Manorburn Conservation Area: vegetation assessment

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1. Summary

1.1 The Manorburn Conservation Area, an area of c. 6 x 2 km, at 840 - 980 m altitude in the upper Manor Burn catchment, inland Otago, contains tussock grassland and wetland vegetation types in good condition and representative of upland parts of the Manorburn Ecological District.

1.2 Compared with the Greenland RAP (Recommended Area for Protection) which adjoins down valley, the Manorburn Conservation Area has a lesser representation of rock outcrop, heath pavement, and scrub veg etation, a comparable presence of sunny scarp turf and of dense wetland red tussock, and a greater area of moss and sedge wetlands. Whereas Greenland RAP has predominant tussock grassland of red and hard tussock, Manorburn Conservation Area is at a sufficiently higher altitude for the main grasslands to be a mixture of narrow-leaved snow tussock with red tussock and hybrids.

1.3 The Manorburn Conservation Area does not contain the full diversity of vegetation types present in the Greenland RAP, nor does it alone represent the altitudinal sequence of tussock grassland and wetland types that are present in the two areas combined. It is a valuable adjunct to the Greenland RAP, rather than an optional area for biological and landscape conservation.

2. Introduction

The Manorburn Conservation Area is a block of upland tussock country recently purchased by the Department of Conservation. It occupies the uppermost head of the Manor Burn, within the Manorburn Ecological District, adjoining and immediately upstream of the Greenland RAP (Recommended Area for Protection). This RAP has been the subject of a Designation by the Minister of Conservation, and subsequent discussions and negotiations towards protection of its conservation values.

Botanical survey of the Manorburn Conservation Area was requested by DoC, with an emphasis on making comparisons with vegetation within the Greenland RAP.

3. Background

The PNA (Protected Natural Area) survey of the Manorburn Ecological District (Fagan & Pillai 1989), provides a broad overview of the District, although the land covered by the Manorburn Conservation Area was not then

available for study. Two other botanical studies are relevant to the present report. The report of Johnson (1986) concentrates on wetlands across the south ends of three runs: Little Valley, Matangi and Mt Campbell. That report lists the flora and describes the general sequences of vegetation types including lake-edge, valley floor, and hillside communities. A more detailed analysis of vegetation types within Greenland RAP is provided in Johnson (1995).

4. Objectives

4.1 To assess the extent and representation within the Manorburn Conservation Area of the key communities identified on the Greenland RAP.

4.2 To base the comparison on the report by Johnson (1994): Little Valley - Greenland RAP: vegetation assessment.

5. Methods

Field survey was undertaken on 25 May 1995 in the company of Mike Clare, Brian Patrick, Neill Simpson (all of DoC Otago Conservancy), and Peter McIntosh (Landcare Research). Access was by vehicle to the south west corner of the block. I walked half the length of the main valley then briefly examined the north-western quarter. Weather was clear and calm; cold enough for the bog surfaces to be frozen, and the sun sufficiently low at this time of year to make for some difficulty in recognising smaller herbs between tussocks.

We recorded the flora, abundance, and principal habitats of vascular plants, bryophytes, and lichens. Semi-quantitative descriptions were made of all vegetation types encountered. Air photos were used to locate a "window" area representative of vegetation and habitat diversity. This "window"-700 x 500 m to match similar ones done on the Greenland RAP Johnson, 1994)-was mapped and used as a baseline for ground-truthing air photo interpretation.

Vertical air photos used were those which happened to be available at Landcare Research in Dunedin. They were:

- Survey 293, Runs 988/ 9-11, 989/ 8-10; dated 1945, a relatively old but low altitude set.

- Survey SN 8215, photos B7 - B9; dated 1984, a high altitude run.

Stereo-viewing of these photos was used as follows:

(a) To establish comparability between 1945 and 1984 photographed vegetation patterns, and 1995 field observations;

(b) To interpret vegetation types in the Manorburn Conservation Area relative to those at known sites within the Greenland RAP;

(c) To estimate percent cover of vegetation types. This was done within 500 x 500 m grids drawn upon the air photos, 46 such grid squares covering the Manorburn Conservation Area, and enabled mean cover values to be derived for the area as a whole, as well to illustrate gradation in vegetation type cover within four zones, running north to south up the Manor Burn.

6. Results

6.1 LANDFORM AND VEGETATION PATTERN

The Manorburn Conservation Area (Fig. 1) is a block of c. 6 x 2 km, comprising the very head of the Manor Burn. Altitudinal range is from 840 m to 980 m. The main valley floor is very gentle, falling only about 40 m over 5 km. Tussocky and boggy wetlands occupy the 50-100 m width of the main valley and extend up all the tributary streams. Intervening tussocky hills are gently rolling across the crests but with somewhat steeper scarp flanks. Fig. 2 illustrates the main vegetation and landform pattern in more detail.

6.2 FLORA

Plant species are listed in the Appendix. The flora is a diverse assemblage that is fairly representative of upland tussock grasslands and wetlands. By comparison with the plant list from the slightly lower country immediately to the north (Johnson 1986), the Manorburn Conservation area has a lesser representation of several elements of the native flora, especially some of the shrub species, lake-edge plants typical of Greenland Reservoir, and certain species more typical of lower and drier country, e.g. several *Raoulia* species. Instead the uppermost Manor Burn has scattered plants of species that would be more common on even higher ground (if it were present in the vicinity), e.g. *Celmisia viscosa, C argentea,* and *Gingidia baxterae*.

The native flora of "higher" plants comprises 124 species. Only 15 naturalised species were recorded, most of them rare or occasional in the area. The most common naturalised plants are sweet vernal *(Anthoxanthum odoratum),* browntop *(Agrostis capillaris),* and catsear *(Hypochoeris radicata).* Mouse-ear hawkweed *(Hieracium pilosella)* is only occasional in abundance.

Three plant species listed nationally as threatened (Cameron et al., 1995) are present. They are (with their threat categories): *Deschampsia caespitosa* (Vulnerable), *Ranunculus ternatifolius* (Vulnerable), and *Carex "tenuiculmis"* (Indeterminate). All occur in the main valley wetlands.

6.3 SUMMARY DESCRIPTIONS OF VEGETATION AND HABITAT TYPES

These are numbered and named the same as those described for Greenland RAP (Johnson, 1994), but with additional or in some cases replacement vegetation types for comparable habitats.

1. Tors

Schist tors are small, very scattered, and restricted to the north end of the Manorburn Conservation Area, close to the main valley sides.

2. Turf near tors

This vegetation type, on thin stony soil, with turf especially of *Leptinella, Scleranthus,* mosses, and lichens was not recorded in the Manorburn Conservation Area.

3. Heath pavement

Appearing as dark splodges, often circular on the air photos; dominated by the dark-leaved mat heath, *Pentachondra pumila,* restricted to a few hill crests and gentle upper slopes at the northern end of the Manorburn Conservation Area. Much less common than in the Greenland RAP

4. Sunny scarp turf

Scarp faces of generally northern aspect are widespread, having a relatively sparse tussock cover and a predominance of low growing heaths and mat herbs. In the Manorburn Conservation Area the typical vegetation composition is *Chionochloa rigida 20%* cover, *Poa colensoi 15%, Raoulia subsericea 20%, Gaultheria* and *Leucopogon* species *20%, Herpolirion novaezelandiae,* and *Stackhousia minima.* This community contains many other small species, yet is probably less diverse, and more tussocky than similar habitats within Greenland RAPThis is the only habitat in the Manorburn Conservation Area with much proportion of bare soil (and then only to about 5% cover), but most bared soil has a cover of crustose lichens (e.g. *Baeomyces).* This is the principal habitat of mouse-ear hawkweed, present as scattered plants at around 5% cover.

5. Bluffs

As with tors (1 above), these are extremely small and localised within the north end of the block within the main valley.

6. Scrub

There is no scrub vegetation to speak of, but merely very scattered individuals of a few shrub species.

7. (Raoulia/ short tussock grassland on crests)

This vegetation type (of Greenland RAP) upon convex hill crests having relatively shallow soils is represented in the Manorburn Conservation Area by vegetation with a high proportion on narrow-leaved snow tussock, much less hard tussock, and less *Raoulia*. It is thus better termed:

7A. Chionochloa rigida/ blue tussock grassland

Typical composition is: *Chionochloa rigida* 50% cover, blue tussock *(Poa colensoi)* 25%, *Pentachondra pumila* 15%, *Raoulia subsericea* 5%, with lesser presence of *Lycopodium fastigiatum, Leucopogon fraseri,* and minor herbs.

8. Red/ hard/ blue mixed tussock grassland

Again, this grassland type, extensive upon the many convex to planar midslopes, has a somewhat different composition to that in Greenland RAP, with a lesser proportion of red and hard tussock and a much greater proportion of narrow-leaved snow tussock and blue tussock in Manorburn Conservation Area. Thus the vegetation type becomes:

8A. C rigida/ red/ blue tussock grassland

Typical composition is: *Chionochloa rigida* 50% cover, red tussock *(C. rubra)* 10%, hybrids between them (to about 10%), blue tussock *(Poa colensoi)* 15%, hard tussock 5%, and ground herbs 5-10%. This vegetation type typically has 100% ground cover. It is the most abundant vegetation type, relatively uniform in composition, although slightly variable in abundance of tall tussocks, these being most dense on shady scarps.

9. Dense wetland red tussock grassland

This occupies parts of the boggy main valley floors as well as beds of tributaries. Red tussock reaches about 70% cover, and can be associated with swards of *Carex coriacea,* browntop *(Agrostis capillaris), Sphagnum* or *Polytrichum* mosses. Relatively pure red tussock is less extensive here than in the Greenland RAP, especially because the Manorburn Conservation Area has a lesser representation of broad headwater basins of tributary stream courses.

10. Sphagnum bog, 11. Sedge wetland, and 12. Moss wetland

In the Greenland RAP (Johnson 1994) it was possible to map these three wetland types separately, using low-level colour air photos. The scale of black and white air photos used for the present study does not show such distinction readily. Furthermore within the Manorburn Conservation Area, the three wetland types form part of a mosaic that is actually more complex on the ground; hence all wetland contribution to total area has been assessed in an overall manner (Tables 2 and 3).

The broad wetland pattern within Manorburn Conservation Area is as follows. *Sphagnum cristatum* bog accounts for about half the area of valley floor wetlands, growing in association with *Carex gaudichaudiana* and *Luzula*

leptophylla. On the wettest ground *Carex echinata* is codominant with the *Sphagnum cristatum*. Better-drained peaty alluvium near the main stream has swards of *Carex coriacea*. Less soggy peat of the valley edges and tributary streams has increasing cover of comb sedge *(Oreobolus pectinatus)* and the driest peat sites can have mats of *Dracophyllum politum* and the mosses *Dicranum* and *Racomitrium*. Steep wet side stream beds can be dominated by *Sphagnum squarrosum*, while *S. falcatulum* becomes common in bog puddles.

Patches of red tussock and clumps of *Juncus conglomeratus* are scattered through all the main valley floor wetlands. Pools may contain *Potamogeton cheesemanii* and *Myriophyllum propinquum*. The meandering main valley stream has aquatic mats of *Callitriche petriei*, and *Juncus novae-zelandiae* on the banks, both notably common.

6.4 COMPARISON OF MANORBURN CONSERVATION AREA WITH GREENLAND RAP

Table 1 sets the scene for this comparison. Repeated from Johnson (1994) it shows the vegetation types, their percentage area, and their relationship to landform in the Greenland RAP, as they were assessed firstly by the PNA survey (Fagan & Pillai 1989), and secondly by more detailed study, assisted by colour air photos, by Johnson (1994).

Table 2 takes the comparison on to the Manorburn Conservation Area, wherein the main points of difference are:

1. Fewer tors and the lack of associated turf vegetation surrounding tors.

2. Less incised topography, with far fewer bluffs, and the virtual absence of scrub vegetation (other than scattered shrubs of a few species).

3. A lesser area of heath pavement (1% cf. 4% overall).

4. A slightly greater relative area of sunny scarp turf (4% of Greenland RAP; 6% of Manorburn Conservation Area), a vegetation/ habitat type which contains more tussock cover and less diversity of turf plants in the latter.

5. A change in composition of hill crest grassland from Raoulia/ short tussock (10% of Greenland RAP) to Cbionocbloa rigida/ blue tussock (14% of Manorburn Conservation Area).

6. A change also in composition of the tall tussock grassland type which dominates both areas, from a red/ hard/ blue tussock type (58% of Greenland RAP) to red/rigida/ blue tussock (57% of Manorburn Conservation Area).

7. A somewhat lesser amount of dense red tussock grassland (18% of Greenland RAP; 11% of Manorburn Conservation Area), and a tendency for this to be mainly in the valley beds.

Manorburn Conservation Area).

Just as there are differences between these two areas, so also there is a gradient of vegetation change within the Manorburn Conservation Area. Table 3 shows the percent contribution of vegetation types within four zones (see Fig. 1), running from north to south towards the Manor Burn Head. Heath pavement is represented mainly at the north end of the block (zone A). Sunny scarp turf decreases in importance from zone A to zone D, and so does the crest tussock grassland type of *C. rigida*/ blue tussock. The main grassland type (red/ *rigida*/ blue tussock) almost doubles its relative cover from zone A to D. Wetland types, including dense red tussock are relatively constant in cover contribution through the zones.

7. Conclusions

The Manorburn Conservation Area is a valuable addition to the conservation estate insofar as it appears to be representative of the upland portion of the Manorburn Ecological District, and it contains a diversity of tussock grassland and wetland vegetation and habitats. The vegetation is in good condition as measured by the general lack of bare soil, the lack of intensive agricultural development, and the relatively low number and low importance of naturalised plants. As an area for protection it has tidy catchment boundaries, and undoubted landscape appeal.

In relation to current negotiations and procedures towards gaining conservation protection of the Greenland RAP a key question is to what extent the Manorburn Conservation Area might duplicate the conservation values of the Greenland RAP. From a vegetation perspective there is a general similarity between the two areas, and the sharing of many vegetation types notwithstanding the greater representation of several types in one or other area.

The major point to consider is the extent to which the two areas potentially contribute to the protection of the gradient in vegetation types. Taking a very broad view of the Manorburn Ecological District, the gradient can be seen as running from a semi-arid inland basin, very gradually as altitude increases to the south and east, to much cooler and wetter uplands. The corresponding gradient in predominant vegetation is, in simple terms, from (now much modified) lowland short tussock grasslands and shrublands, to hard tussock, then intergrading with red tussock grasslands, then to narrow-leaved snow-tussock, with increasing amounts of blue tussock, and on the highest country to slim snow tussock *(Chionochloa inacra*; not seen in the present study but probably present to some extent in the uppermost Manor Burn). Despite the diversity and complexity of the wetland vegetation, this also illustrates something of the overall gradient, for example, by a trend from bogs containing tall hedges *(Carex diandra, Schoenus pauciflorus, Eleocharis acuta)* at relatively lower altitudes, to those typical of the Manorburn Conservation Area where short sedges *(Carex echinata, C. gaudichaudiana)* are dominant, along with increasing abundance of *Sphagnum* species.

Because this land rises so gently, the gradient in climate, soils, and vegetation change is very gradual, but herein lies part of the biological conservation value of the whole district.The gradual change in relative abundance of vegetation types and their composition is illustrated within part of this overall gradient, by Table 3, illustrating the change within the 6 km length of the Manorburn Conservation Area. Might this area then be sufficient to protect an example of the gradient? My conclusion is that on its own the Manorburn Conservation Area contains a good representation of the upland part of the sequence, where narrow-leaved snow-tussock, red tussock, and their hybrids are dominant in the vegetation, but it does not include the next lower portion of the sequence, the red/ hard tussock type which is so characteristic of the Greenland RAP

Together, the Manorburn Conservation Area and the Greenland RAP make for a more robust, diverse, and representative prospect to serve biological conservation, than would either area on its own. Neither area could readily be seen as totally standing in for the other.

References

Cameron, E. K.; de Lange, P. J.; Given, D. R.; Johnson, P. N.; Ogle, C. C. 1995. New Zealand Botanical Society, Threatened and Local Plant Lists (1995 Revision). *New Zealand Botanical Society Newsletter (March 1995)* No. 39:15-28.

Fagan, Brent; Pillai, Dhana, 1989: Manorburn Ecological District. Survey Report for the New Zealand Protected Natural Areas Programme. 117 pp.

Johnson, P N. 1986: Manorburn wetlands: botanical report. Botany Division, DSIR, unpublished report. 18 pp.

Johnson, P N. 1994: Little Valley - Greenland RAP: vegetation assessment. Landcare Research Contract Report LC 9394/103. 22 pp.

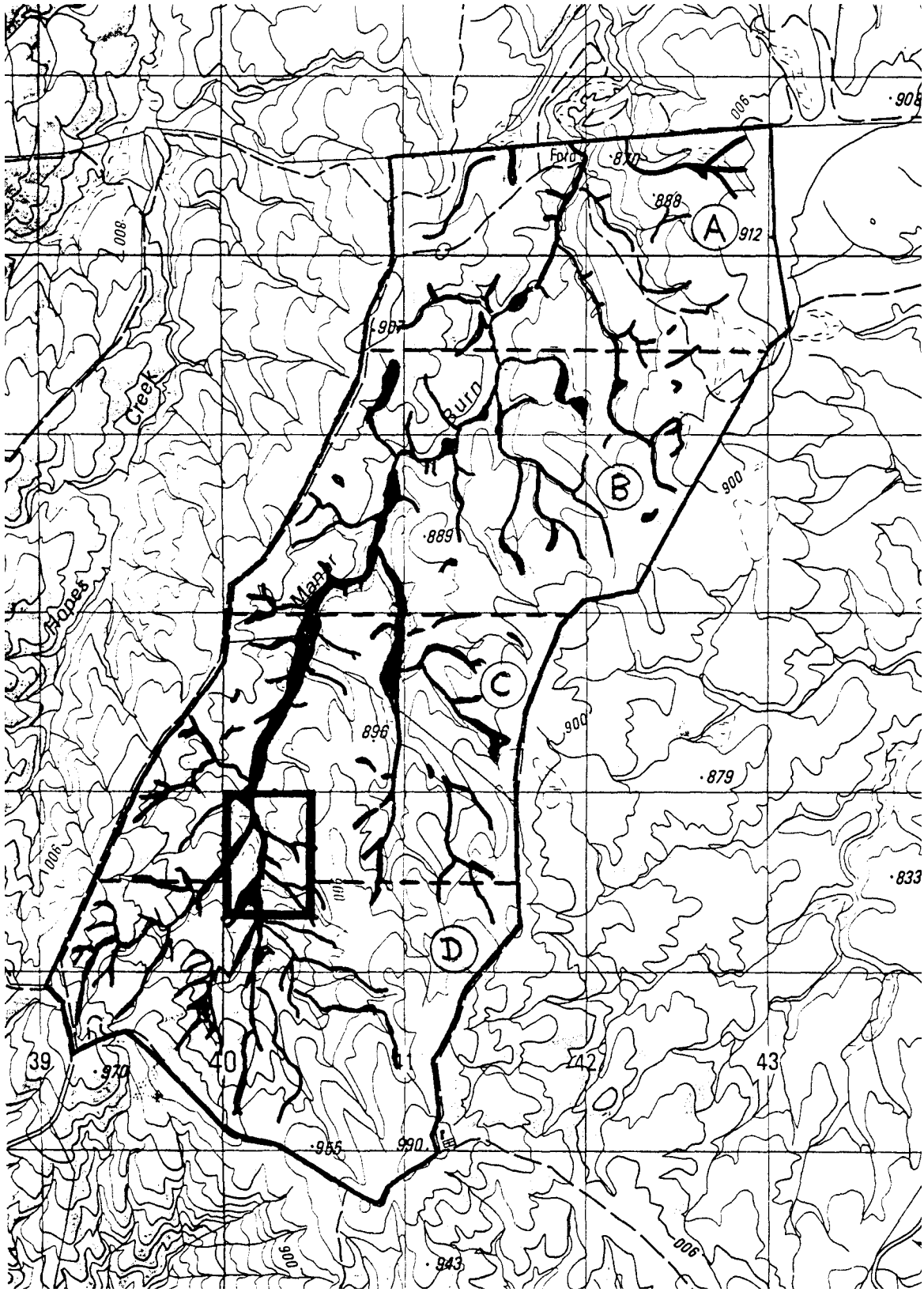

Fig. 1 Manorburn Conservation Area, enlarged x 1.5 from NZMS 260, map sheet G43, showing distribution of wetlands (blackened), division zones A to D (dashed lines; refer to Table 3), and location of "window" mapped in Fig. 2 (dark rectangle).

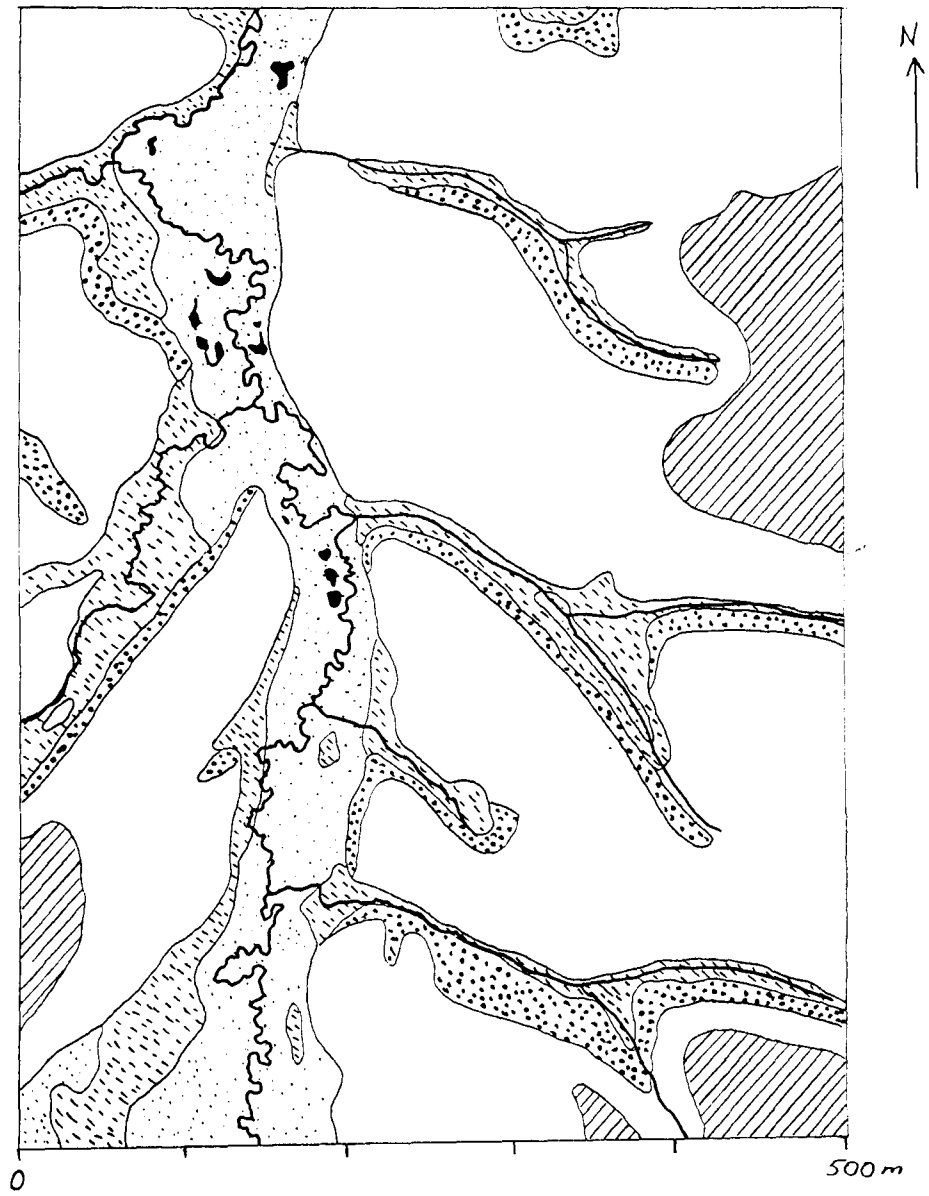

Fig. 2 Vegetation pattern within a 700 x 500 m "window" in southern part of main valley of Manorburn Conservation Area.

Table 1. Comparison of Greenland RAP vegetation types as outlined in Manorburn PNA Report (Fagan & Pillai 1989) with those recognised in 1994 air photo interpretation and field check. (From Johnson, 1994)

PNA SURVEY SUMMARY		1994 STUDY		
Vegetation types	% of RAP	Landform	Vegetation and habitat types	% of RAP
Chionochloa rubra tussockland	75	Hill slope Hill crest Gentle hollow Flood plain Talus slope	8. Red/ hard/ blue tussock 9. Dense wetland red tussock	58 18
Festuca short tussockland	15	Hill slope Hill crest	7. Raoulia, short tussock 2. Turf near tors 3. Heath pavement	10 2 4
Coprosma petriei - Raoulia subsericea dwarf shrub turf	5	Nivation hollow	4. Sunny scarp turf	4
Chionochloa rubra - Coprosma ciliata shrub tussockland	1	Talus slope	6. Scrub	1
Turf vegetation	2	Lakeshore	(not included in this assessment)	
Carex/ Sphagnum bog	1	Bog	10. Sphagnum bog 11. Sedge wetland 12. Moss wetland	1 <1 1
Oreobolus-Phyllachne cushionfield	<1	Hill slope	(minor type not (distinguished)	
		Rock outcrops	1. Tors 5. Bluffs	<1 1

Table 2. Comparison of vegetation types, and their % cover in Greenland RAP and Manorburn Conservation Area.

GREENLAND RAP			MANORBURN CONSERVATION AREA	
Vegetation types		cover		cover
1.	Tors	<1		
2.	Turf near tors	2		
3.	Heath pavement	4		1
4.	Sunny scarp turf	4		6
5.	Bluffs	1		
6.	Scrub	1	-	
7.	Raoulia/ short tussock	10	C. rigida/blue tussock	14
8.	Red/hard/blue tussock	58	Red/rigida/blue tussock	57
9.	Dense wetland red tussock	18		11
10,11,12.	Moss, sedge wetlands	2		11

Table 3. Percent cover of main vegetation types within four zones representing a north to south sequence within the Manorburn Conservation Area.

		Zones			
Vegetation type		A	B	C	D
3.	Heath pavement	7	1	0	0
4.	Sunny scarp turf	10	8	7	2
7.	C. rigida/blue tussock	25	17	12	6
8.	Red/rigida/blue tussock	38	53	61	72
9.	Dense red tussock wetland	11	10	10	9
10,11,12.	Moss, sedge wetlands	9	11	10	11

Appendix

Plant species recorded from Manorburn Conservation Area, May 1995, by P N. Johnson, N. Simpson, and B. H. Patrick.

ABBREVIATIONS:

* = naturalised (not native)

Abundance:
a = abundant
f = frequent
o = occasional
r = rare

Principal habitats:
G = tussock grasslands
W = wetlands
S = sunny scarps
T = tors

MONOCOTS

*	*Agrostis capillaris*	f	G	creeping bent
	Agrostis muscosa	o	G	
*	*Anthoxanthum odoratum*	a	G	sweet vernal
	Carex breviculmis	o	G	
	Carex coriacea	f	W	rautahi
	Carex diandra	o	W	
	Carex echinata	f	W	
	Carex gaudichaudiana	a	W	
	Carex secta var. *tenuiculmis*	r	W	
	Carex wakatipu	o	G	
	Carpha alpina	o	W	
	Chionochloa rigida	a	G	narrow-leaved snow tussock
	Chionochloa rubra ssp. cuprea	a	G	red tussock
	Deschampsia caespitosa	r	W	
	Deyeuxia avenoides	o	G	
	Festuca novae-zelandiae	f	G	hard tussock
*	*Festuca rubra* subsp. *commutata*	r	W	Chewings fescue
*	*Glyceria declinata*	r	W	floating sweet grass
	Herpolirion novae-zelandiae	f	S	grass lily
	Isolepis aucklandica	o	W	
	Juncus conglomeratus	f	W	
*	*Juncus effusus*	o	W	
	Juncus novae-zelandiae	o	W	
	Lachnagrostis lyallii	o	W	
	Luzula leptophylla	f	W	
	Luzula rufa	o	G	woodrush
	Oreobolus pectinatus	a	W	comb sedge
*	*Poa annua*	r	G	annual poa
	Poa breviglumis	r	T	

	Poa colensoi	a	G	blue tussock
*	*Poa pratensis*	o	W	meadow grass
	Potamogeton cheesemanii	r	W	pondweed
	Prasophyllum colensoi	r	G	leek orchid
	Rytidosperma gracile	f	G	
	Rytidosperma pumilum	o	W	
	Uncinia divaricata	r	W	
	Uncinia purpurata	o	G	
	Uncinia rubra	o	W	

DICOTS

	Abrotanella caespitosa	o	W	
	Acaena caesiiglauca	f	G	bidibid
	Acaena fissistipula	o	W	
	Acaena profundeincisa	o	G	
	Aciphylla aurea	r	G	speargrass
	Anisotome aromatica	f	G	
	Anisotome flexuosa	r	G	
	Anisotome "prostrata"	f	W	
	Bracbyglottis bellidioides	r	G	
	Bracbyscome bumilis	r	S	
	Callitricbe petriei	f	W	
	Cardamine debilis	o	W	
	Cassinia vauvilliersii	r	G	cottonwood
	Celmisia argentea	r	W	
	Celmisia gracilenta	f	G	
	Celmisia viscosa	r	G	
	Celmisia sp. *rhizomatous*	r	W	
*	*Cerastium fontanum*	r	G	mouse-ear chickweed
	Chionohebe densiflora	r	S	
	Colohanthus strictus	o	S	
	Coprosma cheesemanii	o	G	
	Coprosma perpusilla	f	S	
	Coprosma petriei	o	S	
	Craspedia sp.	r	G	
	Dracophyllum politum	o	W	
	Drosera arcturi	f	W	sundew
	Epilohium alsinoides	o	G	
	Epilohium brunnescens	o	W	
	Epilohium pubens	r	T	
	Forstera tenella	r	G	
	Galium perpusillum	o	W	
	Gaultheria depressa var. *novae-zelandiae*	f	S	snowberry
	Gaultheria macrostigma	f	S	
	Gaultheria nubicola	f	S	
	Gaultheria parvula	o	W	
	Gentiana amahilis	o	W	
	Gentiana grisehachii	o	W	

	Geranium microphyllum	f	G	
	Geum leiospermum	f	G	
	Gingidia baxterae	o	G	
	Gingidia decipiens	o	W	
	Gnaphalium laterale	f	W	
	Gnaphalium mackayi	o	W	
	Gonocarpus micranthus	o	W	
	Gunnera prorepens	o	W	
	Helichrysum bellidioides	f	S	
	Helichrysum filicaule	f	S	
*	*Hieraceum pilosella*	o	S	mouse-ear hawkweed
	Hydrocotyle heteromeria	r	G	
	Hydrocotyle novae-zeelandiae var. *montana*	o	G	
	Hydrocotyle sulcata	o	W	
*	*Hypochoeris radicata*	f	G	catsear
	Kelleria dieffenbachii	o	G	
	Kelleria laxa	r	G	
	Lagenifera cuneata	r	G	
	Leptinella mediana	o	W	cotula
	Leucopogon fraseri	a	S	patotara
	Leucopogon suaveolens	o	S	
	Montia fontana	o	W	blinks
	Muehlenbeckia axillaris	r	T	
	Muehlenbeckia complexa	r	T	pohuehue
	Myosotis forsteri	r	T	
	Myriophyllum propinquum	o	W	milfoil
	Neopaxia sp.	r	W	
	Nertera balfouriana	o	W	
	Nertera depressa	r	W	
	Oreomyrrhis colensoi	f	G	
	Oreomyrrhis ramosa	f	W	
	Oreostylidium subulatum	o	S	
	Olearia bullata	r	G	
	Pentachondra pumila	a	S	
	Phyllachne colensoi	r	W	
	Pimelea oreophila	r	G	
	Plantago raoulii	o	G	
	Plantago uniflora	f	W	
	Pratia angulata	f	W	panakenake
	Ranunculus cheesemanii	o	W	
	Ranunculus foliosus	f	G	
	Ranunculus glabrifolius	r	W	
	Ranunculus multiscapus	o	G	
	Ranunculus ternatifolius	o	W	
	Raoulia subsericea	a	S	
*	*Rumex acetosella*	o	G	sheep's sorrel
	Schizeilema cockaynei	o	W	
	Scleranthus brockiei	r	G	
	Scleranthus uniflorus	o	G	
	Stackhousia minima	f	S	
*	*Stellaria alsine*	o	W	bog stitchwort

	Stellaria decipiens	r	T	
	Stellaria gracilenta	o	T	
*	*Stellaria media*	r	G	chickweed
*	*Taraxacum officinale*	o	G	dandelion
*	*Trifolium repens*	r	G	white clover
	Viola cunninghamii	r	G	
	Wahlenbergia albomarginata	o	G	native harebell

FERNS AND LYCOPODS

Blechnum penna-marina	o	G	little hard fern
Cystopteris tasmanica	r	T	
Grammitis poeppigiana	r	T	
Lycopodium fastigiatum	a	S	clubmoss
Polystichum richardii	r	T	shield fern
Polystichum vestitum	r	T	prickly shield fern

MOSSES AND LIVERWORTS

Acrocladium sp.	f	W
Breutelia pendula	a	W
Dicranoloma billardieri	o	G
Dicranum scoparium	a	W
Drenanocladus sp.	o	W
Hypnum cupressiforme	a	G
Marchantia berteroana	o	W
Plagiochila sp.	o	W
Polystichum commune	a	W
Racomitrium lanuginosum	o	W
Sphagnum cristatum	a	W
Sphagnum falcatulum	f	W
Sphagnum squarrosum	f	W

LICHENS

Alectoria nigricans	r	T
Baeomyces heteromorphus	r	S
Bryoria austromontana	r	T
Caloplaca cf. *cribrosa*	r	T
Chrysothrix candelaris	r	T
Cladia aggregata	a	G
Cladina mitis	o	W
Cladonia chlorophaea sp.	f	G
Cladonia furcata agg.	f	G
Cladonia gracilis subsp. *tenerrimus*	r	G
Cladonia ramulosa ?	r	G
Cladonia rigida	o	G

Cladonia spp.	o	G
Dibaeis arcuata	o	S
Hypogymnia lugubris	o	S
Lecanora epibryon ssp. *broccha*	a	G
Lecanora pruinosa	r	T
Lepraria incana	r	T
?*Micarea* sp.	r	T
Neuropogon acromelanus	r	T
Parmelia signifera	r	t
Parmelia sulcata	r	T
Peltigera didactyla (= *spuria*)	r	G
Peltigera dolichorhiza	r	G
Peltigera polydactylon	r	T
Pertusaria sp cf *dactylina*	r	S
Pertusaria sp.	r	T
Pseudocyphellaria crocata	r	G
Pseudocyphellaria maculata	r	G
Psoroma hirsutulum	o	G
Siphula decumbens agg.	r	S
Stereocaulon ramulosum	r	S
Teloschistes fasciculatus	r	T
Thamnolia vermicularis	r	T
Umbilicaria cylindrica	r	T
Umbilicaria polyphylla	r	T
Usnea torulosa	r	T
Usnea sp.	o	G
Xanthoria candelaria	r	T