first seen, with the Saddle Range, as one travels north past Killermont homestead, Little Omarama Saddle and the Ewe/Hawkdun Range junction being a natural visual focus. The higher part of the Ewe Range defines and encloses the basin more than the lower northern part. The high junction of the Ewe/Hawkdun Range and the long ridge running east to Mt Horrible forms a long evenly sloping skyline visible above the lower Ewe Range and adjoining rugged hill country.

The Basin floor and parts of the Ewe Range are were categorised as an Outstanding Natural Landscape in the Canterbury Regional Landscape Study (BMP and LA 1993). Interpretation of the text indicates that all the ranges enclosing the Basin were considered outstanding, including the upper Ewe Range and Little Omarama Saddle.

The Ewe Range is clearly visible from Broken Hut Road, with attention focusing on Little Omarama Saddle. The Ewe and Hawkdun Ranges are also visible from the 4WD route over Camp Creek Saddle. The Ewe Range is thus an important part of the recreational experience for users of these roads.

The upper eastern side of Berwen includes part of the extensive range and valley landscape east of the Hawkdun Range. While it is not a high profile “public” landscape, it has some special and distinctive features such as the cirque basins.

The Upper Manuherikia Valley

The skyline of the Hawkdun Range encloses the upper Manuherikia valley, when viewed from the Hawkdun Runs Road. In combination with Camp Creek Spur, it forms the skyline and backdrop around the head of the valley. The valley is an integral part of the enclosing range and the entire area has been identified as an outstanding natural landscape. The high slopes rising abruptly from the valley floor creates a distinctive visual image, which adds to the special character of the valley. It contributes strongly to the remote and “undeveloped” character of the valley.

2.2.3 Property Level Landscape Description

Seven landscape units can be recognised for the two blocks on the property:

Ewe Range Block

(i) South Ewe Range

The south end of Ewe Range is similar to the Hawkdun Range. The topography is planar and angular, the steep slopes being well dissected and mostly smooth with few rock outcrops. Pale grey scree and darker talus is extensive over the summit and upper slopes

forming mosaics with ochre-brown tussock, olive snow totara and red brown *Dracophyllum*. The summit is broadly rounded except for the narrow section above Little Omarama Saddle where a cirque basin is present.

Vegetation cover is similar to that of the Hawkdun Range, with fellfield on exposed ridges and tall tussock dominant on most slopes. Burning and grazing has modified lower slopes near Little Omarama Stream, where degraded short tussock is widespread. The area is fenced off and grazed extensively as one block. There are no cultural features within the block.

(ii) *North Ewe Range*

This unit is a 7km portion of the northern Ewe Range. Depleted tall and short tussock dominates the upper slopes and summit, with speargrass often being common. The vegetation is heavily modified by AOSTD and grazing and there is a distinct green hue from exotic species. Matagouri is extensive with numerous small and discrete patches of mixed shrubland in gullies and around rock outcrops. Sweet brier is common in the north. The range is semi-extensively grazed in several blocks. A 4WD track traverses the summit ridge, with side tracks about half way along and at the south end.

(iii) *Omarama Stream Flats*

The flats occur between the Ewe Range and Broken Hut Road, and are bisected by Little Omarama and Omarama Streams. Much of the area has been developed into large geometric paddocks for pasture and cropping, and conifer shelterbelts are present. There are some areas of semi-natural dense matagouri and rough grassland. The homestead area is located adjacent to the northern tip of the range.

Manuherikia Block

(iv) *Valley Floor Hills*

This small triangular area of valley floor occurs between the Hawkdun Range and Camp Creek Spur. The topography is broadly rolling and slopes to the south. There are several streams with the larger ones having narrow floodplains in valley floors. Rock outcrops are numerous including a distinctive red one in the flatter area.

Tall tussockland is the dominant cover, with smaller areas of short tussock. Exotic green turf is locally dominant, such as in sheep camps. Grey scrub is common on steep dry slopes, floodplains and in gullies. The area is extensively grazed, and a 4WD track loops through the area following fencelines. The most significant cultural feature is a water race, which has its intake in Johnstons Creek and runs along the west side for about 1.5kms till it exits the property. The substantial batter above and below the race, and the parallel vehicle track have caused a substantial visual scar.

(v) *Camp Creek Spur*

This spur separates Camp Creek and the Manuherikia River (East Branch). The spur is broader near the top, but is more narrow and steep lower down. The NW slopes of another spur on the other side of the Manuherikia River are also in this unit. The Manuherikia River has a broad floodplain and a winding boulder channel.

The vegetation is dominated by tall tussock, though it has been depleted in many places by burning and grazing. On the summit it is sometimes reduced to little more than stumps, and on the true left of the Manuherikia there is a speckled appearance due to the sparseness of

the tussock. Matagouri is widespread, and a green-grey hue is also apparent on mid to lower slopes from locally prominent short tussock and hieracium. Grey scrub is common in gullies, while *Dracophyllum* and snow totara occur locally on talus patches and around rock outcrops. The area is extensively grazed. There is a partly bulldozed subdivision fence, and a highly visible 4WD track zig-zagging up Camp Creek Spur just south of a large gully.

(vi) *West Hawkdun Range*

This unit comprises 7kms of the west side of the Hawkdun Range, the high point being 1856m near Little Omarama Saddle. Ridges are narrow to broadly rounded. The vegetation is dominated by tall tussock, with red-brown *Dracophyllum* widespread over large areas at mid-to higher altitude. Scree and fellfield vegetation is also present. Burning has reduced the tall tussock cover locally. The area is extensively grazed. A highly visible bulldozed fence traverses the southern base of the range, and two fences rise vertically to the range top at Little Omarama Saddle and about half-way along.

(vii) *East Hawkdun Range*

This distinctive and dramatic landscape is an integral part of the Otamatapaio River system, which flows east into the Waitaki Valley. The upper east side of the range consists of a series of cirque basins. The range crest varies from a broadly rolling to a narrow rocky ridge with low peaks. The shallow cirque basins have steep and rocky sidewalls, which support summer snowbanks. Their floors are flat to gently sloping, sometimes terraced and they often contain small tarns.

There is a surprising variety of vegetation among the rocky pavements. Orange mounds of speargrass occur on exposed ridges, along with sweeps of alpine tussock and patches of *Dracophyllum*. Elsewhere there is a colourful mosaic of cushion plants and grey lichen-covered rocks. In cirque basin floors alpine tussock, cushion bogs and small water-courses form a colourful mosaic with shattered rock. The area is extensively grazed by Berwen and Otamatapaio stations as there is no boundary fence. There are no cultural features in the area.

2.2.4 Visual values

Visual values are a major component of landscape values and are closely tied to other values (e.g., ecological, geological/scientific). They are assessed in terms of inherent visual values and visibility.

Inherent Visual Values

These relate to what the landscape actually looks like, regardless of whether it is publicly visible. High visual quality is characterised by:

- A high degree of perceived naturalness and intactness.
- Visual coherence (the degree to which the elements fit together, including cultural ones).
- Legibility (the ability to clearly see the different elements and how they were formed).
- Visual distinctiveness/vividness and how memorable it is e.g. (unusual things or contrasting elements).

These attributes also contribute to the special character or “sense of place” of an area. Indigenous flora and fauna and landforms in their natural state are particularly important, though cultural patterns can be very important too.

(i) *Ewe Range Block*

The south end of the Ewe Range and Little Omarama Saddle have similar qualities to the Hawkdun Range. The Saddle has a “classic” simple form, with a sweeping tussock cover. From here, excellent views are available into the Upper Waitaki and Central Otago. This end of the Ewe Range is an extension of the Hawkdun Range. From here, excellent views are available into the Upper Waitaki Basin. Further north the numerous rock outcrops, talus patches and associated shrublands set within tall tussock are distinctive visual features of the range.

(ii) *Manuherikia Block*

The Hawkdun Range is a very natural looking area with high coherence, intactness and legibility which together confer high inherent visual quality. It is a distinctive landscape with special visual character. The broadly rolling summit has a smooth, sweeping and simple appearance, which contrasts with the adjacent steep rock-studded slopes. The expanses of shattered rock pavement and scree are overwhelmingly dominant on the summit and upper slopes. The cirque basins are sharply defined and impressive. The juxtaposition of steep sidewalls, bedrock outcrops, snowbanks and shallow basin floors with their mosaic of colours and textures forms a vivid visual image. The presence of tarns adds to this vividness.

The steep western slopes support a mosaic of grey scree, dark talus, red *Dracophyllum* and pale ochre tussock, and rock outcrops add to the drama. The uniform tussock cover allows every detail of the underlying landform to be seen with clarity. The visual simplicity and consistency of patterns is memorable and distinctive, and creates a powerful image. This is reinforced by the uniformity and straightness of the slopes rising steeply from the valley floor with no intervening hills to interrupt the view.

Vivid images are also obtained at a detailed level, including the texture of shattered rock, the patterns of periglacial features and the rich colours of lichens, fellfield vegetation and tall tussock.

Excellent panoramic views are gained from the summit into the Waitaki valley, Mackenzie Basin and deep into Central Otago.

Camp Creek Spur is less rugged and dramatic, and a uniform tussock cover accentuates its simple form. The broad, sweeping summit is impressive, despite the bulldozed fenceline and areas of very depleted tussock. The side valley contains rock outcrops and patches of scree and talus, which contrast with the tussock cover and shrublands.

The rolling slopes at the base of the Hawkdun Range are of high visual quality, because the snow tussock enhances the landform with its colour, fine texture, and visual simplicity. Locally, strong visual images are created by Spaniards and rock outcrops.

Visibility from Public Places

Travelling north on SH8, the north end of the Ewe Range comes into view from the Birchwood Road, and travelling south it is distantly visible from just south of Kellands Ponds. The highway passes as close as 3.5kms from the north end of the Range, where it is seen in detail. Virtually the entire west side and the slopes below Little Omarama Saddle are clearly visible between Killermont homestead and Short Cut Road as there are no intervening trees or low hills. The whole range is viewed at varying distances from the highway, but in clear light the landforms and vegetation patterns are easily identifiable. The contrast between

green OSTD lower slopes and undeveloped upper slopes is most obvious in spring and early summer.

The range is one of the enclosing skyline ranges of the basin, with attention being drawn to the Little Omarama Saddle area. The lower northern half of the Ewe Range is less significant as it appears to protrude into the Basin rather than enclosing it. It also lacks the drama and naturalness of the higher ranges, and is overshadowed by the St Cuthbert and St Bathans Ranges.

Closer and detailed views are gained from the Berwen and Broken Hut roads. The view up to Little Omarama Saddle is particularly impressive, with its numerous rock bluffs and outcrops on the higher slopes. These roads and the 4WD route over Camp Creek Saddle are popular for recreational driving, and thus the Ewe Range forms part of the visual corridor for the trip. The north end of the Ewe Range can be more distantly viewed from the Clay Cliffs.

The Manuherikia block cannot be seen from any main road or settlement. It is partly seen from the Hawkdun Runs Road from either side of the upper Manuherikia Valley. The Hawkdun Range towers over the valley, and while the Berwen end is most distant, the mountainous backdrop and skyline is a natural visual focus. The higher parts of Camp Creek Spur and Little Omarama Saddle can be also be seen, enclosing the head of the valley.

The Hawkdun Runs Road is little more than a farm track at its north end, and thus recreationalists would be the main viewers. The upper Manuherikia valley is a special landscape due to its undeveloped character and the presence of tall tussock on the valley floor. The Hawkdun Range forms the eastern side of the valley, and its high scree and late snowbanks add much to the remote character of the valley. The contrast between the gentler St Bathans Range and the steeper face of the Hawkdun Range is also striking.

The 4WD track down the East Branch of the Manuherikia River is a popular recreational route, though it is not a public road. Memorable vistas of the Hawkdun Range are gained through side valleys from this track.

A distant view of the upper cirque basins and range summit is briefly possible from SH83 near the Otamatapaio River. This is an important view, as it imparts a sense of mystery to the distant mountains in an otherwise hilly landscape. Their visibility contributes significantly to the special character of this transitional Canterbury-Otago landscape.

2.2.5 Landscape Summary

- The Hawkdun Range, upper Camp Creek Spur and the south end of the Ewe Range are of significant natural landscape value. They form a large part of the distinctive, dramatic and special transitional landscape between the Canterbury greywacke and Otago schist mountains. Their glacial cirques and peri-glacial features make them a special and unique landscape, of which Berwen is a significant part. The dominant rock/scree/snow tussock cover is relatively natural and has associated high inherent landscape values. More special features are the cirque basins and tarns, rock pavements and patterned ground, and the large patches of ancient talus with snow totara and *Dracophyllum*.
- The upper Ewe Range is a clearly visible as one of the enclosing ranges of the Upper Waitaki Basin, a regionally outstanding natural landscape. The range skyline and the Little Omarama Saddle area is particularly eye-catching and significant.
- The Berwen part of the Hawkdun Range makes an important contribution to the special and distinctive landscape character of the upper Manuherikia Valley. It is an

integral part of the outstanding natural landscape identified in the Central Otago District plan.

- The upper Ewe Range and the Hawkdun Range are an important part of the visual experience of recreational users of the 4WD routes across Camp Creek Saddle and down the East Branch of the Manuherikia River.
- Excellent panoramic views are gained into Central Otago and the Upper Waitaki Basin from the ranges and Little Omarama Saddle.

2.3 Climate

The climate is semi-arid with warm, dry summers and cold winters. The rainfall increases with altitude from about 500 mm at the homestead to an estimated 1600 mm on top of the ranges. Snow falls on the mountain tops at any time of year and forms a near continuous cover for at least 4 months. The tops are exposed to high winds resulting in snow accumulation on leeward slopes in cirques with patches often remaining into late summer. The frequent winds also mean the tops are exposed and the conditions are harsh for the plants and animals living there.

2.4 Vegetation

2.4.1 Introduction

Most of the Ewe Range has been oversown and top dressed (OSTD), with exotic grasses grassland dominating lower slopes below about 900m. Shrublands occur in gullies and around rock outcrops. The adjacent flatland is primarily in pasture except for extensive riparian shrublands in the upper Omarama Valley. Above 900 m, there is a mixture of introduced grasses and indigenous tussocks with hard tussock (*Festuca novae-zelandiae*) or mountain tussock (*Festuca mathewsii*) and scattered narrow-leaved snow tussock (*Chionochloa rigida*). Shrubland occurs in many gullies and on rocky outcrops. Further south along the Ewe range narrow-leaved snow tussock is dominant, until it is replaced by slim-leaved snow tussock (*Chionochloa macra*) at around 1500m. Snow tussock dominates the Berwen Saddle area and the west side of the Hawkdun Range.

Red tussock (*Chionochloa rubra*) occurs in wetter gullies and lower rolling slopes at the south end of the property. Cushion bogs and flushes are also found here, and in cirque basins. Extensive screes occur on the western slopes of the Hawkdun Range, with fellfield on range crest and subsidiary spurs. Alpine cushion plant communities are found here, and with snow bank communities in the cirque basins.

2.4.2 Shrublands

Shrublands are mostly small and confined to riparian strips or gullies, except for the Omarama Stream and adjacent OSTD slopes where they are diverse and extensive. The Omarama Stream shrublands are dominated by matagouri (*Discaria toumatou*), with *Coprosma propinqua*, *Melicytus* sp. *Olearia odorata*, sweet brier (*Rosa rubiginosa*) and the scambler *Muehlenbeckia complexa* and *Rubus schmidelioides*. Silver tussock (*Poa cita*), introduced grasses and herbs dominate the spaces between the shrubs. The invertebrate fauna is likely to be high here, as *Olearia odorata* is an important host plant. Matagouri dominates adjacent hill slopes with other shrubs being *Coprosma*, mountain wineberry (*Aristotelia fruticosa*) porcupine shrub (*Melicytus alpinus*) and common broom (*Carmichaelia petriei*).

In the Manuherikia Valley, shrublands are more scattered along the river and stream banks or around rock outcrops. Matagouri is again dominant, with *Coprosma propinqua*, occasional *Olearia odorata* and patches of *Coprosma intertexta*. Wet gullies contain scattered *Olearia*

bullata. One side stream contains an interesting remnant of *Dracophyllum uniflorum*, *D. pronum*, *Olearia cymbifolia*, *Hebe rakaiensis* and mountain flax (*Phormium cookianum*). This community was once widespread in the district, but has been severely reduced burning. Other shrubs are occasionally present among narrow-leaved snow tussock, including indigenous broom, coral broom (*Carmichaelia crassicaule*) and cottonwood (*Ozothamnus fulvida*). Snow totara (*Podocarpus nivalis*) is common around stable screes and mountain toatoa (*Phyllocladus alpinus*) has been recorded from the south side of Berwen saddle (Grove 1994). The latter would have been widespread prior to burning (McGlone, 1998).

At higher altitudes, especially on shady stony or rocky slopes, *Dracophyllum pronum* forms a low shrubland, often in association with cushion plants. This community is far less common here compared to neighbouring properties, possibly because of past burning. Scattered *Dracophyllum uniflorum* is also present.

2.4.3 Introduced grassland and mixed introduced/indigenous grassland

The greatest development has occurred on the flats and along the western side of the Ewe Range, where burning and OSTD has modified the indigenous plant cover or eliminated it entirely. The flat land is primarily pasture, apart from the shrubland described earlier. Sweet vernal (*Anthoxanthum odoratum*), browntop (*Agrostis capillaris*) and cocksfoot (*Dactylis glomerata*) are dominant with white clover (*Trifolium repens*), and extend onto adjacent hill country up to about 1000m. On these slopes the main indigenous plants are hard tussock (lower slopes), mountain fescue (higher slopes), blue tussock (*Poa colensoi*) and narrow-leaved tussock. Smaller herbs or shrubs include *Gaultheria novae-zelandiae*, *Prasophyllum colensoi*, *Raoulia subsericea*, *Bulbinella angustifolia*, *Deyeuxia avenoides*, *Helichrysum filicaule*, *Ranunculus multiscapus*, *Lagenifera cuneata*, *Wahlenbergia albomarginata*, *Celmisia gracilentia* and *Geranium sessiliflorum*. Mouse ear hawkweed (*Hieracium pilosella*), king devil (*H. praeatum*) and to a lesser extent, tussock hawkweed (*H. lepidulum*) are also prominent throughout the lower country.

Introduced grasses occur through the tussockland and along alluvial river terraces in the Manuherikia catchment, but are only dominant small areas.

2.4.4 Short tussock grasslands

Short tussockland is dominated by hard tussock (valley floor), mountain fescue (hill slopes) and blue tussock. They occur only in small areas where burning and/or grazing has removed the shrubland or tall tussock. Associated indigenous plants include patotara (*Leucopogon fraserii*), *Coprosma petriei*, *Pimelea oreophila*, *Raoulia subsericea*, *Anisotome flexuosa*, *Brachyscome sinclairii*, harebell (*Wahlenbergia albomarginata*), violet (*Viola cunninghamii*), *Geranium sessiliflorum*, *Celmisia gracilentia*, *Scleranthus uniflora*, *Luzula rufa*, *Rytidosperma pumilum*, *Blechnum penna marina*, lichens and mosses. Coral broom (*Carmichaelia crassicaule*), *Coprosma cheesemanii* and *Leucopogon suaveolens* occur occasionally. Narrow-leaved snow tussock is scattered though the short tussock, especially on shady slopes.

2.4.5 Tall tussockland

Narrow-leaved snow tussock extends down to 700m in some places, but is generally dominant from 1000m to about 1500m on sunny slopes. Slim-leaved snow tussock occupies the higher altitude areas. They occur together and hybridise at times.

At 1085m on the Ewe Range, narrow-leaved snow tussock has a cover up to 60% though it is relatively short. Also present are mountain fescue (5-10%), rock (10%), mouse ear hawkweed (10-15%), *Raoulia subsericea*, *Kelleria dieffenbachii*, *Luzula rufa*, sweet vernal,

white clover, king devil hawkweed, blue tussock, cats ear (*Hypochaeris radicata*), *Scleranthus uniflorus*, *Pimelea oreophila*, *Gaultheria novae-zelandiae* patotara and golden spaniard. At 1320m additional species are *Celmisia lyallii*, *Brachyscome* aff. *longiscapa*, *Anisotome flexuosa* and hare bell (*Wahlenbergia albomarginata*). *Dracophyllum pronum*, *Lycopodium fastigiatum*, *Coprosma cheesemanii* and lichens occur on small patches of talus.

Where the ground is more stony at 1400m (30% cover), the prominent species are narrow-leaved snow tussock (30-60%), hawkweed (20-25%), mountain fescue (10%), blue tussock, *Celmisia gracilentata*, *Dichelachne crinita*, *Brachyglottis haastii*, *Pentachondra pumila*, *Raoulia subsericea*, mosses and lichens.

On Berwen saddle at 1360m, slim-leaved snow tussock (30%), blue tussock (5%), bare or stony ground (20%), *Celmisia lyallii* (20%), hawkweeds, *Raoulia grandiflora* and *Epilobium alsinoides* are prominent. Higher up adjacent to a fence, the tussock was heavily browsed and open, and sheep's sorrel (*Rumex acetosella*) was prominent. South faces have more tussock cover (55-70%) and less open ground (<5%) than north or west faces (tussock 25-35%, stones 25-35%).

In the Manuherikia catchment, the upper part of Camp Creek Spur has a good cover of snow tussock. The lower end has been burnt and has a sparse cover of snow tussock, with mountain fescue, stony ground, *Pentachondra pumila*, hawkweed and many other indigenous species.

The rolling hill country at the south end of Berwen supports tall tussock except for small areas of introduced grasses. A typical community on a low SE slope at 950m was narrow-leaved snow tussock (50%), mountain fescue (10%), matagouri (10%), bare ground (15%), mouse ear hawkweed (10%) and a number of other common grassland species. A NW slope at the same altitude supported narrow-leaved tussock (40%), matagouri (5%), bare ground (10%), hawkweed (50%), mountain fescue, sweet vernal, blue tussock, white clover, common broom, dwarf broom (*Carmichaelia vexillata*), *Coprosma petriei* and other indigenous species.

2.4.6 Red tussockland

The red tussock has a cover of up to 80% and tussocks are up to 1m tall. This community occupies poorly drained valley floors and adjacent slopes, where comb sedge bogs are also present. Associated plants include mosses, *Carex gaudichaudiana*, *Carex coriacea*, *Celmisia* sp. rhizomatous, *Craspedia* sp., *Gonocarpus micranthus*, *Lagenifera cuneata*, *Bulbinella angustifolia* and *Schoenus pauciflorus*. Where it is slightly drier, mountain fescue, *Gaultheria macrostigma*, *Ranunculus multiscapus*, patotara, blue tussock, mouse ear hawkweed, sweet vernal, brown top, Yorkshire fog and other indigenous grassland species occur. Hybridisation occurs between red and narrow-leaved snow tussock.

2.4.7 Wetland and bog communities

Wetland and bog communities are found on low angle slopes at Berwen Saddle, on rolling slopes at the south end of the property among red tussockland and in alpine cirques. Comb sedge (*Oreobolus pectinatus*) and/or *Schoenus pauciflorus* dominate the lower bogs and wetlands with many other indigenous herbs, sedges, rushes, mosses, liverworts and lichens. Other species include *Coprosma atropurpurea*, *Abrotanella caespitosa*, *Nertera balfouriana*, *Euphrasia zealandica*, *Euphrasia dyeri*, *Utricularia monanthus*, *Epilobium komarovianum*, *Gaultheria parvula*, *Isolepis aucklandica*, *Carex gaudichaudiana*, *Lagenifera barkeri*, *Pratia angulata*, *Agrostis pallescens*, *Deschampsia chapmanii*, *Ranunculus cheesemanii*, *Ranunculus gracillipes*, *Brachyscome* sp. rhizomatus, *Luzula leptophylla*, *Bulbinella*

angustifolia, *Uncinia divaricata*, *Agrostis muscosa*, *Ourisia glandulosa*, *O. caespitosa*, *Psychrophylla obtusa*, *Colobanthus apetalus*, *Neopaxia sessiliflora*, *Luzula tenuis*, *Gnaphalium laterale*, *Celmisia haastii*, *Plantago lanigera*, *Leptinella mediana* and *Celmisia sessiliflora*.

Summit bogs contain a similar range of plants plus *Gentiana amabilis*, *Kellaria paludosa*, *Uncinia drucei*, *Euphrasia* sp. cushion and *Plantago uniflora*. In one cirque basin bog, the tiny threatened *Gentiana lilliputiana* was found. The bog was dominated by comb sedge and mosses, with *Carex berggrenii*, *Ourisia glandulosa*, *Gentiana amabilis*, *Coprosma atropurpurea*, *Psychrophylla obtusa*, *Colobanthus apetalus*, *Epilobium minutiflorum*, *Neopaxia sessiliflora*, *Celmisia haastii*, *Luzula tenuis*, *Oreobolus pectinatus*, *Abrotanella caespitosa*, *Celmisia sessiliflora* and *Carex muelleri*.

2.4.8 Alpine cushion communities

Cushion plant communities occur on most exposed ridge tops where the soil is thin. Species include *Dracophyllum muscoides*, *Dracophyllum pronum*, *Raoulia hectorii*, *Hectorella caespitosa*, *Chionohebe thompsonii*, *Craspedia lanata*, *Kellaria villosa*, *Leptinella pectinata* var. *villosa*, *Luzula pumila*, *Chionohebe densifolia*, *Celmisia sessiliflora*, *Carex kirkii*, *Epilobium tasmanicum*, *Rytidosperma pumilum*, blue tussock and *Brachyscome montana*. Where the soil is deeper relict patches of slim-leaved snow tussock and mats of *Celmisia viscosa* occur. Plants of stony or rocky habitat include lichens, *Schizeilema hydrocotyloides*, *Colobanthus buechananii*, *Poa buechananii*, *Raoulia youngii*, *Agrostis muelleriana*, *Celmisia laricifolia*, *Raoulia grandiflora* and *Myosotis suavis*.

Snow banks are not extensive and contain similar cushion plants. *Celmisia sessiliflora* is prominent with tiny plants such as *Lobelia linnaeoides*, *Plantago lanigera*, *Euphrasia zealandica*, mosses and lichens.

2.4.9 Fellfield, scree and rock outcrops

The summit ridge and subsidiary spur crests contain much shattered rock with patchy snow tussock and cushion vegetation. Other plants scattered among the angular rocks include *Dracophyllum muscoides*, *Raoulia hectorii*, *Luzula pumila*, *Poa colensoi*, *Dracophyllum pronum*, *Phyllachne colensoi*, *Hebe buechananii*, *Anisotome flexuosus* and lichens. *Raoulia petriensis* is reported from the summits of the Ewe and Hawkdun Ranges (Grove 1994) but is uncommon. The small scree hebe, *Hebe haastii* var. *humilis* (identified as *H. epacridea* in Grove 1994) is present occasionally. Large areas contain virtually no plants except for rounded mounds of *Aciphylla dobsonii*.

Specialised scree plants include *Ranunculus haastii*, which is uncommon here, *Ranunculus crithmifolius* and *Epilobium pycnostachyum*. Rock outcrops provide habitat for plants such as *Celmisia angustifolia*, *Celmisia densiflora*, *Koeleria cheesemanii*, *Luzula traversii* and *Epilobium porphyrium*. *Aciphylla montana* var. *montana* was found on talus above Berwen Saddle, which is an eastern extension for this species. Other plants found here were *A. montana* var. *gracilis*, a large and many-flowered gentian (*Gentiana corymbifera*?), *Celmisia angustifolia*, *Hebe pinguifolia*, *H. haastii*, *Poa buechananii*, *Raoulia youngii* and slim-leaved snow tussock.

2.4.10 Evaluation

The northern part of the property contains developed farmland on the flats and is partly developed up to about 1100m. The remainder is largely dominated by indigenous communities, despite the effects of burning and grazing and local OSTD. In these communities introduced grasses and hawkweeds occur in small patches, decreasing with

altitude to the range crest where they are occasionally present. Introduced grasses can be prominent at the south end of the property along valley floors and the irrigation canal. Shrublands are quite extensive in the Omarama Stream valley but much reduced in the Manuherikia catchment. Snow tussock and red tussocklands are in good condition except where they have been recently burnt. Much of the summit plateau is fellfield with only sparse vegetation. Large screes are extensive on upper slopes of the Hawkdun Range, supporting a few specialised plants. Aspect differences are important with the shady slopes supporting a more diverse and dense plant cover than drier, sunny slopes.

The cirque basins with their periglacial features, flush and bog communities are important. They contain a high diversity of plant species including the threatened *Gentiana lilliputiana*. This species was found in one alpine bog, and it may be present in cirque basins further south.

In addition to *Gentiana lilliputiana*, there are other plants of particular note. The dwarf broom, *Carmichaelia vexillata* is listed as vulnerable in the Threatened and uncommon plants of New Zealand. *Raoulia petriensis* is uncommon in stable blockfields and fellfield, its type locality being Mt. St. Bathans. *Coprosma intertexta* is listed as naturally uncommon in the Threatened and uncommon plants, and is found in the Manuherikia Valley on rock debris and toe slopes. The scree buttercup (*Ranunculus haastii*) is highly palatable and occurs in very small numbers. The threatened scree pea (*Montigena novae-zelandiae*) was not seen during this survey but has been recorded from the Hawkdun Range (Grove 1994). Coral broom is scattered through tussocklands and mountain toatoa has previously been recorded.

The diverse shrublands of the valley floors and adjacent slopes are important in their own right and as habitat for invertebrates lizards and birds. They have the potential recolonise that areas from which they have been removed. They are remnants of a previously widespread community characterised by mountain toatoa, bog pine (*Halocarpus bidwillii*), Halls totara, snow totara, matagouri, *Olearia*, *Aristotelia*, *Melicytus*, *Coprosma*, and *Corokia* (McGlone 1998). Halls totara and bog pine are no longer present, though mountain toatoa has previously been recorded here. All plants are vulnerable to burning.

Overall there is a good diversity of plants in tussockland, cushion and fellfield communities. In the absence of burning and grazing, the snow tussock will increase in density and stature and shrublands should expand.

2.5 Fauna

2.5.1 Birds

39 bird species have been recorded in the area. For the endemic species the main habitats these birds are found in are the stream systems (black-fronted terns, black shag, banded dotterel), and the tarns along the western side of the property, and in shrubland remnants (tomtit, rifleman, grey warbler). Pipits and skylarks are found across the whole property, and New Zealand falcon are occasionally seen over the property.

2.5.2 Fish

4 freshwater species have been recorded in the area, two endemic and two species of introduced fish. These are the Canterbury galaxiid (*Galaxias vulgaris*) and the upland bully (*Gobiomorphus breviceps*). Both are not common in any stream, due to the presence of Brown trout which are common. Brook Char have also been recorded.

2.5.3 Invertebrates

In all, 173 species of insects were recorded from Berwen Station. The insects present are discussed under habitats below.

Alpine vegetation

Cushion plant -snow tussock, upland bog vegetation

The relative lack of *Hieraceum* and healthiness of cushion plant (*Phyllachne*, *Dracophyllum* and *Raoulia australis*) was reflected in the insect community with the best populations of both *Anabarynchus robustus* (hover flies) and *Saropogon proximus/fugiens* (leafminer flies) in the district. Day flying moths including the largish pale-snout moth *Orocrambus* sp. and a *Lythris* sp. (Geometridae) which seemed to be associated with the upland bog-flush fringes were noted. These dominant day flying moths were quite different from the main moths collected and seen (but not identified) at similar altitudes on Dunstan Peak.

Scree community

At the south and top end of the Ewe Range crowns of *Aciphylla dobsoni* were observed to be damaged by the speargrass weevil.

Snow tussock- speargrass community

The flower heads of around 20 *Celmisia lyallii* were checked in the Berwen saddle area. A few showed browse damage, but only one still had a fairly fully grown larvae in it. The species was presumed to be the fruit fly *Trypanea centralis* (Spence 1990). In the Hawkdun Range survey Patrick (1994) recorded two other *Trypanea* species in the district presumably from this habitat.

The green cicada with a central yellow band on the abdomen *Kikihia angusta* was the dominant herbivore insect in the snow tussock grassland. Among the barer inter-tussock gaps ants *Monomorium antarcticum*, which partly feed on plant seeds were quite common. Quite extensive sweeping along with observations yielded only two species of moths including an undetermined *Orocrambus* species.

Eight species of spiders were collected or observed during the survey. The wolf spiders are clearly associated with the more open snow tussock grassland include the common wolf spider *Zeocosa hilaris* and the sheetweb spider *Laetesia trispathulata*.

Adults and a fresh pupal skin (under a stone) of the large robber flies *Neoitamus walkeri* were conspicuous and a dominant insect species among the snow tussock. These robber fly adults prey on cicadas and smaller insects.

Native bees *Leioproctus fulvescens* were active in the snow tussock as flower visitors of *Hieracium* and are also likely to visit *Celmisia lyallii* too, which had nearly finished flowering. The green fringed soldier fly *Odontomyia chloris* and tachinids were collected off the flowers on *C. lyallii* in the Berwen saddle area.

A similar range of snow tussock parasites can be expected to occur on Berwen to those recorded on Twinburn and Dunstan Peak stations, but any parasites from the seed feeding *Celmisia lyallii* should be more apparent here. This tussock grassland only had a modest number of tachnid flies active in the fenced off southern block, but both diversity and specimens were more apparent at Berwen Saddle and especially in the cushion plant community.

Grey shrubland

The largest area of grey shrubland in the district was sampled at Little Omarama Stream just up from the airstrip. Major herbivore species in terms of biomass collected from the grey shrubland light trapping were the moths *Declana junctilinea* (Geometridae) *Graphania mutans*, *Tmetolopota astristriga* and *Aletia moderata* (Noctuidae) and of these only *D. junctilinea* is a definite shrubland species. The small amount of native broom *Carmichaelia petriei* present had both the flat, enlarged green gall (probably a gall midge) and the knobby grey gall (probably a mite) present, but there were no gall apparent on any of a considerable amount of *Olearia odorata*.

Two other interesting herbivorous insects were collected from this site. A single *Tephritis* (fruit fly) species was collected in a pan trap at Little Omarama Stream. The patterning on the leading margin of the wings has alternating thin dark and lighter bands and the front costal cell is clear and not darkened as in most other *Tephritis* species, so without more extensive study it appears to be an undescribed new species rather than *T. cassinae*. The other unusual insect collected was a nymph of the aphid Peloridiidae, which is a small southern hemisphere family, which live in mosses and liverworts.

Two small fragments of regenerated *Olearia bullata* shrubland along the lower margin of the canal before Stable Creek and a tiny (10-20m) remnant of *Coprosma intertexta* dominated shrubland were inspected for invertebrates. This was the only site to support both the native spittle bug *Carystoperpa fingsiens* and booklice (so far unidentified), which are typically litter inhabitants. No native spittle bugs were reported in either the Rock and Pillar shrubland study which focused on *Coprosma propinqua* and *Olearia bullata* (Derriak *et al.* 2001) or in the Hawkdun DOC survey (Patrick 1994). Nor were any booklice recorded in the Hawkdun report (Patrick 1994). The presence of the native spittle might indicate a preference for *C. intertexta* and with booklice probably indicates both a relatively undisturbed (from livestock) and protected litter from desiccation due to the dense divaricating foliage

The greyish-brown orbweb spider *Colaranea veratum* was common and a green crab spider was also present in the *C. intertexta* shrubland, while at the Little Omarama stream shrubland the nursery web spider was prominent.

Four samples of stream invertebrates collected by Environment Canterbury in the Omarama district at Quail Burn, Otemamata Stream, Ahuriri River and Omarama Stream had generally similar invertebrate composition. The Omarama Stream samples of 420 insect specimens at 620m were dominated by *Deleatidium* mayflies, *Aoteapsyche*, *Olinga*, *Pycnocentodes*, *Pycnocentria* caddisflies and Elmidae beetles. The Elmidae were relatively numerous at this site and the stone fly *Sternoperla* was also present. This site is only around 60m below the site sampled by the airstrip on Little Omarama Stream. Light trapping of a smaller side creek revealed *Hydrobiosis* species as the main caddisflies. Although Patrick (1994) recorded eight species of caddisfly from the Hawkdun range only *Aoteapsyche colonica* and *Costachorema callistum* were in common with the survey. This emphasises that the species diversity in the district is not well recorded and that it is quite diverse with at least 22 species in the Omarama Stream catchment.

The upland bog and springs on the ridge at the south end of Ewe range had an excellent selection of aquatic fly specialists including a possibly undescribed species, which tends to key to *Ephydrella aquaria*. This appears to be the highest altitude record for *Ephydrella aquaria*. In addition there were also excellent populations of the large grey undescribed *Spilogona* (house fly) species, which were observed to be visiting the *Euphrasia* readily along the sides of the spring.

Two main types of wetland vegetation were apparent in the upper reaches of the Little Omarama Stream and the eastern Ewe Range tributary creek, where the track to the ridge in constructed to the north of it. Insects were swept from *Scheonus* at both the less disturbed south side spring at Berwen Saddle and on Twinburn. Apart from the presence of a plant hopper no other insect was associated with this plant at Berwen Saddle.

2.6 Public Recreation

2.6.1 Physical Characteristics

Berwen Pastoral Lease occupies the entire western face of the Ewe Range, rising from 500m in the valley floor to 1800m on the top of the Range. The lease also occupies the northern end of the Hawkdun Range where it rises to 1850m.

The Little Omarama Stream flows northwards along the valley floor in the northern part of the lease, joining the Omarama Stream within the lease and continuing to flow northwards past the homestead. In the southern part of the lease streams flow southwards into the Manuherikia River. Between the northern and southern sections of the lease there is a high saddle known as Berwen Saddle.

The lease is principally steep hill country with incised stream beds. There is a small area of flats around the homestead at the northern end of the lease and a larger area of flats in the Little Omarama Stream valley.

2.6.2 Legal Access

The Berwen Road provides legal access to the homestead from State Highway 8. The legal road continues around the western side of the lease, diverts away from the lease at the Twinburn homestead and then returns to follow the western edge of the lease close to Berwen Saddle.

A marginal strip is laid off adjacent to Omarama Stream near the Berwen homestead and it is recognised that a marginal strip will apply on the rest of Omarama Stream within the lease.

2.6.3 Activities

Recreational activities on Berwen have been undertaken in conjunction with the adjoining leases, particularly Twinburn and Dunstan Peaks. The activities have included extended 4wd, tramping, mountainbiking, horseriding and cross-country skiing trips. The Ewe Range, Berwen Saddle and the Hawkdun Range have been the focus of these trips.

The route along the Mt Ida Water Race to its intake in Johnstons Creek in the southern part of the lease has also been used. This route provides good access in to the southern part of the lease from the Manuherika River

PART 3

OTHER RELEVANT MATTERS & PLANS

3.1 Consultation

At a meeting held with Non-Government Organisations in Timaru on 26 September, 2001 it was commented that the Camp Creek Track through the adjoining property to the southern part of Berwen appeared to be the original dray track and would provide good access to the area. It was recommended that all of the Hawkdun Range including the Manuherikia faces be protected because of the presence of extensive tussock grasslands and because of the regular use of this area by 4wds, trampers, cross-country skiers, horse riders and mountain bikers.

A written submission from the Federated Mountain Clubs also supported protection of all the southern block of the lease and, further, recommended protection of the upper part of the Little Omarama Stream catchment. FMC called for access to be provided along the Ewe Range crest and down a track into the Little Omarama Stream valley.

3.2 District Plans

Berwen pastoral lease lies within the Rural S (Rural Scenic) Zone in the Waitaki District. The Rural Scenic Zone contains areas of the District which have significant scenic values – the high country, rangelands and inland basin areas. The majority of this zone lies above the 400 m contour (a.s.l).

The proposed Waitaki District Plan was publicly notified in December 1996. Following public submissions and hearings on the proposed plan, the District Plan as amended by Council decisions was released in September 1999. The Plan establishes what sort of activities are Permitted, Controlled, Discretionary or Non-complying. The Plan also establishes Site Development Standards and Critical Zone Standards for these activities. A permitted or controlled activity that does not comply with any one or more of the Site Development Standards becomes a restricted discretionary activity. However, the Plan has undergone a number of changes in the Rural Scenic Zone following Council's decisions on submissions and a number of matters are still to be resolved.

3.3 Conservation Management Strategies

Berwen is within the Waitaki Unit of the Canterbury Conservation Management Strategy. The key priorities for this unit are:

- To identify, maintain and seek to enhance the natural landscapes and natural landscape values of the unit – through appropriate methods such as tenure review and district plans.
- To identify the significant native vegetation and threatened species of the unit and to use a range of effect methods to protect a representative range of indigenous biodiversity of the unit as well as protecting and enhancing the viability of priority threatened species populations and their habitats in the unit.
- For recreation and access the Conservancy's objectives are to provide new recreational facilities and opportunities by the Department and other organisations and concessionaires where natural and historic resources and cultural values are not compromised, and to liaise with adjacent landholders to resolve conflicts over access for recreation to land managed by the Department.

- To reduce and maintain rabbit and thar densities to levels that ensure their adverse effects on natural values are minimised.

Other priorities identified in the CMS that are Conservancy wide and relevant to tenure review on these properties are – to undertake necessary actions to secure the conservation of Category A and B species, including predator control, fencing and habitat protection.

PART 4

MAPS ETC.

4.1 Additional information

4.1.1 References

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4.2 Illustrative Maps

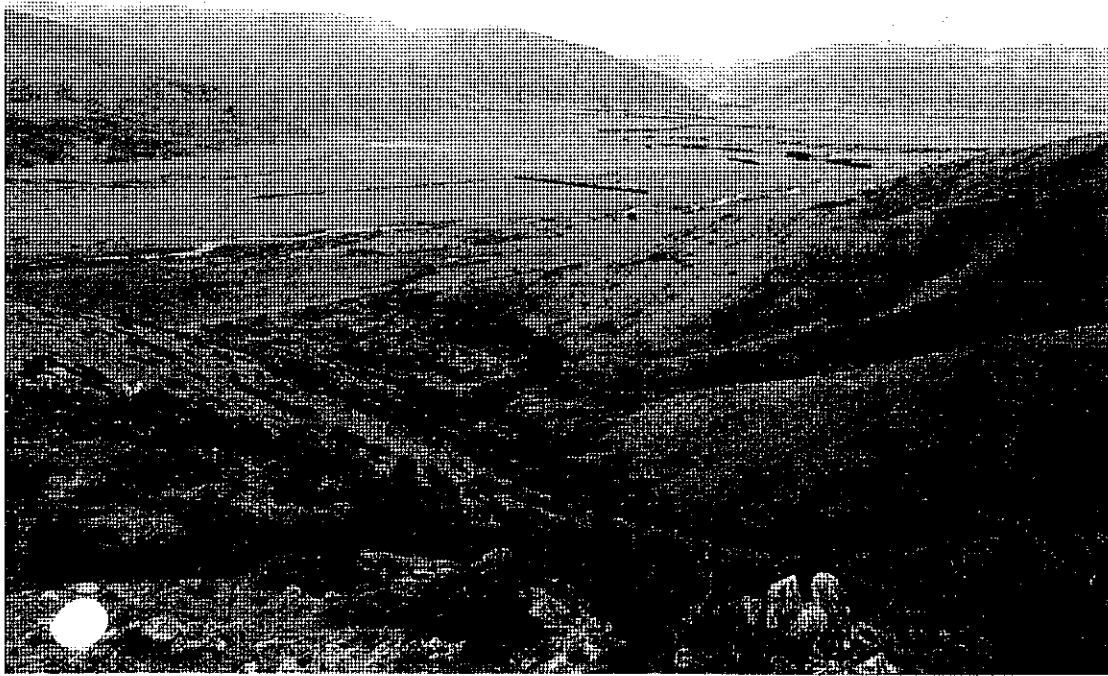
4.2.1 Topo/Cadastral (attached)

4.2.2 Values (attached)

Berwen Pastoral Lease

"RELEASED UNDER THE OFFICIAL INFORMATION ACT"

P1 Slopes of Ewe Range north of Berwen



P2 View south along Ewe Range to head of Omarama Stream and Hawkdun Range



P3 Narrow-leaved snow tussock and matagouri shrubland with introduced grassland. Ewe Range.



P4 Ewe Range with introduced grassland and hard tussock



P5 Ewe Range –mountain tussock at 1085 m with narrow leaved snow tussock, golden speargrass, sweet vernal, white clover, blue tussock, king devil hawkweed, native daphe, Seieranthus uniflora, etc



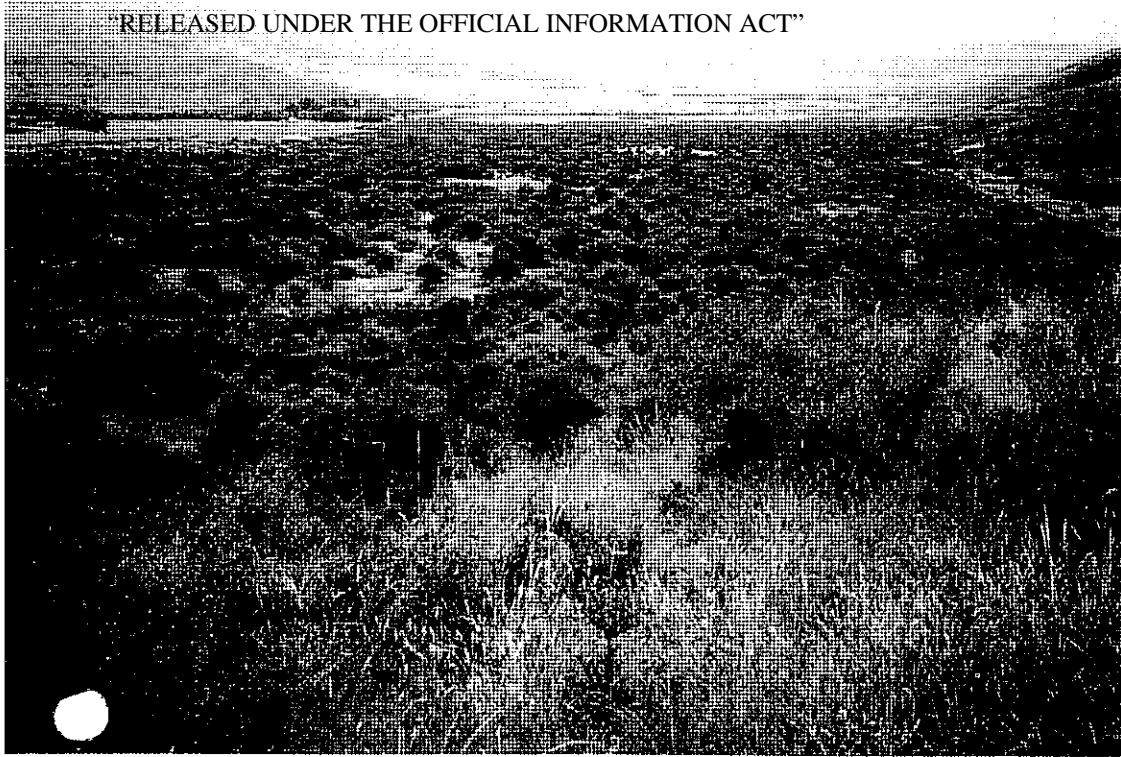
P6 Low stature narrow leaved snow tussockland on top of Ewe Range



Berwen Pastoral Lease

"RELEASED UNDER THE OFFICIAL INFORMATION ACT"

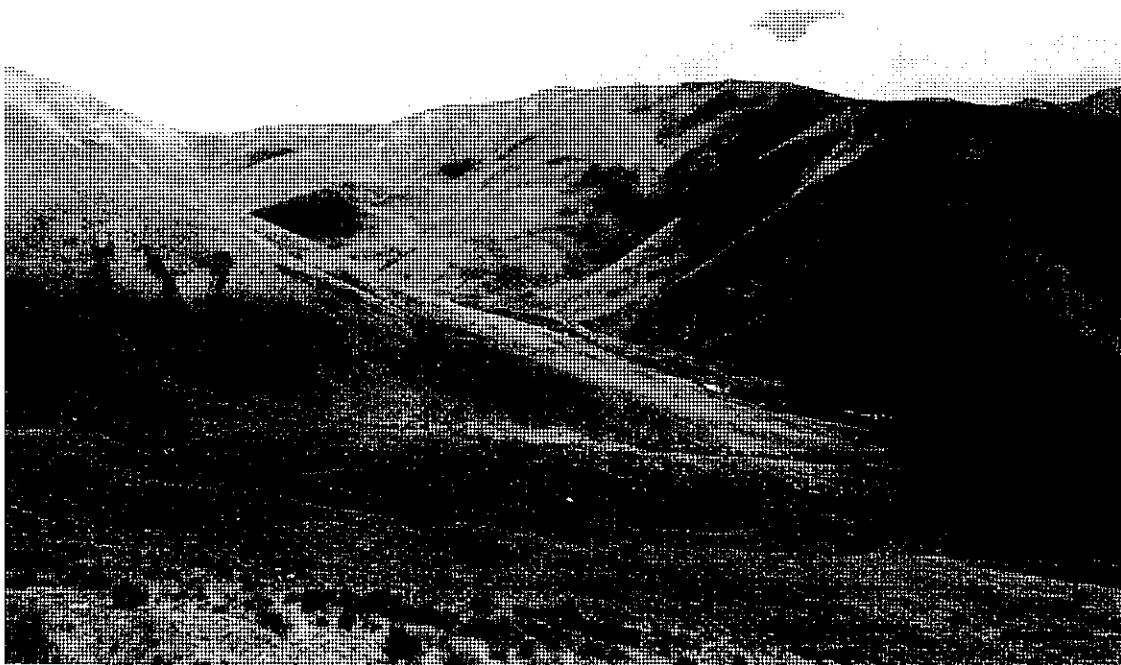
P7 Matagouri shrubland in Omarama Stream with *Olearia odorata*, *Coprosma propingu*, sweet briar, *Melicytus* sp. Silver tussock, Introduced grasses, etc



P8 View to the floor of Omarama Valley and shrublands

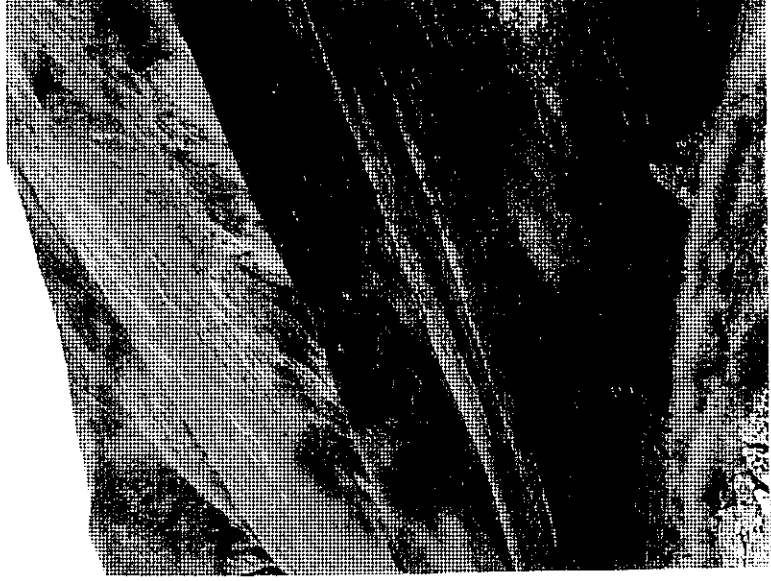


P9 Head of Omarama Stream, shrublands, grasslands and snow tussock.

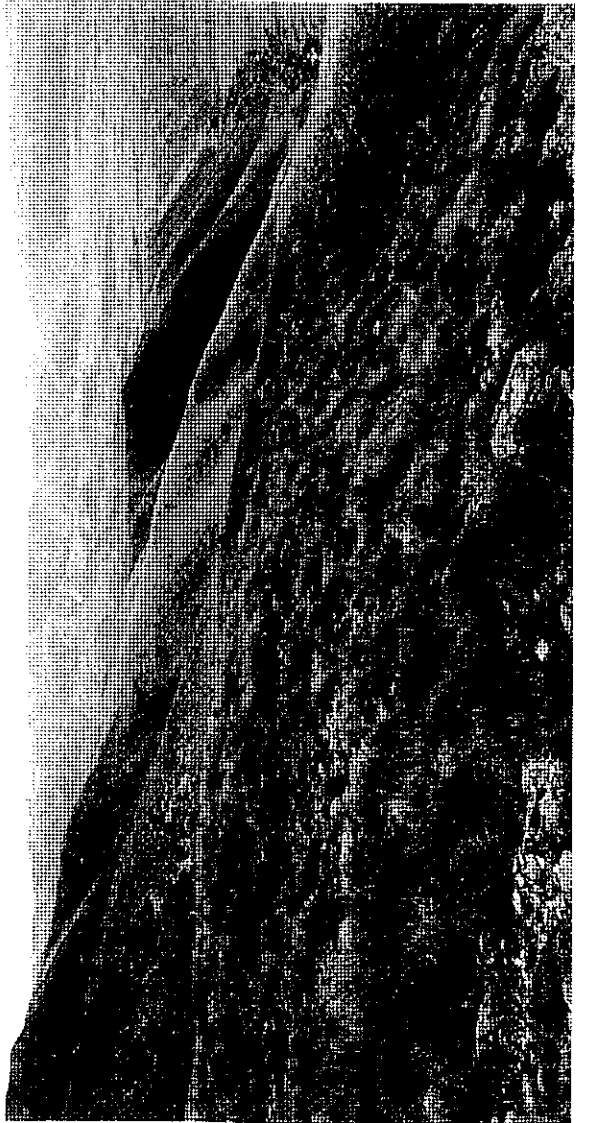


Berwen Pastoral Lease

P10 Head of Omarama Stream, Ewe Range and Hawkdun Range



P11 Head of Omarama Stream and narrow-leaved snow tussock near the saddle



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