ECOLOGICAL REGIONS AND DISTRICTS OF NEW ZEALAND

THIRD REVISED EDITION IN FOUR 1:500 000 MAPS

Booklet to accompany SHEET 4:
descriptions of Districts in the southern South Island from Browning to Snares; also southern islands not shown on map.

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ABSTRACT

New Zealand's 268 ecological districts in 85 ecological regions are listed and an introduction describes the concept, definitions, the districts shown on each of the four map sheets, the format and content of the prescriptions (printed on the maps), descriptions of each district and acknowledgements to the large number of contributors of scientific information. A glossary defines certain words and abbreviations used in the text and lists common plant and animal names used, together with their scientific names. Ecological descriptions of the districts shown on each map sheet are given in the booklet accompanying that sheet.

Keywords: New Zealand; maps; ecological districts; ecological regions; topography; geology; climate; soils; vegetation; flora, fauna.

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CONTENTS

LIST OF ECOLOGICAL REGIONS AND DISTRICTS OF NEW ZEALAND iii

INTRODUCTION x

Background

Definitions

The Biological Resources Centre and the
Ecological Regions and Districts Project xi

Other Uses of the Ecological Region and District Framework.

THE MAPS xii

Presriptions xiii

Descriptions

Acknowledgements xv

Future Amendments

GLOSSARY AND EXPLANATION OF TERMS xvi

General

Abbreviations

Geology xvii

Soils

Vegetation and Flora

Mammals xxi

Birds xxii

Reptiles

Frogs

Fish

Invertebrates

ECOLOGICAL DISTRICT DESCRIPTIONS

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LIST OF ECOLOGICAL REGIONS AND DISTRICTS OF NEW ZEALAND
AND THEIR CODE NUMBERS
DECEMBER 1986

Region	District	Code
KERMADEC	Kermadec	01.01
THREE KINGS	Three Kings	02.01
TE PAKI	Te Paki	03.01
AUPOURI	Aupouri	04.01
WESTERN NORTHLAND	Maungataniwha	05.01
	Hokianga	05.02
	Tutamoe	05.03
	Tangihua	05.04
EASTERN NORTHLAND	Eastern Northland and Islands	06.01
	Taranga	06.02
POOR KNIGHTS	Poor Knights	07.01
KAIPARA	Kaipara	08.01
AUCKLAND	Rodney	09.01
	Waitakere	09.02
	Tamaki	09.03
	Rangitoto	09.04
	Inner Gulf Islands	09.05
	Awhitu	09.06
	Manukau	09.07
	Hunua	09.08
COROMANDEL	Little Barrier	10.01
	Great Barrier	10.02
	Colville	10.03
	Mercury Islands	10.04
	Thames	10.05
	Tairua	10.06
	Waihi	10.07
	Te Aroha	10.08
	Mayor	10.09
WAIKATO	Meremere	11.01
	Hapuakohe	11.02
	Hauraki	11.03
	Hamilton	11.04
	Hinuera	11.05
	Maungatautari	11.06
	Waipa	11.07
TAINUI	Raglan	12.01
	Kawhia	12.02
	Herangi	12.03

NORTHERN VOLCANIC PLATEAU	Motiti	13.01
	Tauranga	13.02
	Otanewainuku	13.03
	Rotorua	13.04
	White Island	13.05
WHAKATANE	Te Teko	14.01
	Taneatua	14.02
	Opotiki	14.03
WESTERN VOLCANIC PLATEAU	Ranginui	15.01
	Pureora	15.02
	Tokoroa	15.03
CENTRAL VOLCANIC PLATEAU	Atiamuri	16.01
	Taupo	16.02
EASTERN VOLCANIC PLATEAU	Kaingaroa	17.01
	Whirinaki	17.02
TONGARIRO	Tongariro	18.01
RAUKUMARA	Waioeka	19.01
	Motu	19.02
EAST CAPE	Pukeamaru	20.01
	Waiapu	20.02
	Turanga	20.03
UREWERA	Waimana	21.01
	Ikawhenua	21.02
	Waikaremoana	21.03
WAIROA	Tiniroto	22.01
	Mahia	22.02
	Waihua	22.03
KING COUNTRY	Waitomo	23.01
	Taumarunui	23.02
TARANAKI	North Taranaki	24.01
	Matemateaonga	24.02
EGMONT	Egmont	25.01
MOAWHANGO	Moawhango	26.01
KAIMANAWA	Kaimanawa	27.01
RUAHINE	Ruahine	28.01
HAWKES BAY	Maungaharuru	29.01
	Heretaunga	29.02
RANGITIKEI	Rangitikei	30.01
MANAWATU	Manawatu Plains	31.01
	Foxton	31.02

MANAWATU GORGE	Manawatu Gorge North	32.01
	Manawatu Gorge South	32.02
PAHIATUA	Woodville	33.01
	Puketoi	33.02
EASTERN HAWKES BAY	Eastern Hawkes Bay	34.01
EASTERN WAIRARAPA	Eastern Wairarapa	35.01
WAIRARAPA PLAINS	Wairarapa Plains	36.01
AORANGI	Aorangi	37.01
TARARUA	Tararua	38.01
SOUNDS-WELLINGTON	Wellington	39.01
	Cook Strait	39.02
	Sounds	39.03
	D'Urville	39.04
RICHMOND	Pelorus	40.01
	Para	40.02
	Fishtail	40.03
WAIRAU	Blenheim	41.01
	Wither Hills	41.02
	Grassmere	41.03
	Flaxbourne	41.04
	Hillersden	41.05
INLAND MARLBOROUGH	Waihopai	42.01
	Medway	42.02
	Bounds	42.03
	George	42.04
MOLESWORTH	Sedgemere	43.01
	Balaclava	43.02
	Miromiro	43.03
CLARENCE	Tapuaenuku	44.01
	Dillon	44.02
	Manakau	44.03
KAIKOURA	Kekerengu	45.01
	Aniseed	45.02
	Kowhai	45.03

NORTH-WEST NELSON	West Whanganui	46.01
	Wakamarama	46.02
	Golden Bay	46.03
	Totaranui	46.04
	Heaphy	46.05
	Wangapeka	46.06
	Arthur	46.07
	Karamea	46.08
	Matiri	46.09
NELSON	Motueka	47.01
	Moutere	47.02
	Bryant	47.03
	Red Hills	47.04
NORTH WESTLAND	Ngakawau	48.01
	Foulwind	48.02
	Buller	48.03
	Reefton	48.04
	Punakaiki	48.05
	Maimai	48.06
	Totara Flat	48.07
	Blackball	48.08
	Hochstetter	48.09
	Greymouth	48.10
	Brunner	48.11
SPENSER	Rotoroa	49.01
	Travers	49.02
	Ella	49.03
	Lewis	49.04
	Hope	49.05
WHATAROA	Hokitika	50.01
	Whitcombe	50.02
	Harihari	50.03
	Wilberg	50.04
	Waiho	50.05
	Glaciers	50.06
	Karangarua	50.07
	Mahitahi	50.08
ASPIRING	Paringa	51.01
	Mataketake	51.02
	Landsborough	51.03
	Haast	51.04
	Okuru	51.05
	Arawata	51.06
	Dart	51.07
LOWRY	Hundalee	52.01
	Leslie	52.02
	Culverden	52.03
	Waiau	52.04
	Cheviot	52.05
	Motunau	52.06
	Waikari	52.07

HAWDON	Minchin	53.01
	Arthur's Pass	53.02
PUKETERAKI	Sumner	54.01
	Poulter	54.02
	Cass	54.03
	Torlesse	54.04
	Craigieburn	54.05
	Coleridge	54.06
CANTERBURY FOOTHILLS	Ashley	55.01
	Oxford	55.02
	Whitecliffs	55.03
CANTERBURY PLAINS	High Plains	56.01
	Low Plains	56.02
	Ellesmere	56.03
BANKS	Port Hills	57.01
	Herbert	57.02
	Akaroa	57.03
D'ARCHIAC	Browning	58.01
	Armoury	58.02
	Mt Cook	58.03
HERON	Mathias	59.01
	Mt Mutt	59.02
	Arrowsmith	59.03
	Hakatere	59.04
	Two Thumb	59.05
TASMAN	Godley	60.01
	Dobson	60.02
PAREORA	Orari	61.01
	Fairlie	61.02
	Geraldine	61.03
	Hunters	61.04
	Waimate	61.05
	Hakataramea	61.06
WAINONO	Makikihi	62.01
	Glenavy	62.02
	Oamaru	62.03
MACKENZIE	Tekapo	63.01
	Pukaki	63.02
	Ben Ohau	63.03
	Grampians	63.04
	Ahuriri	63.05
	Omarama	63.06
	Benmore	63.07
WAITAKI	Kirkliston	64.01
	St Mary	64.02
	Hawkdun	64.03
	St Bathans	64.04

KAKANUI	Duntroon	65.01
	Dansey	65.02
	Waianakarua	65.03
LAKES	Huxley	66.01
	Wanaka	66.02
	Richardson	66.03
	Shotover	66.04
	Remarkables	66.05
CENTRAL OTAGO	Lindis	67.01
	Pisa	67.02
	Dunstan	67.03
	Maniototo	67.04
	Old Man	67.05
	Manorburn	67.06
	Rock and Pillar	67.07
LAMMERLAW	Macraes	68.01
	Waipori	68.02
	Tapanui	68.03
	Lawrence	68.04
OTAGO COAST	Waikouaiti	69.01
	Dunedin	69.02
	Tokomairiro	69.03
	Balclutha	69.04
CATLINS	Waipahi	70.01
	Tahakopa	70.02
OLIVINE	Cascade	71.01
	Pyke	71.02
FIORD	Darran	72.01
	Doubtful	72.02
	Te Anau	72.03
	Preservation	72.04
MAVORA	Livingstone	73.01
	Eyre	73.02
	Upukerora	73.03
WAIKAIA	Nokomai	74.01
	Umbrella	74.02
GORE	Gore	75.01
SOUTHLAND HILLS	Takitimu	76.01
	Taringatura	76.02
	Hokonui	76.03
TE WAE WAE	Waitutu	77.01
	Tuatapere	77.02
	Longwood	77.03
MAKAREWA	Southland Plains	78.01
	Waituna	78.02

RAKIURA	Foveaux	79.01
	Anglem	79.02
	Freshwater	79.03
	Mt Allen	79.04
	Solanders	79.05
	Snares	79.06
CHATHAMS	Chathams	80.01
BOUNTY	Bounty	81.01
ANTIPODES	Antipodes	82.01
AUCKLAND ISLANDS	Auckland Islands	83.01
CAMPBELL	Campbell	84.01
MACQUARIE	Macquarie	85.01

INTRODUCTION

> "A sense of identity or place develops where an individual grows up within a particular province and learns to recognise its flora and fauna, to respond to its climatic regime, to become familiar with its limits. Many serious land use blunders could have been avoided if people had not tried to transplant land-use practices developed within one biotic province to the differing ecological conditions of another."
>
> Raymond Dasmann, 1976, Biogeographical Provinces, Understanding Whole Systems; the Co Evolution Quarterly.

Background

New Zealand's physical environment is extremely diverse and this diversity is reflected in the indigenous plant and animal communities (ecosystems). The concept of dividing New Zealand into a series of Ecological Regions and Districts evolved because of the need for the establishment of a representative system of reserves which would encompass this ecological diversity. One purpose of the Reserves Act 1977, is to ensure the

> "preservation of representative samples of all classes of natural ecosystems and landscapes which in the aggregate originally gave New Zealand its own recognisable character."
>
> (Section 3(1) (b))

Before this could be done a framework on which to define representativeness was necessary. In the late 1970s Mr John Nicholls, then forest ecologist with the New Zealand Forest Research Institute, Rotorua, pioneered the idea of ecological districts grouped within an ecological region. He proposed the division of a large area in North Westland (defined as the NORTH WESTLAND Ecological Region) into eleven smaller parts (Ecological Districts) as a framework for the selection of forest reserves (Ecological Areas) by the Scientific Co-ordinating Committee. Each ecological district is a unique unit with its own distinctive general pattern of ecosystems and special features. Together they form an ecological region with its own broad ecological character, differing in many ways from those of its neighbouring regions.

Definitions

Ecological District:

The definition of an ecological district depends on a thorough consideration of the topography, geology, climate, soils, vegetation and man-induced modifications of the area (Nicholls, 1979). Thus an ecological district is a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities (Park et al., 1983).

Ecological Region:

An aggregation of adjacent ecologicl districts with very closely related characteristics together form an ecological region. In some cases, a single very distinctive ecological district is given the status of ecological region to emphasise its uniqueness (Park et al., 1983).

The Biological Resources Centre and the Ecological Regions and Districts Project

The concept of ecological regions and districts was embraced by the New Zealand Biological Resources Centre which co-ordinated the mapping of the country into over 260 districts in 1982. Many different scientists were involved in this exercise, with DSIR Botany Division scientists, Dr Ian Atkinson and Dr Brian Molloy, overall convenors for the North and South Island respectively.

First edition maps of ecological regions and districts were produced and circulated widely, together with a publication describing the concept and calling for submissions (Simpson, 1982). Many of the suggested changes were incorporated into second edition maps which were produced as an overlay series (Biological Resources Centre, 1983). Since then further refinements have been made to the region and district boundaries, particularly as a result of surveys made under the Protected Natural Areas Programme, and these are shown in the present edition.

Other Uses of the Ecological Region and District Framework

Ecological regions and districts are refinements at a national scale of the concept of the "biogeographic province". This concept has been widely promoted by the International Union for the Conservation of Nature and Natural Resources (IUCN) as a valuble scientific tool for nature conservation planning.

The ecological regions and districts system is already in use, for example, in the Register of Protected Natural Areas (Department of Lands and Survey, 1984), and in the Protected Natural Areas Programme (under the auspices of the National Parks and Reserves Authority). However the ecological regions and districts framework has potential values which go well beyond its original purpose as a basis for designing a representative system of protected natural areas throughout New Zealand. For example the concept helps to make people aware of the natural areas that make their own district unique and can help to promote the feeling of local identity (a sense of place), the awareness of landscape and the stewardship of local and national heritage values. It can also be used in many practical ways to organise, record and retrieve biological and other resource information; to aid in land use planning; and as an educational tool.

THE MAPS

There are four maps at 1:500,000 scale. The ecological region and district boundaries have been printed on Department of Lands and Survey NZMS 242 topographic maps.

Sheet 1 — The northern North Island including ecological descriptions and prescriptions of 29 ecological districts: from Kermadec E.D. and Three Kings E.D. in the north (not shown on map) to Mayor E.D. in the south.

Sheet 2 — The central North Island including ecological descriptions and prescriptions of 55 ecological districts: from Meremere E.D. in the north to Eastern Hawkes Bay E.D. in the south.

Sheet 3 — Central New Zealand including ecological descriptions and prescriptions of 84 ecological districts: from Eastern Wairarapa E.D. in the north to Akaroa E.D. in the south; also includes Chathams E.D. (not shown on map).

Sheet 4 — The southern South Island including ecological descriptions and prescriptions of 100 ecological districts (plus parts of CANTERBURY Low Plains and High Plains): from Browning E.D. in the north to Snares E.D. in the south; also includes Bounty, Antipodes, Auckland Islands, Campbell and Macquarie E.D.'s (not shown on map).

Prescriptions

Brief prescriptions, summarising the ecological character of each of the ecological districts, are printed on the map surface of each map.

Descriptions

Ecological descriptions of each district on Sheet 1 are included in this booklet. They have been compiled giving a broad picture of the district in terms of topography, geology, climate, soils, vegetation and modifications; information about flora and fauna with special conservation or scientific value is included where this is known. Descriptions vary in length depending on the district's size and complexity and the amount of information which has been compiled. The descriptions are compiled under a series of headings as follows:

Criteria: a statement at the beginning of each description lists the criteria on which the district has been defined, in the order of importance where it is possible to determine this. Criteria consist of one or more of the features of the district which distinguish it from neighbouring districts.

GEOLOGY: the descriptions of geology were compiled using New Zealand Geological Survey (DSIR) geological maps (scale 1:250,000), and edited by regional geologists from the New Zealand Geological Survey.

CLIMATE: for most districts the climate description is based on the New Zealand Meteorological Service map "New Zealand Climate Regions (scale 1:2,000,000)"; temperatures (cool, warm etc.) generally refer to the lowlands in districts which include a wide altitudinal range. The rainfall ranges are from the New Zealand Meteorological Service "Mean Annual Rainfall (1941-70)" maps (scale 1:500,000). Other climate information was included when provided by ecologists with local knowledge.

SOILS: descriptions of soils for most districts (apart from some island districts), were written by Mr Des Cowie, formerly of the New Zealand Soil Bureau; they have been shortened for inclusion here. The descriptions deliberately avoid the use of descriptive soil names (e.g. yellow-brown earth) and instead attempt to describe the soils in ecological terms.

TOPOGRAPHY/VEGETATION: most of the information in these sections was provided by a large number of plant ecologists. In the north of the North Island the main contributors were Mr John Nicholls (formerly F.R.I., NZ Forest Service) and Dr Bruce Clarkson (DSIR Botany Division, (BD)). Dr Ian Atkinson (BD) was responsible for the south of the North Island as well as the outlying and offshore islands off the North Island. Dr Brian Molloy (BD) was responsible for the north of the South Island with other contributors including Dr Peter Williams (BD), Dr Philip Simpson (Commission for the Environment, now Department of Conservation), Dr Geoff Park (Biological Resources Centre, now DOC), and Dr Peter Wardle (BD). Dr Peter Johnson (BD) was responsible for the south of the South Island with other contributors including Dr Ralph Allen (BD), Dr Collin Meurk (BD), and Professor Alan Mark (Otago University). Other contributors include Mr Geoff Kelly (BD), Mr Hugh Wilson, Mr Chris Jenkins (NZ Forest Service), Mr Rowly Taylor (DSIR Ecology Division), Mr Henk Stengs (NZ Forest Service), Dr Colin Burrows (Canterbury University), Mr Colin Ogle (NZ Wildlife Service), Mr Willie Shaw (Forest Research Institute), Mr Mike Page (MOWD), Dr Niel Mitchell (Auckland University), Mr Geoff Rogers (Victoria University), Mr Ash Cunningham (NZ Forest Service), Mr Geoff Walls (BD), Mr Warren Burke, Dr John Wardle (FRI), Ms Cathy Brumley, Dr Kathy Dickenson, Ms Maggie Bayfield, Mrs Margaret Bulfin (BD) and Mr Pat Burstall (Wildlife Service).

MODIFICATIONS: include changes to indigenous ecosystems caused by farming, forestry, urban and other developments and by introduced plants and animals. Land uses were taken from "The New Zealand Atlas" (Government Printer, 1976) and checked by local ecologists. Introduced mammals such as rodents, rabbits, mustelids, possums, and deer are widespread and not always mentioned; their absence may be a more notable ecological feature than their presence. In some cases modifications are described together with the vegetation section.

FLORA: where contributors mentioned any special elements of the flora of a district these were included. In some cases flora is combined with the vegetation section.

FAUNA: most animal information is restricted to species considered to be important in terms of nature conservation. Information about indigenous animals has come from a wide variety of sources.

MAMMALS: only bats and marine mammals are included. The short-tailed bat belongs to an endemic family Mystacinidae, and is classified as vulnerable in "The Red Data Book of New Zealand" (Nature Conservation Council, 1981); It is mentioned where it has been positively identified in recent years. The long-tailed bat is an endemic species of a southern hemisphere family and is widespread in suitable habitats; it is only mentioned in districts where the population is isolated. Dr Mike Daniel (DSIR Ecologuy Division) provided bat information (Daniel, M.J. and Williams, G.R. 1984 "A Survey of the Distribution, Seasonal Activity and Roost Site of New Zealand Bats," New Zealand Journal of Ecology 7:9-25)
Marine mammals are mentioned if they breed in the district or are present in large numbers. Much of the information was provided by Mr Rowly Taylor (DSIR Ecology Division). Breeding localities of New Zealand fur seals were obtained from Crawley, M.C. and Wilson G.J., 1976 "The Natural History and Behaviour of the New Zealand Fur Seal (Arctocephalus forsteri)," Tuatara 22:1.29.

Introduced mammals are mentioned in the MODIFICATIONS section.

BIRDS: only certain groups of birds are mentioned, including kiwi, sea bird colonies, endemic ducks, falcon, crakes, large congregations of waders, kaka, parakeets, kea, Rock Wren, Yellowhead and Fernbird; other birds are mentioned where they occur close to the limits of their range, or show other peculiarities of distribution. Mr Sandy Bartle (National Museum) contributed much of the bird information, especially about the North Island and north of the South Island and Mr Tony Whitaker added bird information for the rest of the country. Bird distributions were obtained from the Ornithological Society of New Zealand's "Atlas of Bird Distributions in New Zealand", the "New Guide to the Birds of New Zealand" (Collins), the "Complete book of New Zealand Birds" (Readers Digest), Notornis, 1976-86 and a variety of papers and reports. Additional bird information was received from Mr Paul Sagar and Mr Wynston Cooper (both Ornithological Society of New Zealand) and Mr John Atkinson (Lands and Survey).

REPTILES AND FROGS: Mr Whitaker also provided information about indigenous reptiles and frogs. Reptiles considered to be widespread and common are only mentioned where they occur at the limits of their range, show other pecularities of distribution or are distinctive or peculiar in other ways. Information was obtained from the NZ Wildlife Service's amphibian and reptile distribution mapping scheme, a variety of papers (see Reptiles in Glossary) and some personal observations by Mr Whitaker. Dr Ben Bell (Victoria Univeristy) provided additional frog information.

FISH: information about fresh-water fish was obtained from Dr Bob McDowell (MAF, Fisheries Research Division). Only indigenous fish listed in "The Red Data Book of New Zealand" (Nature Conservation Council, 1981) are included.

INVERTEBRATES: information was compiled by Ms Jojette Drost (while employed by the National Museum) from a large number of sources; further information was added by Ms Cath Walker (NZ Wildlife Service), Mr Frank Climo (National Museum) and Mr Graeme Ramsay (DSIR Entomology Division).

Acknowledgements

The Biological Resources Centre acknowledges the help of all these contributors and also others whose names may have been omitted inadvertently. Without the assistance of so many experts the task of compiling the descriptions of the 268 Ecological Districts would have taken many years. Special thanks are due to Mrs Karen Lewis who typed most of the extensive manuscript and made the numerous corrections and alterations with unending patience.

Future Amendments

In such a large project there are certain to be errors both of omission and of fact or interpretation. If you know any corrections or additional information which could be used to improve this work, please forward them to the Biological Resources Centre for inclusion in future editions of this map series.

It is expected that further refinements to ecological region and district boundaries will be made in future, especially in the course of surveys made under the Protected Natural Areas Programme.

GLOSSARY AND EXPLANATION OF TERMS

General

Certain words have been used in the text to mean specific things:

"Original" refers to conditions prior to the arrival of Polynesian man in New Zealand; original conditions are only included when they are well known.

"Former" refers to conditions at the time of European settlement, about 1840.

"Treeline" refers to the "timberline" of other authors, indicating the upper altitudinal limit of tree growth.

"Remnant" refers to vegetation or animal populations which are diminished from their former size because of the influence of man.

"Scattered patches" refers to vegetation types which were once extensive but are now reduced to small areas because of natural change, e.g. climate change.

"Offshore islands" are within 50 km from the New Zealand mainland.

"Outlying islands" are further than 50 km from the New Zealand mainland.

"Pakihi" refers to dense low cover of sedges, umbrella fern, rushes and low growing shrubs and herbs on level water-logged country.

"Endemic" refers to plants and animals which are restricted to a certain area; in this case usually one or several Ecological Districts.

"Indigenous" means native.

"Exotic" means introduced, as opposed to indigenous, usually referring to pine plantations.

Abbreviations

a.s.l.	above sea level
E.A.	Ecological Area
E.D.	Ecological District
E.R.	Ecological Region
L.	Lake
N, S, E and W etc.	North, South, East and West etc.
p.a.	per annum
R.	River
S.F.	State Forest
Stm	Stream

Plant Names Used (in alphabetical order)

Maori or Common Name	Scientific Name
agropyron	Agropyron scabrum
akeake	Dodonea viscosa
akepiro	Olearia furfuracea
akiraho	Olearia paniculata
alpine fescue tussock	Festuca matthewsii
beech	Nothofagus spp.
black maire	Gymnelaea cunninghamii (Nestegis cunninghamii)
black beech	Northofagus solandri var. solandri
blue tussock	Poa colensoi
bog pine	Dacrydium bidwillii (Halocarpus bidwillii)
boxthorn	Lycium ferrocissimum
bracken	Pteridium esculentum
broadleaf	Griselinia littoralis
broom	Cytisus scoparius
browntop	Agrostis tenuis
bull kelp	Durvillaea antarctica
cabbage tree	Cordyline spp.
celmisias	Celmisia spp.
clover	Trifolium spp.
cocksfoot	Dactylis glomerata
composites	Family Compositae
coprosma	Coprosma spp.
corokia	Corokia spp.
crack willow	Salix fragilis
cyperus	Cyperus spp.
Douglas fir	Pseudotsuga menziesii
dracophyllum	Dracophyllum spp.
fescue tussock	Festuca novae-zelandiae
fivefinger	Pseudopanax arboreus
flax	Phormium spp.
fuchsia	Fuchsia excorticata
golden spaniard	Aciphylla aurea
gorse	Ulex europeus
Hall's totara	Podocarpus totara
hangehange	Geniostoma ligustrifolium
hard beech	Nothofagus truncata
hard tussock	Festuca novae zelandiae
hawkweed	Hieracium pilosella H.pracaltum, H.aurantiacum, H.lachenalii
hebes	Hebe spp.
heketara	Olearia rani
Himalayan honeysuckle	Leycesteria formosa
hinau	Elaeocarpus dentatus
hohere	Hoheria spp.
inaka	Dracophyllum longifolium
inanga	Dracophyllum longifolium

kahikatea	Podocarpus dacrydioides (Dacrycarpus dacrydioides)
kaikawaka	Libocedrus bidwillii
kaikomako	Pennantia corymbosa
kamahi	Weinmannia racemosa
kanuka	Leptospermum ericoides (Kunzea ericoides)
karaka	Corynocarpus laevigatus
karamu	Coprosma australis
karo	Pittosporum crassifolium
kauri	Agathis australis
karaka	Libocedrus plumosa
kawakawa	Macropiper exelsum
Kermandec pohutukawa	Metrosideros kermandecensis
kiekie	Freycinetia banksii
kohekohe	Dysoxylum spectabile
kohuhu	Pittosporum tenuifolium
koromiko	Hebe spp.
kowhai	Sophora spp.
lacebark	Hoheria populnea
lancewood	Pseudopanax crassifolius
larch	Larix decidua
leatherwood	Olearia spp.
lemonwood	Pittosporum eugenioides
mahoe	Melicytus ramiflorus
maire	Gymnelaea spp. (Nestegis spp.)
mamaku	Cyathea medullaris
mangeao	Litsea calicaris
mangroves	Avecinnia resinifera
manuka	Leptospermum scoparium
mapau	Myrsine australis
marbleleaf	Carpodetus serratus
marram	Ammophila arenaria
matagouri	Discaria toumatou
matai	Podocarpus spicatus
microlaena	Microlaena spp.
mingimingi	Coprosma propinqua
miro	Podocarpus ferrugineus
mistletoe	Family Loranthaceae
mountain beech	Nothofagus solandri var. solandri
mountain flax	Phormium cookianum
mountain lacebark	Hoheria glabrata
mountain toatoa	Phyllocladus alpinus
narrow-leaved lacebark	Hoheria angustifolia
narrow-leaved snow tussock	Chionochloa rigida
native broom	Carmichaelia spp.
ngaio	Myoporum laetum
nikau	Rhopalostylis sapida
niggerhead	Carex secta
northern rata	Metrosideros robusta
pate	Schefflera digitata
pampas grass	Cortaderia spp.
pine	Pinus spp.
pigeonwood	Hedycarya arborea
pigmy pine	Dacrydium laxifolium (Lepidothamnus laxifolius)
pingao	Desmoschoenus spiralis
pink pine	Dacrydium biforme

	(Halocarpus biformis)
praire grass	Bromus carthaticus
pohuehue	Meuhlenbeckia complexa
pohutukawa	Metrosideros excelsa
pokaka	Elaeocarpus hookerianus
ponga	Cyathea dealbata
Poor Knights ngaio	Myoporum laetum var. decumbens
pukatea	Laurelia novae-zelandiae
puriri	Vitex lucens
putaputaweta	Carpodetus serratus
quintinia	Quintinia spp.
rarekau	Coprosma australis
rata	Metrosideros spp.
raupo	Typha orientalis
red beech	Nothfagus fusca
red tussock	Chionochloa rubra
restiad	Family Restionaceae
rewarewa	Knightea excelsa
ribbonwood	Hoheria glabrata
	or Plagianthus betulinus
rimu	Dacrydium cupressinum
rush	Family Juncaceae
ryegrass	Lolium spp.
scabweed	Raoulia spp.
sedge	Family Cyperaceae
silver beech	Nothofagus menziesii
silver fern	Cyathea dealbata
silver pine	Dacrydium colensoi
	(Lagarostrobos colensoi)
silver tussock	Poa laevis
slim snow tussock	Chionochloa macra
sorrel	Rumex spp.
southern rata	Metrosideros umbrellata
snow totara	Podocarpus nivalis
snow tussock	Chionochloa spp.
spaniard	Aciphylla spp.
supplejack	Ripogonum scandens
swamp maire	Eugenia maire
	(Syzygium maire)
sweet brier	Rosa rubiginosa
sweet vernal	Anthoxanthum odoratum
tanekaha	Phyllocladus trichomanoides
taraire	Beilschmiedia tarairi
tarata	Pittosporum eugenioides
tawa	Beilschmiedia tawa
tawari	Ixerba brexioides
tauhinu	Cassinia leptophylla
taupata	Coprosma repens
tawapou	Planchonella novo-zelandica
tawaroa	Beilschmiedia tawaroa
	(ref. Wright 1984, NZ J.Bot.22(1))
thyme	Thymus spp.
titoki	Alectryon excelsus
toatoa	Phyllocladus glaucus
toetoe	Cortaderia spp.

toro	Myrsine salicina
totara	Podocarpus totara
towai	Weinmannia silvicola
tree lupin	Lupinus arboreus
tree mallow	Lavatera arboria
tutu	Coriaria spp.
umbrella fern	Gleichenia spp.
whau	Entelia arborescens
white maire	Gymnelaea lanceolata (Nestegis lanceolata)
wineberry	Aristotelia serrata
wire rush	Empodism minus
yellow silver pine	Dacrydium intermedium (Lepidothamnus intermedius)

Mammal Names Used (in alphabetical order)

Common Name	Scientific Name
bats	Chalinobus tuberculatus or Mystacina tuberculata
black rat	Rattus rattus
bush wallabies	Macropus rufogriseus
cattle	Bos taurus
cats	Felis catus
chamois	Rupicapra rupicapra
deer	Cervus spp. etc.
dolphins	Family Delphinidae
elephant seal	Mirounga leonina
fallow deer	Dama dama
ferret	Mustela putorius
fur seal	Arctocephalus forsteri
goats	Capra hircus
hares	Lepus europaeus
Hooker's sealion	Phocarctos hookeri
horses	Equus caballus
leopard seal	Hydrurga leptonyx
lesser short-tailed bat	Mystacina tuberulata tuberculata
long-tailed bat	Chalinobus tuberculatus
mice	Mus musculus
mustelids	Mustela spp.
New Zealand fur seal	Arctocephalus forsteri
Norway rat	Rattus norwegicus
pigs	Sus scrofa
Polynesian rat	Rattus exulans
possums	Trichosurus vulpecula
rabbits	Oryctolagus cuniculus
rats	Rattus spp.
red deer	Cervus elaphus
sea leopard	Hydrurga leptonyx
short-tailed bat	Mystacina tuberculata
stoats	Mustela ermina
tahr	Hemitragus jemlahicus
wallabies	Macrocopus spp.
wapiti	Cervus canadensis
whales	Cetaceans
whitetail deer	Odocoileus virginianus

Birds

Only common names have been used for birds. Scientific names can be found in the "Annotated Checklist of the Birds of New Zealand" by the Checklist Committee (F.C. Kinsky, Convenor), Ornithological Society of N Z Inc. A.H. and A.W. Reed, 1970. Capital letters are used for full common names, e.g. Red-crowned Parakeet; small letters are used for generalised common names, e.g. parakeets.
Some commonly used abbreviations are followed e.g. SIPO for South Island Pied Oystercatcher.

Reptiles

Both common and scientific names have been used in the text. Nomenclature follows several authorities:

Hardy, G.S. 1977: The New Zealand Scincidae (Reptilia:Lacertilia); a taxonomic and zoogeographic study. New Zealand Journal of Zoology 4:221-325

McCann, C. 1955: The lizards of New Zealand. Gekkonidae and Scincidae. Dominion Museum Bulletin No 17. 127p.

Robb, J. 1980: Three species of gekkonid lizards, genera Hoplodactylus Fitzinger and Heteropholis Fischer, from New Zealand. National Museum of New Zealand records 1:305-310

Robb, J.; Rowlands, R.P.V. 1977: Reinstatement of Hoplodactylus maculatus (Boulenger) with redescription of H. pacificus (Gray) (Reptilia:Squamata:Gekkonidae). Records of the Auckland Institute and Museum 14:133-142

Robb, J.; Hitchmough, R.A. 1980: Review of the genus Naultinus Gray (Reptilia:Gekkonidae). Records of the Auckland Institute and Museum 16:189-200

Thomas, B.W. 1981: Hoplodactylus rakiurae n.sp. (Reptilia:Gekkonidae) from Stewart Island, New Zealand, and comments on the taxonomic status of Heteropholis nebulosus McCann. New Zealand Journal of Zoology 8:33-47

Whitaker, A.H. 1984: Hoplodactylus kahutarae n.sp. (Reptilia:Gekkonidae) from the Seaward Kaikoura Range, Marlborough, New Zealand. New Zealand Journal of Zoology 11:259-270

Frogs

Both common and scientific names are given in the text.

Fish

Both common and scientific names are given in the text.

Invertebrates

Information about invertebrates is very varied. Mainly large conspicuous species are included; in particular large wetas, cicadas, beetles and land snails. Scientific names (where known) are given in the text.

N.B. Snails: refers to land snails only.

ECOLOGICAL DISTRICT DESCRIPTIONS

On the following pages are ecological descriptions of the 81 ecological districts from Browning (58.01) to Snares (79.06) and also Bounty (81.01), Antipodes (81.01), Auckland Islands (82.01), Campbell (84.01) and Macquarie (85.01).

The southern parts of High Plains (56.01) and Low Plains (56.02) appear on Sheet 4 and their descriptions are included here (as well as in the booklet accompanying Sheet 3); also included are the southern 6 districts of the WHATAROA Region, Harihari (50.03)
to Mahitahi (50.08) and the 7 districts of ASPIRING Region giving a total of 101 descriptions.

HARIHARI ECOLOGICAL DISTRICT 50.03

Criteria: landform (moraine and outwash surfaces, large coastal lagoons), vegetation (mixed forest without beech), climate.

TOPOGRAPHY/GEOLOGY: recent alluvial valleys separated by hills, terraces and plateaux, mainly formed of older moraines; generally less than 200m a.s.l. with moraine plateaux to 240m at inland margin; two greywacke and argillite hills exceed 1,000m; two large coastal lagoons (Okarito and Saltwater) and several inland lakes (e.g. Rotokino and Ianthe). Near the Alpine Fault a few outcrops of Paleozoic Greenland Group greywacke and argillite and Tuhua Granite.

CLIMATE: mild temperatures, high rainfall, 2800-5600mm p.a. with winter minimum.

SOILS: loamy to gravelly alluvial soils, mostly with poor drainage on river flats; very strongly leached low fertility soils with poor drainage on terraces and moraines, with associated peaty soils in swamps; stony, strongly leached and podzolised steepland soils on hill and mountain slopes.

VEGETATION: podocarp and podocarp-hardwood forests with marked floristic uniformity; beech absent; extensive swamps in valleys; nikau on the coast northwest of Harihari township.

FLORA: southern boundary marks the southern limits of hinau, toro and Cordyline banksii as common species.

BIRDS: extensive forests support a diverse avifauna but bird density is moderate, probably limited by uniformity of vegetation. Most important forests for birds are Ianthe SF and Saltwater SF. Kaka, Yellow-crowned Parakeet (Red-crowned Parakeet have also been reported), Rifleman and robin (more abundant here than either N or S) widespread in forested habitats; Yellowhead reported from Mt Hercules; Weka only in Saltwater SF; falcon throughout; Fernbird widespread (especially common at L. Rotokino); Blue Duck on some rivers; kea above the tree line; Southern Crested Grebe present on L. Ianthe and L. Rotokino. Only N.Z. breeding colony of White Heron is at Okarito Lagoon. Southern Blue Penguin breed at Wanganui R. mouth.

REPTILES: skink (Leiolopisma nigriplantare) known from the Wanganui R. (all lizards, except forest gecko (Hoplodactylus granulatus), are very scarce on the West Coast).

FISH: include giant kokopu (Galaxias argenteus), short jawed kokopu (G. postvectis) and brown mudfish (Neochanna apoda), the latter at its (known) southern limit.

MODIFICATIONS: recent alluvial flats grazed; sown in pasture or kept in early successional stages; wet alluvial soils cleared and drained in part, converted to pasture; attempts at draining swamps; lower altitude forests logged; pioneer vegetation on gravel floodplains dominated by gorse north of Whataroa River.

WILBERG ECOLOGICAL DISTRICT 50.04

Criteria: geology (metamorphic rocks), landform (glaciated peaks), vegetation (beech absent), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: mountainous district inland from Harihari formed mostly of Haast Schists grading into Torlesse Supergroup greywacke and argillite towards the E; summits glaciated although altitudes less than 2700 m a.s.l.

CLIMATE: high rainfall mountain climate, 5000-8000mm p.a.

SOILS: strongly leached stony steepland soils grading at higher altitudes to alpine soils with large areas of scree and bare rock; on easier slopes drainage may be impeded, topsoils peaty.

VEGETATION: a sequence of vegetation belts characteristic of high rainfall areas where beech is lacking: mixed podocarp-hardwood forest on lower slopes; rata-kamahi forest at higher altitudes; subalpine scrub; snow tussockland, cushion bogs, herbfield and high-alpine vegetation. Little botanical knowledge.

BIRDS: kiwi (species unknown) have been reported; falcon occur throughout; kaka present in forest; kea above the tree line; Blue Duck present on some rivers.

MODIFICATIONS: introduced mammals include deer, chamois, thar, goats and possums.

WAIHO ECOLOGICAL DISTRICT 50.05

Criteria: landform (high moraine plateaux), vegetation (extensive stunted mixed forest without beech, also bog), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: wide recent alluvial valleys and moraine plateaux with extensive areas above 300m; much smaller coastal lagoons and sharper relief than Harihari. Large outcrops of Paleozoic Tuhua Granites and Greenland Group greywacke and argillite, the largest, Omeoroa Range, reaching 1000m a.s.l.

CLIMATE: mild temperatures, high rainfall, 3000-4800mm p.a. with winter minimum.

SOILS: strongly leached, low fertility soils on hill slopes; very strongly leached soils with poor drainage on terraces and moraines with associated peaty soils in swamps; stony strongly leached steepland soils on steeper country; more fertile gravelly, sandy and loamy alluvial soils on river flats, many with poor drainage.

VEGETATION: podocarp and podocarp-hardwood forests with marked floristic uniformity; no beech; extensive rolling areas on plateau summits S of Waiho River occupied by mosaics of stunted forest dominated by small Dacrydium species, manuka scrub and Empodisma-Gleichenia-red tussock bog, mostly in virgin condition; pioneer vegetation on gravel floodplains dominated by native plants.

FLORA: kawakawa (at its southern limit) and Lycopodium cernum (near its southern limit) occur on cliffs between Okarito and Three Mile Lagoon.

BIRDS: terrace rimu forests characteristic of this district support a diverse avifauna at low densities. Isolated population of Brown Kiwi in South Okarito SF may be subspecifically distinct from populations further S in Arawata E.D. and southwards. Great Spotted Kiwi also present, extending southwards to the Cook R. in the adjacent Glaciers E.D. Falcon, kaka, Yellow-crowned Parakeet and Fernbird widespread; weka only at Okarito, Rifleman restricted, perhaps due to absence of beech; robin not S of L. Mapourika; Yellowhead regularly seen in South Okarito in recent years (but scarce between Arthurs Pass E.D. and Landsborough E.D.); kea above tree line; largest and southernmost population of Southern Crested Grebe on the West Coast is at L. Mapourika; Marsh Crake present at Okarito, Gillespies Point and along the Cook R.; records of Scaup on some lakes.

FISH: include giant kokopu (Galaxias argenteus).

INSECTS: include the osiriine beetle, Paratrochus foveatus occurs in litter and humus beneath rimu, kamahi, tree fern and ferns at L. Wahapo.

MODIFICATIONS: recent alluvial flats grazed; sown in pasture or kept in early successional stages; wet alluvial soils cleared and drained in part, converted to pasture; attempts at draining swamps; most forests in alluvial valleys partly or heavily logged.

GLACIERS ECOLOGICAL DISTRICT 50.06

Criteria: landform (highest peaks on and west of Main Divide), geology (metamorphic rocks, well-developed lowland chrono-sequences down valley from retreating glaciers), climate (high rainfall), vegetation (beech absent).

TOPOGRAPHY: includes most of the highest peaks in New Zealand; maximum altitude 3477m a.s.l.; also the country's largest west-flowing glaciers.

GEOLOGY: Haast Schist.

CLIMATE: high rainfall, mountain climate, 4800-8000mm p.a.

SOILS: stony alpine soils with large areas of bare rock and scree at higher altitudes. At lower altitudes strongly leached stony steepland soils; minor areas of soils on moraines showing increasing soil development related to age.

VEGETATION: a sequence of vegetation belts characteristic of high rainfall areas where beech is lacking: mixed podocarp-broadleaved forest on lower slopes; rata-kamahi forest at higher altitudes; subalpine scrub; snow tussock grasslands, herbfields and high-alpine vegetation.

FLORA: some Fiordland species present (e.g. Dracophyllum fiordense, D. menziesii and Raoulia buchananii); some northern species reach their southern limits (e.g. Ranunculus godleyanus). Low altitude, glacially related vegetation and soil chrono-sequences in Franz Josef and Fox valleys are a special feature.

BIRDS: Great Spotted Kiwi in montane and subalpine forests in the Waiho and Cook catchments; falcon, weka, kaka and parakeet (Yellow-crowned?) widespread; isolated records of robin; kea and Rock Wren above tree line and on lateral moraines of Fox Glacier at low altitudes; Blue Duck have been recorded on some rivers (e.g. Copland).

INSECTS: include the grass moth Orocrambus clarkei clarkei Philpott at Mount Moltke (43°25'S), Franz Joseph (also occurs at Wanaka and possibly in Wilberg District); the osiriine beetle Paratrochus foveatus occurs in litter and humus beneath mixed forest including beech near Franz Joseph glacier; large alpine grasshopper (e.g. Brachapsis sp.) appears to be absent.

KARANGARUA ECOLOGICAL DISTRICT 50.07

Criteria: geology, landform (alluvial terraces and extensive swamps), vegetation (mixed forest includes extensive kahikatea stands, but silver beech only as outliers in the south), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: low recent alluvial terraces and extensive swamps broken only by narrow moraine ridges and Cretaceous coal measures cropping out at Mt Arthur; maximum altitude 477.5m a.s.l.

CLIMATE: mild temperatures, high rainfall, 3200-4800mm p.a. with winter minimum.

SOILS: alluvial soils, moderately fertile but mainly with poor drainage on river flats; deep acid peaty soils in swamps; very strongly leached and poorly drained soils on terraces and moraines; strongly leached, low fertility soils on hilly land.

VEGETATION: largest remaining areas of kahikatea forest in New Zealand intergrade with poorly drained stands of rimu and silver pine and open swamplands, much of the latter completely undisturbed; beech species limited to scattered outliers of silver beech extending northwards to the true right bank of Mahitahi river.

FLORA: southern limit of quintinia.

BIRDS: good diversity of forest birds at moderate densities. Falcon, weka, kaka (abundant in Bruce Bay), Yellow-crowned Parakeet (Red-crowned Parakeet also reported) widespread; Rifleman very restricted, perhaps due to lack of beech; Yellowhead at Hunts Beach SF; robin absent. Kea present above tree line; Blue Duck present on the Manakaiau R. Northern breeding limit for Fiordland Crested Penguin; Sooty Shearwater reported breeding on headlands at Makawhio SF.

FISH: include giant kokopu (Galaxias argenteus) and short jawed kokopu (G. postvectis).

MODIFICATIONS: some alluvial flats grazed, some forest clearance on flats; some drainage attempted at Bruce Bay.

MAHITAHI ECOLOGICAL DISTRICT 50.08

Criteria: geology (metamorphic rocks), landform (glaciated peaks), vegetation (forest mainly without beech, but isolated stands of silver beech present through district), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: a block of Haast Schist mountains dissected by three major river valleys filled with Postglacial alluvial fans; maximum altitude 2621m a.s.l.

CLIMATE: high rainfall, mountain climate, 4800-8000mm p.a.

SOILS: strongly leached stony steepland soils, soils on easier slopes have impeded drainage; many screes and bare rock outcrops; more fertile soils on terraces and fans.

VEGETATION: outliers of silver beech in the N and the beginning of continuous beech forest in the S; however apart from these isolated stands and a few larger blocks of silver beech, the vegetation sequence is characteristic of mountains to the N where beech is lacking: mixed podocarp-hardwood forest on lower slopes; rata-kamahi forest at higher altitudes; subalpine scrub; snow tussockland, herbfield and high alpine vegetation. S side of upper Karangarua valley unusual, with scrub of pink pine, manuka etc. growing on shallow soils over schist bed rock. Red tussock seen on river flats.

FLORA: at high altitudes there is a small increase in southern species (e.g. Celmisia laricifolia, Hebe cockayniana; an undescribed prostrate Dracophyllum intermediate between D. kirkii and D. politum occurs.

BIRDS: kaka and parakeet (Yellow-crowned) present; Blue Duck have been reported from the rivers, and kea from above the tree line.

PARINGA ECOLOGICAL DISTRICT 51.01

Criteria: geology/landform (granites and Tertiary rocks forming high hills), vegetation (mixed forest and silver beech forest, the latter increasing toward the S), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: high, rugged, forested hills, mostly early Paleozoic Greenland Group greywacke and argillite, locally intruded by small plutons of granite; outcrops of late Cretaceous and Tertiary sediments, mainly coal measures close to the coast; several lakes; maximum altitude 969m a.s.l.

CLIMATE: mild temperatures, high rainfall, 4000-5600mm p.a. with winter minimum.

SOILS: strongly leached stony steepland soils associated with deeper soils on Tertiary sedimentary rocks; areas of very strongly leached, poorly drained soils on terraces; poorly drained alluvial soils on river flats; sand soils on dunes.

VEGETATION: an almost unbroken mosaic of podocarp-hardwood, silver beech-hardwood and silver beech forest, with proportion of beech increasing towards the S; mountain beech present near Bald Hill in the S.

FLORA: southern outlier of Cordyline banksii on coast; also Dicksonia lanata.

BIRDS: diverse topography and vegetation supports a wider range of bird species, and at higher densities, than the adjacent districts. Falcon, weka, kaka, Yellow-crowned Parakeet, Yellowhead and Fernbird are widespread; robin scarce and localised; S.I. Kokako reported from this district and may persist; kea present above tree line. Fiordland Crested Penguin breed along coast.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: alluvial flats grazed; some forests on them cleared; otherwise little change.

MATAKETAKE ECOLOGICAL DISTRICT 51.02

Criteria: geology (metamorphic rocks), landform (glaciated peaks), vegetation (upper forests dominated solely by silver beech), climate (high rainfall).

TOPOGRAPHY/GEOLOGY: mountainous district of Haast Schist reaching its highest elevation in Mt Hooker, 2633m a.s.l.

CLIMATE: high rainfall, mountain climate, 5600-8000mm p.a..

SOILS: mainly very strongly leached to podzolised steepland soils from schist on steep mountain country, with strongly leached soils from Pleistocene gravels on hilly slopes; very poorly drained acid, low fertility soils with peaty topsoils and massive grey subsoils on higher terraces; more fertile well drained moderately leached soils, moderately deep over gravels, on lower terraces; sandy to clayey alluvial soils, generally with poor drainage, on river flats.

VEGETATION: characterised by unbroken silver beech forests, extending from a regular treeline down to altitudes where other hardwoods and podocarps become competitive.

FLORA: floristically similar to Mahitahi.

BIRDS: Falcon, kaka and Yellow-crowned Parakeet present in forest; kea above tree line; Fernbird reported; Blue Duck present on the upper Moeraki R.

LANDSBOROUGH ECOLOGICAL DISTRICT 51.03

Criteria: geology (metamorphic rocks), landform (glaciated ranges separated by a large valley), climate (noticeable rain shadow, severe frosts), vegetation (forests almost exclusively silver beech).

TOPOGRAPHY/GEOLOGY: the catchments of Landsborough R. and its tributary, Clarke R., form this distinctive district of broad valley flats bounded by two high glaciated Haast Schist ranges, the Hooker in the NW and the Main Divide in the SE: the valleys therefore lie in a relative rain shadow which is reflected in the vegetation; maximum altitude 2722m a.s.l.

CLIMATE: high rainfall, 6400mm p.a., but protected from much of the cloud and drizzle of valleys which flow directly to the sea; heavy winter frosts.

SOILS: mainly strongly leached to podzolised stony, shallow steepland soils showing an altitudinal sequence; unstable soils and areas of bare rock and scree extensive on higher slopes.

VEGETATION: silver beech forests dominate below treeline; podocarps only occur on lowest slopes towards the confluence with Haast R.; red tussock dominates the terraces.

FLORA: botanical relationships are as much with the adjoining headwaters of the Waitaki R. as with Westland: several species characteristic of Canterbury occur on the flats; a few species above treeline are not found elsewhere in South Westland.

BIRDS: Falcon widespread; kaka, Yellow-crowned Parakeet and Yellowhead (still common in parts of the Landsborough valley) in the forest; kea and Rock Wren above tree line; Blue Duck have been recorded on rivers.

HAAST ECOLOGICAL DISTRICT 51.04

Criteria: landform (alluvial plains, granite domes and Holocene dunes), climate, vegetation (mainly mixed forest, pakihi bog and swamp, except on granite outcrops which support up to three beech species).

TOPOGRAPHY /GEOLOGY: low-lying land between the Coal Creek in the N and Neil's Beach in Jackson Bay extending from the coast inland to the Alpine Fault: recent river flats and outwash gravel plains formed since sea-level reached its present height about 6000 years ago; generally poorly drained particularly the swampy interfluves; a number of generally small Tuahua granite outcrops including the highest peak, Mt McLean, 689m a.s.l.; plus a series of arcuate Holocene dunes that extend inland in places almost to the Alpine Fault.

CLIMATE: mild temperatures, rainfall 3000-4000mm p.a. with little seasonal variation.

SOILS: very poorly drained low fertility soils with peaty topsoils and massive grey subsoils on higher terraces with associated deep acid peats; lower terraces slightly better drained with moderately deep soils over gravels; alluvial soils, generally poorly drained on river flats; strongly leached to podzolised sandy and gravelly soils on coastal dunes and beach ridges; small areas of steepland soils from granite.

VEGETATION: indigenous vegetation largely swamps and pakihi bogs, some impressive podocarp and mixed silver beech-podocarp stands; mountain beech and hard beech occur only sporadically on the granite outcrops S of Haast R. Beeches diminish towards the N: the most northern outcrop supports only a few pockets of silver beech among the prevailing podocarp-hardwood forest.

MAMMALS: breeding colony of N.Z. Fur Seal on Open Bay Islands.

BIRDS: this district mostly comprises cold, infertile, badly-drained flats with varying proportions of forest cover. There is a diverse avifauna but at low densities. Brown Kiwi may be present S of the Haast R.; falcon, kaka (abundant), Yellow-crowned Parakeet and Fernbird are widespread (abundant on Open Bay Islands); Rifleman present only in isolated beech stands; Yellowhead present near Okuru; robin very scarce. Kea present above tree line. On the Open Bay Islands there are large breeding colonies of Sooty Shearwater and Fairy Prion; Spotted Shag breed there; weka are abundant. Fiordland Crested Penguin breed along the coast.

REPTILES: forest gecko (Hoplodactylus granulatus) on Open Bay Islands are distinctive and may require sub-specific status.

FISH: include giant kokopu (Galaxias argenteus) and short jawed kokopu (G. postvectis).

MODIFICATIONS: recent alluvial flats grazed; some logging of forested private land.

OKURU ECOLOGICAL DISTRICT 51.05

Criteria: topography, climate (high rainfall), geology, vegetation (silver beech), flora (southern floristic element).

TOPOGRAPHY: strongly glaciated mountainous district with flat valley floors S of Haast R.; altitude mostly below 2000m a.s.l.; highest point Mt Brewster, 2423m.

GEOLOGY: mostly Haast Schist with Holocene gravel, sand and silt in the river valleys.

CLIMATE: mountain climate characterised by high rainfall, 5600-8000mm p.a.; minimum in winter; prevailing winds NW to SW; gales not frequent. Includes both W and E flowing valleys, latter in partial rainshadow with more severe climates.

SOILS: altitudinal sequence of stony, shallow to moderately deep, steepland soils from schist: in lower altitude and rainfall areas of the SE soils strongly leached with yellowish brown friable subsoils; with increasing altitude and rainfall soils range from very strongly leached to podzolised; soils on easier slopes at higher altitudes have peaty topsoils and impeded subsoil drainage; unstable soils and areas of bare rock and scree extensive on upper slopes of mountains; small areas of alluvial soils on river flats.

VEGETATION: snow tussock and silver tussock on wide valley floors; lowland silver beech-podocarp forests on lower slopes; altitudinal sequence to montane, subalpine silver beech forests, scrub and tussockland; areas of mixed forest and scrub on seaward faces of mountains.

FLORA: southern alpine floristic element becomes noticeable, e.g. Hebe hectori, Aciphylla congesta, Dracophyllum fiordense. Northern limit of Celmisia markii (recently described South Westland - West Fiordland species).

BIRDS: falcon widespread; kaka and Yellow-crowned Parakeet present in forested areas; Yellowhead widespread (more abundant in Makaroro Valley); robin only in Makaroro Valley; Fernbird at low elevations in the W. Kea and Rock Wren above tree line; Blue Duck have been reported along rivers.

MODIFICATIONS: river flats grazed (cattle), red deer, possums, chamois present; southern limit of thar in the NE.

ARAWATA ECOLOGICAL DISTRICT 51.06

Criteria: topography (steep, heavily glaciated), climate, geology, vegetation (mostly silver beech forest).

TOPOGRAPHY: high, moderately steep, strongly glaciated mountains and flat valley floors; altitudinal range from 150m to highest point, Mt Aspiring, 3027m a.s.l.; drained to the N, SE and E.

GEOLOGY: mostly Haast Schist with Holocene gravel, sand and silt in river valleys.

CLIMATE: very high rainfall, mountain climate, mostly 5000-8000mm p.a.; extensive but diminishing snowfields above 2000m.

SOILS: altitudinal sequence of stony, shallow to moderately deep steepland soils from schist: in lower rainfall and altitude areas of the W soils strongly leached with friable yellowish brown subsoils; with increasing altitude and rainfall soils more strongly leached to podzolised, with soils on easier slopes at higher altitudes having peaty topsoils and poor subsoil drainage; unstable soils and extensive areas of bare rock and scree on upper slopes of mountain; small areas of alluvial soils on river flats.

VEGETATION: snow and silver tussock on wide valley floors, lowland beech-podocarp forest on lower slopes (silver and localised red beech in Arawata Valley); altitudinal sequence grading to subalpine silver beech forests; subalpine scrub, alpine snow tussockland and high-alpine fell field and nival zones.

BIRDS: Great Spotted Kiwi (in Waiatoto R.; southern limit) and Brown Kiwi (an isolated population separated from those in Waiho E.D. and FIORD region) are present; widespread forest species include falcon, kaka (abundant), Yellow-crowned Parakeet (Red-crowned Parakeet have also been reported), Rifleman and Yellowhead (especially in the Arawata R.); robin are absent; isolated population of weka in the Arawata R.; Rock Wren and kea are present above tree line. Blue Duck are known only from the Arawata catchment; Scaup have been reported. Wrybill and Pied Stilt breed on the Makaroro R.; S.I. Pied Oystercatcher breed on the Waiatoto and Arawata Rivers.

MODIFICATIONS: most river flats grazed (cattle); deer, chamois, hares present.

DART ECOLOGICAL DISTRICT 51.07

Criteria: topography, altitude, climate, geology, vegetation, flora.

TOPOGRAPHY: moderately steep N-S trending mountains with flat valley floors; altitudinal range from 150m to highest point, Mt Earnslaw, 2819m a.s.l.; drained by Hollyford R. in the W, Dart R. in the E.

GEOLOGY: includes Paleozoic Haast Schist in the NE, Permian sandstones, argillite and siltstones and partly schistose greywacke and argillite, breccias tuffs etc. in the Ailsa and Humboldt Mountains, with Permian Livingstone Volcanics, Howden Formation, Tapara Formation and Upper Eocene feldspathic sandstone etc. in the Bryneira Range, E of L. Alabaster; alluvial valley floors.

CLIMATE: very high rainfall, 2000-8000mm p.a., mountain climate.

SOILS: mainly shallow, stony steepland soils from a range of indurated rocks showing an altitudinal sequence: in lower altitude and rainfall areas soils from more siliceous rocks strongly leached with friable yellowish brown subsoils; with increasing altitude soils more strongly leached to podzolised with peaty topsoils and iron-stained subsoils on more stable sites; soils from more basic rocks in the W have slightly heavier textured, redder subsoils but show similar altitudinal sequence; generally unstable soils and areas of bare rock and scree extensive on higher mountain slopes; sandy and silty generally well drained alluvial soils on recent fans and river flats with small areas of stony podzolised soils on moraines and deeper soils from loess on high terraces.

VEGETATION: modified indigenous tussocklands (silver and snow tussock) occupy wide valley floors in the NW with lowland beech-podocarp forests on low slopes (red and silver beech); an altitudinal sequence grading to silver beech along and W of the Main Divide; silver beech - mountain beech and pure mountain beech forests at tree line on E side of the Divide; subalpine scrub, alpine tussockland and high-alpine zones.

FLORA: Alpine flora has southern affinities.

BIRDS: widespread forest species include falcon, weka, kaka, Yellow-crowned Parakeet (isolated records of Red-crowned Parakeet), Yellowhead (more common in the Caples R. and Route Burn), Rifleman and robin; kea and Rock Wren are present above tree line. Blue Duck occur on some rivers; Scaup have been reported.

MODIFICATIONS: cattle graze on valley floors E of the Divide; deer, chamois, possum, hare occur throughout.

HIGH PLAINS ECOLOGICAL DISTRICT 56.01

Criteria: climate, topography: vegetation and soils influenced by the former two criteria.

TOPOGRAPHY: a long narrow district of higher altitude coalesced fans fringing the eastern foothills of the Southern Alps from the Okuku R. to the Rangitata; between 150 and 600m a.s.l.; drained also by the Ashley, Waimakariri, Selwyn, Rakaia, Ashburton, Hinds, Orari and Opihi Rivers.
GEOLOGY: mainly Pleistocene glacial outwash gravels and Holocene alluvial deposits; minor emergent volcanic outcrops, some forming small hills, Cretaceous in the S, late Miocene in the N.

CLIMATE: low rainfall though higher than Low Plains, 800-1000mm p.a.; in the S slightly more rain in summer than other seasons; warm summers with occasional hot foehn northwesterlies giving temperatures above 32^{0}C; cool winters (cooler than Low Plains), frequent easterly showers, though winds less fierce than Low Plains, frequent frosts and occasional snowfalls (more snow than Low Plains).

SOILS: mainly droughty shallow and stony soils on terraces and low angle fans; alluvial soils ranging from stony sands to deep silt loams on river flats and low terraces; apart from deeper siltier soils most are droughty; on higher terraces and rolling downs deep clayey soils from loess with compact subsoils and slow internal drainage; deep silty and fine sandy soils on terraces bordering rivers where loess is currently accumulating.

VEGETATION: originally largely forested; former vegetation mainly lowland short tussockland; stands of kanuka above Eyrewell and Moronan; few remnants of indigenous vegetation remain: tall tussock (Chionochloa rigida) S of Rakaia, C. macra and red tussock (C. rubra) N of Rakaia, latter on poorly drained soils; extensions of hill beech/hardwood forest near Oxford, Alford and Mt Somers; well developed riparian mixed scrub and hardwood woodland along river banks and terraces edges (kowhai, kohuhu, cabbage tree etc.); minor areas of mixed scrub throughout tussockland.

FLORA: southern limit for Pomaderris phylicifolia var. ericifolia.

BIRDS: highly modified for farming and no land birds of note have been reported. The large rivers (Waipara, Ashley, Waimakariri, Ashburton, Rangitata, Orari, Rakaia), are important for species adapted to braided riverbeds such as Wrybill (especially on the Rakaia R. where there are 1,000-1,500 birds) and Caspian Tern.

MODIFICATIONS: most of district farmed (intensive sheep, cattle and crops), with plantations of exotic trees.

LOW PLAINS ECOLOGICAL DISTRICT 56.02

Criteria: climate (drier than High Plains), topography: vegetation and soils resulting from the interaction of these two.

TOPOGRAPHY: large area of coalesced fans N and S of Banks Peninsula ranging from sea level to about 300m a.s.l.; extending from the Waipara R. in the N to the Washdyke Creek in the S, drained also by the Ashley, Waimakariri, Selwyn, Rakaia, Ashburton, Hinds, Rangitata, Orari and Opihi Rivers.

GEOLOGY: mainly Pleistocene glacial outwash gravels and Holocene alluvial deposits; significant areas of Holocene coastal swamp deposits near Tuahiwi/Ohoka, Marshlands, Doyleston, Longbeach, Seadown; significant areas of beach gravels from Christchurch to Waipara R. and at Seadown in the S; extensive coastal sands from Christchurch to Waipara R.; minor areas of inland dunes centred on Halkett.

CLIMATE: low rainfall: 600-800mm p.a.; in the S slightly more rain in summer than other seasons; warm summers with hot foehn northwesterlies giving temperatures above 32^{0}C; cool winters with frequent frosts and occasional light snowfalls.

SOILS: shallow, stony, droughty soils on terraces and coalescing low angle fans with poorly drained, gleyed, silty and clayey soils on lower parts of fans; alluvial soils on river flats and low terraces, ranging from excessively drained stony sands to well drained deep silty soils; local areas of more poorly drained alluvial and peaty soils where water-tables are high; excessively drained sandy soils on both coastal and terrace dunes; salty soils bordering Lake Ellesmere where high water-tables are saline; deep clayey soils with compact subsoils and impeded drainage from loess on flattish to strongly rolling downlands.

VEGETATION: vegetation types and yellow-grey earth soils reflect the dry climate. Former vegetation mainly lowland short tussockland with some floodplain forest; forest remnants (podocarp-hardwood) formerly occured at Rangiora, Kaiapoi and Woodend; still occur at Riccarton and Arowhenua; extensive kanuka, with minor manuka, stands at Eyrewell, Bankside and Moronan; extensive flax, sedge, cabbage tree etc.; swampland on swamp deposits listed above; dry riparian kowhai-mixed hardwood woodland flanking major rivers, especially on Great Island at Rakaia mouth; elsewhere mixed short tussock, native grasses, shrubs (e.g. matagouri, Coprosma, Olearia).

FLORA: Hinau and Gahnia xanthocarpa reach their southern limits in eastern South Island in Riccarton Bush; species with eastern limits include Iphigenia novae-zelandiae, Bulbinella angustifolia, Stackhousia minima and Carmichaelia monroi.

BIRDS: highly modified for farming and there are no land birds of note (there is an isolated report of robin from the N). The large rivers (Waipara, Ashley, Waimakariri, Ashburton, Rangitata, Orari, Rakaia) are valuable habitat (both feeding and breeding) for species adapted to braided riverbeds such as Wrybill, Caspian Tern (also coastal), Black-fronted Tern, and Black-billed Gull; Red-capped Dotterel have bred with the high breeding populations of Banded Dotterel on the Ashley R.; Black-fronted Dotterel breed on the Ashburton, Orari and Opihi Rivers. The large estuaries are valuable sites for waders and for birds such as the bittern and Marsh Crake (also known from swamps and wetlands elsewhere in

the district); Scaup are known from this district. Southern Blue Penguin breed at Ashburton beach.

REPTILES: jewelled gecko (Heteropholis gemmeus) reported from Eyrewell SF (northern limit) and Brighton. Spotted skink (Leiolopisma lineoocellatum) present on the coast at Spencerville and inland at Macleans I.

FISH: include the Canterbury mudfish (Neochanna burrowsius), between the Ashley and Waitaki Rivers from se level to 350m a.s.l.

MODIFICATIONS: most of district farmed (intensive sheep, cattle and crops), some areas of exotic forest, numerous small settlements, plus major urban centre of Christchurch.

BROWNING ECOLOGICAL DISTRICT 58.01

Criteria: climate (bounded in the E by a sharp drop in rainfall and consequent drop in heavy forest; more forest than Armory; less ice than Murchison), vegetation, altitude (topography).

TOPOGRAPHY: heavily glaciated, rugged mountains immediately E of crest of Southern Alps; altitudinal range mostly 900-2100m a.s.l.; highest point Mt Murchison, 2400m; drained to the E via the Wilberforce, Mathias and Rakaia Rivers.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite; Holocene river gravel, sand and silt in the river beds.

CLIMATE: high rainfall mountain climate: humid to super humid, annual rainfall 2000-5000mm; cool summers, cold winters, some relatively small areas of permanent snow and ice.

SOILS: mainly bare rock and scree with areas of shallow, stony alpine soils; strongly leached steepland soils in subalpine zone; very strongly leached to podzolised steepland soils at lower altitudes under beech forest; well drained sandy alluvial soils on river flats.

VEGETATION: alpine vegetation; extensive subalpine scrub (Dracophyllum traversii, D. longifolium, Phyllocladus alpinus, Olearia ilicifolia); tussockland (snow tussock: Chionochloa flavescens, C. pallens, C. crassiuscula); cushion bog and red tussock (Chionochloa rubra) in wet sites; confier/hardwood forest at lower altitudes (Hall's totara dominant with stands of kaikawaka; some southern rata and Dacrydium biforme).

FLORA: district marks western limit of beech forest in central South Island; local rare and uncommon plants include Olearia colensoi, Eleocharis sphacelata (in bog), Myosotis uniflora (in riverbed).

BIRDS: kaka, Rifleman and Yellow-crowned Parakeet are known from forested sites, and kea and Rock Wren occur above tree line; falcon are widespread; Blue Duck have been observed on some rivers.

MODIFICATIONS: introduced mammals include red deer, a few thar, possum and hares.

ARMOURY ECOLOGICAL DISTRICT 58.02

Criteria: landform (rugged mountains, extensive glaciers, moraines), climate, vegetation.

TOPOGRAPHY: heavily glaciated high mountains and wide river valleys with braided streams; largely over 1000m a.s.l.; several peaks above 2500m; drained to the E via the Rakaia and Rangitata Rivers.

GEOLOGY: almost entirely Mesozoic Torlesse Supergroup greywacke and argillite; Pleistocene glacial and outwash gravels in valley floors; extensive Holocene moraines.

CLIMATE: high rainfall mountain climate: superhumid; rainfall 3000-5000mm p.a., much winter snow; cool summers, cold winters, strong west winds; large areas of permanent snow, glaciers, moraine and ice plateaux; snow avalanches important.

SOILS: mainly bare rock and scree with areas of stony and shallow alpine soils; strongly leached steepland soils in subalpine areas; very strongly leached to podzolised steepland soils at lower altitudes under beech forest; sandy alluvial soils, some with imperfect to poor drainage on river flats.

VEGETATION: subalpine scrub on lower and mid slopes, Dracophyllum longifolium and Phyllocladus alpinus; alpine vegetation at higher altitudes, Chionochloa flavescens, C. pallens and C. crassiuscula, rich in herbs (where thar not abundant); a few small Oreobolus-Donatia cushion bogs.

FLORA: important plant species include Parahebe birleyi, Ranunculus godleyanus, rare Libocedrus bidwillii (Rakaia), Dracophyllum traversii (Clyde R.), scattered Metrosideros umbellata, patches of Hall's totara forest, Hoheria glabrata, and Griselinia littoralis.

BIRDS: as this district contains mostly subalpine and alpine habitats it has a relatively poor avifauna. Kea and Rock Wren occur at higher elevations; falcon are present; Blue Duck are found on some rivers.

MODIFICATIONS: severe thar damage to vegetation and soils in places - especially Havelock R.; other introduced mammals include chamois, red deer, hares and possums.

MT COOK ECOLOGICAL DISTRICT 58.03

Criteria: topography, altitude, presence of glaciers, climate, vegetation.

TOPOGRAPHY: heavily glaciated, very high steep mountains including the highest mountain in New Zealand, Mt. Cook, 3764m a.s.l. (most of district in Mt Cook National Park); much of district above 3000m; large areas occupied by glaciers and ice.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite with small areas of Holocene alluvium and Pleistocene till in valleys.

CLIMATE: high rainfall, 2000-8000mm p.a., mountain climate: relatively few rainy days, but occasional short periods of intense rainfall; cool summers, cold winters; permanent snow about 2150m, seasonal snow down to about 1000m; heavy snowfalls at lower altitudes may damage vegetation; winds commonly reach gale force even in valleys.

SOILS: mainly bare rock and scree with areas of stony and shallow alpine soils; at lower altitudes strongly leached stony steepland soils under beech forest; small areas of deeper but stony soils on moraines and terraces; sandy alluvial soils on river flats and fans.

VEGETATION: patterns complex; resulting from complex interaction of factors including altitudinal range, height, steepness, climatic gradients, glaciation, fire and herbivores: altitudinal zones working downwards include perennial snow and ice, alpine rock and debris, alpine grassland and herbfield (e.g. Chionochloa pallens, C. crassiuscula, C. flavescens, Rytidosperma spp., Poa colensoi, Celmisia spp.); upper-subalpine shrublands and scrub (e.g. Podocarpus nivalis, Dracophyllum uniflorum, Gaultheria crassa); subalpine and montane grasslands (e.g. Chionochloa rigida, Festuca spp., Poa "silver tussock"; lower-subalpine and montane forests (Hall's totara forest and limited silver beech forest; kaikawaka very rare); vegetation also occurs on rock, transported debris, wetlands and artificially disturbed and burnt areas.

FLORA: there are few species endemic to the central South Island alpine region (compared with areas N and S) e.g. Colobanthus monticola, Myosotis suavis, Ranunculus godleyanus, R. grahamii; Celmisia hectori reaches its northern limit here.

BIRDS: forested areas contain species such as Rifleman, robin and Yellow-breasted Tit but kaka are now believed to be absent; falcon throughout; kea and Rock Wren at higher elevations; Blue Duck occur on the upper reaches of some rivers; lower where the rivers are braided there are riverbed species like Wrybill (less common than formerly due to habitat loss because of invasion by lupin), Black-fronted Tern, Banded Dotterel, and S.I. Pied Oystercatcher.

REPTILES: jewelled gecko (Heteropholis gemmeus) occur around the Hermitage.

INSECTS: include two alpine grasshoppers (Sigaus australis, Brachopsis nivalis), two lower altitude species (S. campestris, Phaulacridium marginale); giant weta Deinacrida connectens found on De La Beche Ridge in Tasman Valley.

MODIFICATIONS: introduced mammals include thar, chamois, hares, rabbits (latter at low altitudes), deer in Hall's totara forest, sheep on Tasman and Hooker flats.

MATHIAS ECOLOGICAL DISTRICT 59.01

Criteria: topography, vegetation, climate.

TOPOGRAPHY: high, glaciated rugged mountains, valleys, braided rivers on wide flood-plains, in lower reaches of Wilberforce and Mathias Rivers; mostly between 300m and 2100m a.s.l.; drained to the SE ultimately by Rakaia R.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite; Holocene river gravel, sand and silt in river beds; small outcrop of Tertiary sands at Mt Algidus.

CLIMATE: moist, cold winters, moderately warm summers; rainfall 2000-4000mm p.a.; snow lies at higher altitudes for several months in winter.

SOILS: extensive areas of bare rock and scree with stony and shallow alpine soils; at lower altitudes soils grade through strongly leached steepland soils in subalpine zone to very strongly leached to podzolised steepland soils at lower altitudes under beech forest; sandy alluvial soils, some with imperfect drainage on river flats and young fans; small areas of stony soils on moraines, terraces and older fans.

VEGETATION/MODIFICATIONS: original forest cleared by fire in early days of European settlement: vegetation mainly modified tussocklands (Chionochloa pallens, Festuca novae-zelandiae with introduced grasses etc. on valley floors); alpine communities; extensive areas of mountain beech forest; some montane conifer/hardwood forests (mainly Hall's totara/broadleaf, Pittosporum tenuifolium, lancewood in Mathias and Rakaia valleys; also a little kaikawaka, rare matai and miro at Mt Algidus; a little southern rata and kamahi; scrub (manuka, mountain toa toa and Dracophyllum).
District is grazed (extensive sheep and cattle) with some developed pasture; red deer, chamois, hare and possum present.

FLORA: western boundary is limit of beech forest forming contact with mixed forest; Raoulia haastii and Myosotis uniflora occur in riverbeds.

BIRDS: kaka reported from forested sites; kea present at higher elevations; falcon widespread; the braided riverbeds of the larger rivers (e.g. Wilberforce and Rakaia) provide habitat for species such as Wrybill, Black-fronted Tern and Black-billed Gull.

MOUNT HUTT ECOLOGICAL DISTRICT 59.02

Criteria: topography, vegetation (less plant cover, different forest composition from Mathias and Arrowsmith), geology, climate.

TOPOGRAPHY: high, moderately glaciated ranges; altitudinal range mostly 600-1200m a.s.l.; highest point Mt Taylor, 2330m; drained to the E by North Ashburton R. and tributaries of Rakaia R., to the S into L. Heron basin.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite; Pleistocene glacial outwash deposits; Holocene alluvium in major river beds; small areas of Tertiary sands and limestone at Swin and Smite Rivers and Redcliffe Hill (where limestone has been quarried); Cretaceous Mt Somers volcanics along eastern boundary, conglomerate and coal at Rakaia Gorge, Tertiary sands and limestone at Taylors Stm. and Staveley; some Mesozoic plant fossils.

CLIMATE: subhumid to humid; cold winters and cool summers; strong W winds, also exposed to SW; rainfall 1200-2000mm p.a.; at high altitudes snow lies for several months in winter.

SOILS: at higher altitudes, strongly leached, low fertility steepland soils from greywacke and related slope deposits with some podzolised soils. Large areas of bare rock and scree; at lower altitudes in the SE steepland soils less leached, more fertile; small areas of shallow, stony, droughty soils on terraces; generally well drained alluvial sois on river flats.

VEGETATION: mainly modified tussocklands (Chionochloa macra at high altitudes, Festuca novae-zealandiae at lower levels); alpine communities: scree flora with Ranunculus haastii, Stellaria roughii, Lobelia roughii etc.; significant areas of mountain beech forest; a little silver beech in Lake Stm. tributaries and at Mt Somers; minor podocarp element (Hall's totara, matai, kahikatea); southern rata in places; scrub (Dracophyllum uniflorum, D. acerosum, Phormium cookium etc.).

FLORA: uncommon or rare species include Euphrasia dyeri; there is a somewhat unusual occurrence of Chionochloa pallens and Coprosma serrulata; Raoulia hectori is at its northern limit.

BIRDS: Yellow-crowned Parakeet reported from forested sites; falcon present; kea occur at higher elevations; Blue Duck are found on the upper reaches of some rivers; Banded Dotterel, Black-fronted Tern and Wrybill breed on the braided riverbeds of the Rakaia and Ashburton Rivers; Scaup also occur in this district.

INSECTS: include a newly discovered weta, Deinacrida sp. near Woolshed Creek.

MODIFICATIONS: vegetation modified by repeated burning; much of district is grazed (extensive sheep and cattle); red deer, chamois, hare and possums present.

ARROWSMITH ECOLOGICAL DISTRICT 59.03

Criteria: topography (precipitous glaciated peaks, alligned mountain river valleys, wide river floodplains, braided rivers, large moraines, less rugged than Mt Hutt and Two Thumb), vegetation (tall tussock, matagouri scrub, pockets of forest, more forest than Mathias).

TOPOGRAPHY: high moderately glaciated mountains and valleys between Rakaia and Havelock Rivers; some gentler hills on the E; altitudinal range mostly between 900 and 2,100m a.s.l.; highest point Mt Arrowsmith, 2795m; drained by Lawrence, Clyde, Havelock, Ashburton, Potts and Cameron Rivers flowing to the SE.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite including Tank Gully fossil bed, some Tertiary sediments and extensive fluvio-glacial and glacial deposits; areas of Holocene alluvium in the major river beds.

CLIMATE: subhumid to humid: strong W winds, cold winters, moderately warm summers; rainfall about 1000-4000mm p.a.; permanent snow and ice persists at high altitudes with a number of small valley glaciers.

SOILS: extensive areas of bare rock and scree with areas of alpine soils at higher altitudes passing down to strongly leached stony steepland soils; moderately to strongly leached, shallow to moderately deep soils with good drainage on terraces, fans and moraines in the S; small areas of well drained alluvial soils.

VEGETATION: original vegetation included Hall's totara - mixed hardwood forest and beech forest. Now mainly modified tussocklands and alpine communities: Festuca novae-zealandiae on valley floors and lower slopes but also tall tussock extensive there and on mid slopes, Chionochloa rigida (with C. macra at higher altitudes and C. pallens in west) plus Celmisia spectabilis var magnifica; small areas of beech forest (mainly mountain beech with a little silver beech rare in central Canterbury), and montane podocarp/hardwood forests (with Hall's totara, mountain toatoa, Pittosporum tenuifolium, broadleaf and Hoheria lyallii) and scrub (matagouri on valley floors and lower slopes; Podocarpus nivalis and Dracophyllum uniflorum higher).

FLORA: important species include alpine Parahebe birleyi and Ranunculus crithmifolius, montane Pittosporum anomalum, and Myosotis uniflora - in riverbeds; northern limit of Olearia moschata.

BIRDS: forest remnants contain the more usual forest species (Yellow--breasted Tit, Brown Creeper) and also Yellow-crowned Parakeet; falcon widespread; kea at higher elevations; Blue Duck have been recorded; braided riverbeds are used by species such as Wrybill, Banded Dotterel, S.I. Pied Oystercatcher and Black-fronted Tern.

MODIFICATIONS: most of vegetation modified by burning beginning in Polynesian times (c.500 years ago) and continuing in early days of European settlement. Today much of district grazed (extensive sheep and cattle). Introduced mammals include mustelids, rabbits, hares, red deer, thar, chamois.

HAKATERE ECOLOGICAL DISTRICT 59.04

Criteria: topography (much lower and gentler than the surrounding districts, but nevertheless quite diverse), vegetation and fauna associated with lakes, tarns and wetlands, geology (moraines, terraces), climate.

TOPOGRAPHY: glacial intermontane basin with moraines, low hills and braided river beds of South Ashburton and Rangitata valley systems; altidudinal range mostly 300 to 900m a.s.l., hills up to 1360m; Ashburton lakes with associated wetlands are characteristic of district.

GEOLOGY: extensive Pleistocene till with rolling morainic topography, some outwash gravels and Holocene alluvium; small areas of Tertiary sandstone and mudstone at Turkey Gully, the mouths of Cameron and Potts Rivers, Haast Stream, and the head of North Branch Hinds R.; the Clent Hills are Mesozoic Torlesse Supergroup greywacke and argillite (with Clent Hills Formation plant beds), and basic lavas and tuffs; hard Cretaceous Mt Somers Volcanics and soft Cretaceous - Tertiary coal measures, sands and limestone occur between Mt Somers and Clent Hills (several working opencast quarries).

CLIMATE: subhumid with cold winters, warm summers; rainfall 800-2000mm p.a.

SOILS: shallow to moderately deep soils from variable thickness of loess over till, alluvium and colluvium on moraines, terraces and fans: in lower rainfall areas moderately leached and droughty, under higher rainfalls more strongly leached with more even moisture conditions; on steeper hill country soils from greywacke with variable cover of loess, those in lower rainfall areas droughty in summer.

VEGETATION: mainly modified lowland short tussockland (Festuca novae zealandiae), some tall tussockland (Chionochloa rigida with Celmisia spectabilis var magnifica) especially on hills; scrub (matagouri, Caprosma species and some manuka).

FLORA: wetlands particularly extensive and very important for their flora (e.g. Chionochloa rubra, Typha, Carex secta, Schoenus pauciflorus) and fauna values; small tarns in moraine also have distinctive flora. Pimelea pulvinaris reaches its northern limit in this district.

BIRDS: the scarcity of forest habitats is reflected in a very poor forest avifauna, the only species of note from this district being the Yellow-crowned Parakeet. Falcon widespread; kea present at higher elevations. The L. Heron wetland is of great significance and is probably the best wetland of this type in the S.I. high country. Birds at L. Heron include: Southern Crested Grebe (one of the two main populations is here but they also occur at other lakes in the district), bittern, Marsh Crake, Scaup, and Australasian Coot (common). L. Emma supports a locally important breeding population of Black Swan. Also of significance in this district are the braided riverbeds which provide habitat (feeding and breeding) for Wrybill (especially the Rangitata R.), Pied Stilt, S.I. Pied Oystercatcher, Banded Dotterel, Caspian Tern and Black-fronted Tern; Blue Duck have been reported from the upper reaches of some rivers.

REPTILES: spotted skink (Leiolopisma lineoocellatum) present on the Peter Range.

FISH: include the rare Canterbury mudfish (Neochanna burrowsius).

MODIFICATIONS: vegetation modified by repeated burning, extensive sheep and cattle grazing and considerable pasture development. Introduced mammals include mustelids, rabbits, hares, red deer, thar, chamois. Introduced fish include salmonids.

TWO THUMB ECOLOGICAL DISTRICT 59.05

Criteria: topography (essentially a steep mountain block), climate, vegetation.

TOPOGRAPHY: the Two Thumb Range and associated mountains, moderately glaciated in the N, mostly between 1000 and 2100m a.s.l.; highest point The Thumbs, 2545m; drained to the NE into the Rangitata R., to the SE into the Fairlie Basin, to the W and S into the Mackenzie Basin.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite metamorphosed to Chlorite IT subzone in the S.

CLIMATE: humid climate with cold winters, moderately warm summers; rainfall 800-5600mm p.a; the mountains receive fairly heavy snowfalls from the S; permanent snow persists only on highest peaks.

SOILS: extensive areas of bare rock and scree at higher altitudes with some shallow and stony alpine soils; at lower altitudes mainly strongly leached stony steepland soils from greywacke and related slope deposits, unstable, screes common; slightly deeper soils on hilly land in the SE.

VEGETATION/MODIFICATIONS: mainly tussocklands and alpine communities, mostly modified by repeated burning beginning in Polynesian times, and grazing by both domestic and wild animals; originally Hall's totara - mixed forest on lower to mid slopes and some mountain beech forest in the E; small areas of mountain beech and podocarp-hardwood forest remain in E; matagouri and coprosma scrub occurs on lower slopes and in some valleys, also tussocklands, Festuca novae zealandiae on drier slopes, Chionochloa rigida and Celmisia spectabilis var. magnifica on wetter lower to mid slopes and Chionochloa macra at higher altitudes. Introduced mammals include bush wallaby, than, chamois, red deer, fallow deer, mustelids, rabbits and hares.

FLORA: district forms the northern limit for several species including Aciphylla dobsoni, Anisotome lanuginosa, and Lobelia linnaeoides.

BIRDS: forest remnants include only relatively common and widespread species including Brown Creeper and Yellow-breasted Tit. Falcon widespread; kea occur at higher elevations.

GODLEY ECOLOGICAL DISTRICT 60.01

Criteria: landforms, climate, vegetation, glaciation and geology.

TOPOGRAPHY: high mountains and broad glacier-formed open valleys; present day glaciers small, along the W; altitudinal range from about 540 to nearly 3000m a.s.l.; drained to the S into L. Tekapo and L. Pukaki.

GEOLOGY: Mesozoic Torlesse Supergroup greywacke and argillite with Pleistocene till and Holocene alluvium in the major valleys.

CLIMATE: dominated by rain-shadow effect of Main Divide: semicontinental, low humidity, cold winters, snow may lie on valley floors, is permanent for several months above about 1000m a.s.l.; ice perennial above about 2500m; sunny cool summers; rainfall ranges from about 5000mm p.a. in the W to less than 1000mm in the E.

SOILS: extensive areas of bare rock and screes at higher altitudes with areas of stony and shallow alpine soils; at lower altitudes mainly strongly leached stony steepland soils from greywacke and related slope deposits; some areas of deeper soils from loess over till, alluvium and greywacke on terraces, fans and rolling and hill land; sandy shallow to moderately deep generally well drained alluvial soils on river flats and fans.

VEGETATION: chiefly tall tussockland with short tussockland and matagouri on river flats; scrub and forest very limited (chiefly Hall's totara/Phyllocladus alpinus plus a small grove of silver beech in SE). Much bare rock and scree with scattered, specialised plants.

BIRDS: no forest birds of note are known from the few small areas of forest. Falcon widespread; kea and Rock Wren occur at higher elevations; the braided riverbeds of the Tasman, Godley and Macauley Rivers are valuable habitat (feeding and breeding) for riverbed birds such as Black Stilt, Pied Stilt, Wrybill, Banded Dotterel, Black-fronted Tern, Caspian Tern and S.I. Pied Oystercatcher.

REPTILES: jewelled gecko (Heteropholis gemmeus) known from along the Tasman R.

MODIFICATIONS: modified by fire and introduced mammals (e.g. thar, chamois, red deer, hares).

DOBSON ECOLOGICAL DISTRICT 60.02

Criteria: landforms, vegetation, climate, glaciation and geology.

TOPOGRAPHY: high, steep-sided mountains with deep glacier-formed valleys, broad in their lower reaches; present-day glaciers of moderate size; altitudinal range from about 550m to over 2100m a.s.l.; drained in the E into L. Pukaki and elsewhere by south flowing Dobson and Hopkins Rivers.

GEOLOGY: Mesozoic Torlesse Supergroup greywacke and argillite surround the Dobson R., weakly metamorphosed to Chlorite II subzone Haast Schists to the E and W; small areas of Pleistocene tills and Holocene alluvium in valleys.

CLIMATE: inland, mountain climate: strong winds; high rainfall diminishing away from Southern Alps from over 5000mm p.a. in the N along the Main Divide to about 2000mm in the S; permanent snow above about 2150m, seasonal snowfalls at lower altitudes.

SOILS: extensive bare rock and scree at higher altitudes with some areas of alpine soils; at lower altitudes strongly leached stony steepland soils from greywacke and related slope deposits, unstable, screes common; slightly deeper soils from loess on till, alluvium and greywacke on terraces, moraines, fans and hilly land.

VEGETATION: chiefly beech forest, open tussockland (Chionochloa at high altitudes and short tussock in valleys) and scrub (Dracophyllum, Phyllocladus, Podocarpus etc.); much bare rock and scree with scattered, specialised plants.

BIRDS: Falcon common and widespread; kea and Rock Wren at higher elevations; Black Stilt and Wrybill have been reported from the braided riverbeds of the Hopkins R., and Caspian Tern occasionally nest there.

REPTILES: jewelled gecko (Heteropholis gemmeus) known from sites along the shores of L. Pukaki.

MODIFICATIONS: modified by fire and introduced mammals (e.g. that, chamois, red deer and hares) - but rather less so than the Mt Cook, Godley and Tekapo districts to the N.

ORARI ECOLOGICAL DISTRICT 61.01

Criteria: topography, climate, flora, vegetation.

TOPOGRAPHY: a non-glaciated "refuge" district of low mountains including the Harper, Mount Peel and Four Peaks Ranges; altitudinal range mostly 6001500m a.s.l.; highest point Mt Harper, 1833m; drained to the SE, mostly by the Rangitata and Orari rivers.

GEOLOGY: mainly Mesozoic Torlesse Supergroup weakly indurated and moderately weathered sandstones and mudstones with Mt Somers Volcanics (rhyolite and andesite) between the Rangitata and Hewson rivers, and small areas of Tertiary and Quaternary deposits including limestone.

CLIMATE: a subhumid hill climate with cool to cold winters and mild dry summers; rainfall 1000-2800= p.a.; receives much less snow than Mt Hutt E.D. to the N; NW winds prevail with occasional very strong gales especially along river courses.

SOILS: mainly stony steepland soils from greywacke and related slope deposits, differences mainly dependent on altitude and rainfall: at lower altitudes and rainfall soils droughty in summer, deeper associated soils have pale-coloured compact subsoils; at intermediate altitudes soils have browner more friable subsoils, more even moisture conditions; higher altitude soils less stable, areas of scree and bare rock extensive.

VEGETATION: former vegetation included some beech forest, podocarp forest and podocarp-hardwood forest and subalpine tussockland and scrub. Some areas of podocarp and lowland podocarp-hardwood forest remain on Mt Peel protected in Peel Forest Park: best lowland totara/matai/kahikatea forest in mid central South Island; mostly milled pre 1900 or earlier. Extensive hardwood forests on eastern faces, broadleaf, mahoe, kowhai, ribbonwood, fivefinger, pokaka etc.; extensive stands of Southern rata, kanuka, mountain lacebark; extensive silver and fescue tussockland; extensive Chionochloa macra, C. rigida, C. pallens tall tussockland; extensive mountain flax, dracophyllum scrub; extensive subalpine vegetation; remnant stands of mountain beech; pockets of kaikawaka and black beech.

FLORA: a district rich in native plant species (over 600): an endemic unnamed edelweiss occurs here; district is the centre of distribution for Hebe amplexicaulis. The distributional limits of several plants occur here: eastern limits of Chionochloa pallens, Helichrysum plumeum, Marsippospermum gracile, Coprosma serrulata; western limit of Olearia fragrantissima; northern limits of Celmisia ramulosa, Anisotome capillifolia; southern limits of Notospartium torulosum, Hebe traversii, Celmisia allanii. Six species of mistletoe occur here.

BIRDS: most of district highly modifed for farming. Falcon and Scaup are present; Blue Duck occur in tributaries of the Orari, Opihi and Rangitata Rivers (generally they are scarce E of the Southern Alps).

REPTILES: jewelled gecko (Heteropholis gemmeus) known from Peel Forest and various sites further up the Rangitata R.

MODIFICATIONS: today most of the district is grazed (extensive or semi-extensive sheep and cattle and deer farming); some exotic forests in the south.

FAIRLIE ECOLOGICAL DISTRICT 61.02

Criteria: topography, climate, land use.

TOPOGRAPHY: the non-glaciated Fairlie basin and low hills; altitudinal range between about 150 and 600m a.s.l.; drained to the SE via the Opuha and Tengawai Rivers.

GEOLOGY: includes large areas of Pleistocene tills, loess-covered weathered gravels on terraces, outwash gravels etc., smaller areas of Tertiary marine deposits including siltstone and limestone, and weathered non--marine indurated sandstone gravel etc.

CLIMATE: subhumid with cool winters and mild dry summers: rainfall 700-1000mm p.a.; NW winds prevail with occasional very strong gales.

SOILS: on rolling downlands and hills soils from loess over Tertiary sedimentary rocks and Pleistocene gravels: in lower rainfall areas subsoils compact, pale-coloured, droughty in summer; in higher rainfall areas subsoils mottled, poorer winter drainage but less droughty in summer; shallow, stony, droughty soils on terraces; moderately deep to shallow silty and sandy alluvial soils on river flats, fertile, generally with good drainage.

VEGETATION/FLORA: former vegetation was mostly lowland short tussockland, tall tussockland, forest remnants in gullies, scrub and wetlands. Small remnants of podocarp, mixed hardwood forest remain on the Tengawai R. and Opihi Gorge; forest remnants in gullies are mainly mixed hardwoods, mahoe, broadleaf, fivefinger etc.; some interesting occurrences e.g. Pseudopanax ferox, Olearia fragrantissima, Hebe pareora, residual totara, matai and kahikatea. Areas of mixed coprosma, corokia scrub. Wetlands, especially in N. Opuha extensive and floristically rich; much red tussock. Flanks of Opihi Gorge have caps of Chionochloa rigida tall tussock and Celmisia spectabilis.

BIRDS: few bird species of note as this district is highly modified for farming. Species such as Rifleman, Bellbird, Yellow-breasted Tit and N.Z. Pigeon persist in forest remnants.

REPTILES: jewelled gecko (Heteropholis gemmeus) recorded near Cave.

MODIFICATIONS: largely farmed (semi-intensive sheep and cattle N of Fairlie and intensive sheep, cattle and crops).

GERALDINE ECOLOGICAL DISTRICT 61.03

Criteria: topography (altitude), geology, climate.

TOPOGRAPHY: downlands between the Orari and Tengawai rivers and drained also by the Opihi R; altitudinal range between 100 and 300m a.s.l.

GEOLOGY: includes large areas of Pleistocene tills and loess-covered weathered gravels on terraces with smaller areas of Tertiary marine deposits including greensands, siltstones and quartzose coal-measures, limestone and small areas of Holocene alluvium in river beds.

CLIMATE: a subhumid climate with cool winters and mild dry summers: rainfall 700-800mm p.a.; NW winds prevail with occasional very strong gales.

SOILS: mainly from loess overlying Tertiary sedimentary rocks and Pleistocene gravels; in lower rainfall areas subsoils pale-coloured, compact, droughty in dry seasons; under higher rainfalls subsoils mottled, poor winter drainage but less droughty. Moderately deep to shallow silty and sandy alluvial soils on river flats, fertile, generally with good drainage.

VEGETATION: former vegetation was mostly lowland short tussockland and forest remnants. A few small areas of podocarp forest remain; district includes several small reserves mostly of mixed hardwoods, including an unusual occurrence of ngaio, also mahoe, broadleaf, fivefinger etc.; remnant stands of totara, matai, kahikatea mixed forest; extensive kowhai in places.

FLORA: includes a small limestone flora.

BIRDS: few bird species of note as this district is highly modified for farming. Species such as Rifleman, Bellbird, Yellow-breasted Tit and N.Z. Pigeon persist in forest remnants.

MODIFICATIONS: today the district is largely farmed (intensive sheep, cattle and crops) with some exotic forestry in the W.

HUNTERS ECOLOGICAL DISTRICT 61.04

Criteria: topography, geology, flora, vegetation.

TOPOGRAPHY: the non-glaciated low mountains of the Albury and Single Hill Ranges and the NW-SE trending Hunters Hills; altitudinal range mostly between 600 and 1500m a.s.l.; highest point Mt Nimrod, 1525m; drained to the NE via the Pareora and smaller rivers, and to the SW mostly via the Hakataramea and Waihao Rivers.

GEOLOGY: mostly Mesozoic-Paleozoic Torlesse Supergroup greywacke and argillite with some Haast Schists and smaller areas of Pliocene weathered non-marine indurated sandstone gravel, Pleistocene loess covered weathered gravels and Tertiary marine deposits including siltstones, sandstones and limestones.

CLIMATE: a subhumid hill climate with cool to cold winters and mild dry summers: rainfall 800-1200mm p.a.; NW winds prevail with occasional very strong gales.

SOILS: mainly stony steepland soils from greywacke and related slope deposits: at lower altitudes subsoils pale-coloured, compact, droughty in summer; at intermediate altitudes subsoils browner and more friable, less droughty in summer; soils at high altitudes less stable, screes common. Deep silty soils from loess on rolling and hilly lands with pale-coloured compact subsoils and mottled indicating poor winter drainage.

VEGETATION: former vegetation included extensive tussocklands with podocarp and podocarp-hardwood forest remnants. Today the district includes extensive tussocklands with both silver and fescue tussock, and farmlands; much tall tussock and Celmisia spectabilis; gullies have extensive mixed scrub (coprosma etc.); isolated stands of silver beech.

FLORA: Hebe pareora is virtually endemic; several "Otago" plants occur on the tops e.g. Celmisia ramulosa; silver beech and Celmisia spectabilis are at their eastern limits.

BIRDS: district highly modified for farming; only birds of note are falcon; Blue Duck have been reported; Caspian Tern present on the rivers.

MODIFICATIONS: most of the district is grazed (semi-extensive sheep and cattle).

WAIMATE ECOLOGICAL DISTRICT 61.05

Criteria: topography, geology, climate, land use.

TOPOGRAPHY: downlands lying E and S of The Hunters Hills; mostly between 150 and 600m a.s.l.; drained mostly to the E via the Pareora and Waihao and several smaller rivers.

GEOLOGY: complex: some Mesozoic Haast Schists in the north; Pliocene Timaru Basalt west of Timaru; Pleistocene tills and loess-covered gravels in the east and various Tertiary deposits including limestones with sink holes and caves near Frenchman's Gully.

CLIMATE: subhumid with cool winters and mild dry summers; rainfall 700-800mm p.a.; NW winds prevail with occasional very strong gales.

SOILS: mostly deep soils from loess on rolling to hilly land with pale-coloured compact subsoils: on lower rainfall areas droughty in summer; in higher rainfall areas subsoils mottled, winter drainage poor, but not as droughty. Fertile soils with deep, dark coloured topsoils on calcareous sediments; shallow to moderately deep silty and sandy alluvial soils on river flats, natural fertility high, drainage good to excessive; small areas of steepland soils on greywacke and schist hill country.

VEGETATION: former vegetation mostly lowland short tussockland with podocarp-mixed hardwood forest remnants in gullies, e.g. mahoe, fivefinger, lancewood and broadleaf; some totara-matai and miro. Waimate and Pareora Gorges have substantial forest remnants - mainly hardwoods, with some totara, matai. Other stands of mixed podocarp/hardwood forests, rare silver beech, along low hills and valleys - several scenic reserves embody these.

BIRDS: district is highly modified for farming; species such as Rifleman, Bellbird, Yellow-breasted Tit and N.Z. Pigeon persist in forest remnants; only birds of note are falcon. Caspian Tern breed on the Waitaki R.

MODIFICATIONS: the district today is largely farmed (intensive sheep, cattle and crops).

HAKATARAMEA ECOLOGICAL DISTRICT 61.06

Criteria: climate, topograph, geology, vegetation.

TOPOGRAPHY: the Hakataramea River basin and nearby hills; mostly between 300 and 900m a.s.l.; highest point Mt Orr 1021m. Drained mostly via the Waitaki and Waihao rivers.

GEOLOGY: includes areas of Mesozoic Torlesse Supergroup greywacke and argillite and Haast Schists (mostly east of the Hakataramea R.); various Pleistocene deposits (mostly west of tie Hakataramea); smaller areas of Tertiary deposits including siltstones, sandstones mudstones and limestones and small areas of Holocene alluvium in the river beds.

CLIMATE: cool to cold winters and mild dry summers: rainfall 500-800mm p.a.; NW winds prevail with occasional very strong gales.

SOILS: on flattish, rolling and hilly land deep to moderately deep soils from loess over sedimentary rocks and alluvial gravels with pale-coloured very compact subsoils, fertile but very droughty, some with impeded drainage; on steep slopes generally shallow and stony soils: those in lower rainfall areas droughty; those in higher rainfall areas have browner and more friable subsoils, less droughty in summer. Small areas of fertile moderately deep to shallow alluvial soils on river flats.

VEGETATION: former vegetation was mostly tall tussockland, lowland short tussockland with forest remnants in gullies to the E and S. Now farmland and short tussockland at lower altitudes with many cabbage trees; tall tussockland (Chionochloa rigida) on higher hills, especially E and S, sometimes to low altitudes. Much scrub (mixed species) on steep faces; pockets of mixed hardwood forest; pockets of Hall's totara.

BIRDS: district highly modified for farming; the only land birds of note are falcon but the rivers (Waitaki and Hakataramea) provide habitat for a variety of riverbed species including Black Stilt, Pied Stilt, Wrybill, Banded Dotterel, Caspian Tern and Black-fronted Tern. Marsh Crake occur in wetlands adjacent to the Waitaki R.

MODIFICATIONS: farming includes intensive sheep, cattle and crops in the W and semi-extensive sheep and cattle in the E.

MAKIKIHI ECOLOGICAL DISTRICT 62.01

Criteria: topography, geology, climate, vegetation.

TOPOGRAPHY: coastal downlands and small coastal plain between Timaru and the Waihao R., mostly below 150m a.s.l.; drained by the Tengawai, and many small rivers. Includes an estuarine lagoon and long unbroken coastline.

GEOLOGY: mainly Pleistocene gravels and loess; basalt at Timaru; Pliocene conglomerate at Makikihi R.

CLIMATE: a subhumid cliamte: low rainfall, 600-700mm p.a.; warm summers, cool winters.

SOILS: mainly deep soils on rolling to hilly downlands from loess with pale-coloured compact subsoils, fertile but droughty; some in higher rainfall areas have impeded drainage. Moderately deep to shallow silty and sandy alluvial soils on better drained parts of river flats; deep silty, gleyed soils with poor drainage where water-tables are high.

VEGETATION: former vegetation was mostly lowland short tussockland with remnant scrub and minor forest. Some remnants of coastal vegetation and lowland podocarp/hardwood forest survive; typical hardwood species in forests (mahoe, broadleaf etc.) but small; woodlands of similar but scattered species, cabbage trees; areas of modified tussocklands, minor scrub; coastal dune, swamp, gravel beach and other vegetation types especially around Wainono Lagoon.

BIRDS: district highly modified for farming; no land birds of note. The Wainono Lagoon (estuary) is an important breeding locality for many different wetland birds including Scaup, Grey Duck, Grey Teal, and N.Z. Shoveler; Marsh Crake are present. The lagoon is visited by a wide variety of waders including Wrybill and, occasionally, Black Stilt; Caspian Tern also breed at the lagoon.

FISH: include the rare Canterbury mudfish (Neochanna burrowsius).

MODIFICATIONS: includes city of Timaru; district largely farmed (intensive sheep, cattle and crops).

GLENAVY ECOLOGICAL DISTRICT 62.02

Criteria: topography, geology, soils, vegetation.

TOPOGRAPHY: the floodplain of the Waitaki R; mostly below 150m a.s.l. with along coastline, broken by Waitaki River mouth.

GEOLOGY: mainly Pleistocene gravels, with some Pliocene conglomerate near Pikes Point and along the northern boundary.

CLIMATE: subhumid: low rainfall, 600mm p.a.; warm summers, cool winters.

SOILS: free draining alluvial soils on river flats, low terraces and younger fans: those on river flats range from droughty stony sands to fertile deep silty loams; on low terraces and, younger fans moderately deep to shallow silty and sandy soils, generally droughty in summer; in lower-lying parts where water-tables are high, poorly drained deep, fertile silty soils; on higher terraces and fans, droughty shallow and stony soils; small areas of deep silty and compact soils on downlands and hills.

VEGETATION /MODIFICATIONS: former vegetation mostly lowland short tussockland and scattered scrub; today district largely farmed (intensive sheep, cattle and crops). Some areas of modified tussocklands and minor scrub remain.

BIRDS: district highly modified for farming; no land birds of note. Wrybill have been reported on the Waitaki R.; Caspian Tern, Black-fronted Tern and Black-billed Gull breed on the Waitaki R.

OAMARU ECOLOGICAL DISTRICT 62.03

Criteria: topography, climate, soils, geology.

TOPOGRAPHY/GEOLOGY: coastal downlands dominated S of the Kakanui R. and N of Oamaru City by high level piedmont terraces with limestone vale and questa topography in between; altitude all below 300m a.s.l.; drained by several small rivers. Coastline includes extensive cliffs on several capes and points of harder marine Tertiary sedimentary and volcanic rocks as far N as Cape Wanbrow, beyond which lies a rather narrow, low level, coastal plain; S of Kakanui white sand beaches predominate, N of it gravel storm beaches backed by low cliffs; the renowned Moeraki Boulders occur at the southern limit. Mainly loess-covered, late Cretaceous-Tertiary marine sedimentary and volcanic rocks (bioclastic limestone with intercalcated marine basalts and tuffs most prevelant).

CLIMATE: mild subhumid; low rainfall, 500-650mm p.a.; warm summers, cool winters.

SOILS: mainly deep silty soils from loess with compact pale-coloured subsoils and associated dark-coloured and heavy textured soils (rendzinas) from limestone downlands; some loess soils on flatter slopes have impeded drainage; black silty clays on basaltic tuffs in Waiareka district, very fertile but sticky when wet, dry out in summer; small areas of shallow, stony soils on terraces and alluvial soils on river flats.

VEGETATION/FLORA: formerly mainly lowland short tussockland; some areas of modified tussocklands, minor scrub and woodland (kowhai, narrow-leaved lacebark, cabbage trees, kanuka) remain. Southern limit of Olearia paniculata.

BIRDS: district highly modified for farming; no land birds of note. Yellow-eyed Penguin, Sooty Shearwater and Southern Blue Penguin breed at Cape Wanbrow.

MODIFICATIONS: today largely farmed (intensive sheep, cattle and crops; orchards and market gardens south of Oamaru).

TEKAPO ECOLOGICAL DISTRICT 63.01

Criteria: topography, geology.

TOPOGRAPHY: several glacial lakes and surrounding moraine country below 900m a.s.l.

GEOLOGY: composed of tills of the Otira glaciation, derived from Mesozoic Torlesse Supergroup greywacke and argillite mountains to the N; local areas of Pliocene conglomerate (Glentanner Group); small outcrops of ? Miocene coal measures at Coal River.

CLIMATE: humid to sub-humid inland climate, cold winters, warm summers; rainfall 600-1600mm p.a.

SOILS: mainly shallow to moderately deep silty and sandy soils from variable thickness of loess over till or alluvial gravels on moraines, outwash terraces and fans: in lower rainfall areas moderately leached and droughty; in higher rainfall areas more strongly leached but not as droughty in summer; small areas of alluvial soils.

VEGETATION/MODIFICATIONS: formerly extensive red tussockland; now mainly highly modified fescue-red tussocklands (remnants of red tussockland restricted to depressions and water courses), replaced with increasing altitude, by snow tussock (Chionochloa rigida); some kettlehole tarns and associated wetlands; some intact areas of fescue tussock and scattered blue tussock (Poa colensoi), with prostrate mat plants e.g. Coprosma petriei, Raoulia subsericea; some scattered scrub, matagouri with Coprosma propinqua and sweet brier.

BIRDS: the virtual absence of forest means there are few forest birds of note. Yellow-breasted Tit occur in open conifer plantations; falcon widespread. The wetlands and lakes support a diversity of water birds including: Southern Crested Grebe (largest population in N.Z. On L. Alexandrina), Scaup, Australasian Coot, Marsh Crake (common at L. Alexandrina) and Spotless Crake; Black Stilt breed near L. ALexandrina. The braided riverbeds provide habitats for Wrybill (widespread at Pukaki, Tekapo and on the Godley and Cass Rivers (more than 50 pairs)) and other riverbed species such as Banded Dotterel, Pied Stilt, Black-fronted Tern (common), Caspian Tern (infrequent) and Black-billed Gull.

REPTILES: spotted skink (Leiolopisma lineoocellatum) occurs at several sites around L. Tekapo (southern limit). Scree skink (Leiolopisma otagense form waimatense) present on Mt Hay Station (known elsewhere only from the Balaclava, Coleridge, Benmore and Hawkdun E.D.). Unnamed skink (aff. Leiolopisma nigriplantare) on Mt Hay Station known elsewhere only from L. Tennyson (Balaclava E.D.).

INVERTEBRATES: several endemic and rare invertebrates present e.g. grasshopper, Brachapsis robustus.

PUKAKI ECOLOGICAL DISTRICT 63.02

Criteria: climate, topography, geology.

TOPOGRAPHY: dry outwash plains between Lakes Tekapo and Benmore, mostly below 600m a.s.l. but including isolated hills up to 1000m, Mary Range and Simons Hill.

GEOLOGY: composed of fluvioglacial outwash deposits of the Otira glaciation, overlying Pliocene basin fill with isolated Torlesse Supergroup greywacke and argillite hills; Recent faults near westernmost boundary.

CLIMATE: semi-arid to sub-humid inland climate, cold winters, warm summers; rainfall 600-1600mm p.a.

SOILS: moderately deep to shallow soils from variable thickness of loess over alluvial gravels on outwash terraces and fans: in lower rainfall areas less leached with more compact subsoils; most soils moderately fertile but very droughty in summer; small areas of shallow and stony steepland soils from greywacke, very droughty, erode readily, bare screes common.

VEGETATION/MODIFICATIONS: depleted fescue tussocklands with much hawkweed and bare ground; matagouri scrub with Coprosma, sweet brier, scrub kowhai (Sophora prostrata) and Corokia cotoneaster especially on Mary Range and adjacent to lower Tekapo riverbed; pasture, croplands, hay meadows occupy deeper soils; former swamps in Maryburn and Grays River now pasture; red and snow tussocklands restricted to Ben Ohau Range or hilltops; large impact of grazing by sheep and rabbits.

BIRDS: the virtual absence of forest means there are no forest birds of note; falcon widespread. The braided riverbeds provide important habitat for Black Stilt, Pied Stilt, Wrybill, Banded Dotterel, Black-fronted Tern, Caspian Tern and Black-billed Gull. Blue Duck present on the upper reaches of some rivers; Scaup reported.

INSECTS: include two rare grasshoppers, Sigaus minutus, Brachapsis robustus; the grass moth Orocrambus fugitivellus (Hudson) n.comb. is only known from the Mackenzie Plains.

BEN OHAU ECOLOGICAL DISTRICT 63.03

Criteria: topography, geology.

TOPOGRAPHY: glaciated mountain range (maximum altitude 2255m a.s.l.) and moraine-dammed glacial lake; elsewhere ponds, tarns, swamps, riverflats etc.

GEOLOGY: includes Mesozoic Torlesse Supergroup folded greywacke and argillite and Haast Supergroup schist mountains, Pleistocene tills plastered against the range, Holocene alluvial gravels in large river beds; Recent faults near Lake Pukaki.

CLIMATE: humid inland climate, cold winters, warm to cool summers; rainfall 1200-4800mm p.a.; above 1000m much precipitation occurs as snow; prevailing NW wind.

SOILS: shallow, stony steepland soils from greywacke and schist on steeper mountain slopes in the E passing up through alpine soils with extensive screes to areas of bare rock and screes at higher altitudes; moderately deep to shallow soils in valleys from variable thickness of loess over till or gravelly alluvium, moderately fertile but droughty in summer; small areas of alluvial soils along rivers.

VEGETATION: fescue and tall tussock associations: fescue tussocks only on mountain footslopes grading upwards to abundant Chionochloa rigida with Festuca matthewsii and F. novae-zelandiae and Raoulia subsericea; snow tussocks (C. macra and C. rigida) with blue tussock (Poa colensoi) around 1500m; blue tussock with Dracophyllum pronum and Raoulia spp. between 1800m and 2000m; forest remnants (isolated clumps of Hall's totara and mountain toatoa close to valley floor, often on rockfields; mountain beech in narrow stream gorges); scrub (matagouri, Coprosma spp., some manuka); large areas of scree and fellfield characterise range.

BIRDS: Robin have been reported from forest remnants, and other forest species uncommon in the region (Bellbird, Rifleman) are present; falcon widespread; Southern Crested Grebe and Scaup occur on L. Ohau. The braided riverbeds provide habitats for Black Stilt and other riverbed species such as Banded Dotterel, Pied Stilt, Black-fronted Tern, Caspian Tern and Black-billed Gull.

INSECTS: several endemic to MACKENZIE e.g. a carab bettle, Megadromus alternus.

GRAMPIANS ECOLOGICAL DISTRICT 63.04

Criteria: topography, geology, climate.

TOPOGRAPHY: dissected N-S aligned block mountains forming the south-eastern margin of the MACKENZIE region; includes the Rollesby, Dalgety and Grampian Ranges; ranging from 350m to 1911m a.s.l. on Grampian Range.

GEOLOGY: includes Paleozoic Torlesse Supergroup greywacke, argillite conglomerates (e.g. Dalgety Range) and some schist; small areas of Tertiary sands (e.g. Snow River).

CLIMATE: a semi-arid to sub-humid inland climate (humid on Rollesby and Dalgety Ranges) with cold winters and mild to hot summers; rainfall less than 600-1200mm p.a.

SOILS: shallow, stony steepland soils on steep slopes; at higher altitudes and rainfall subsoils yellowish brown, friable; at lower altitudes subsoils pale, more compact, more droughty; moderately deep to shallow droughty silty and sandy soils on fans and terraces.

VEGETATION: modified and depleted tussocklands with heavy weed infestation but wide range of plant communities remain: matagouri/Oleria scrub on valley floors grades into fescue/silver tussock which above T000m grades into dense snow tussockland (Chionochloa rigida) and into thick, slim snow tussockland (C. macra) with patches of Dracophyllum uniflorum scrub; good subalpine and alpine scrub communities and alpine fellfield associations occur above 1600m (Dracophyllum pronum, Phyllacne spp., Poa colensoi, Raoulia spp.).

BIRDS: few birds of note have been reported from this district. Falcon widespread; Blue Duck have been reported.

REPTILES: jewelled gecko (Heteropholis gemmeus) occurs on the Hakataramea Saddle. Large skinks reported from the Mackenzie Pass may be scree skink (Leiolopisma otagense form waimatense).

MODIFICATI0NS: district is grazed (extensive sheep and cattle).

AHURIRI ECOLOGICAL DISTRICT 63.05

Criteria: topography, geology, climate.

TOPOGRAPHY: glaciated mountain range reaching 2332m a.s.l. (Mt St. Mary), and large river valley with extensive wetlands.

GEOLOGY: includes Mesozoic Torlesse Supergroup greywacke, argillite and schist, Pleistocene tills and Holocene alluvial gravels.

CLIMATE: humid inland climate, cold winters, warm to cold summers; rainfall ranges from 800mm in S to 5600mm p.a. on Barrier Range.

SOILS: shallow, stony steepland soils on steep slopes; at higher altitudes and rainfall subsoils yellowish brown, friable; at lower altitudes subsoils pale, more compact, more droughty; moderately deep to shallow droughty silty and sandy soils on fans and terraces.

VEGETATION: a wide range of vegetation types: developed river flats; modified fescue and tall tussock (Chionochloa rigida) tussocklands (much of it oversown and topdresse, occupying pre-Polynesian montane forest sites; at higher altitudes screes may be extensive; Dracophyllum subalpine scrub on shady aspects; C. macra/C. rigida/Poa colensoi and C. macra/Festuca matthewsii grasslands around 1600m; forest remnants (most extensive in region), including mountain beech in mid-Ahuriri and the Maitland R. valley (large area), and Hall's totara with mountain toatoa in discontinuous patches throughout the montane zone; scrub associations including snow totara typically on steep, rocky slopes, small stands of manuka near L. Ohau, matagouri with Coprosma proinqua and/or sweet brier; alpine fellfields above 1800m and rock scree with specialised associations.

BIRDS: beech forest remnants contain Rifleman, Yellow-breasted Tit and Bellbird; falcon widespread. The braided riverbed of the upper Ahuriri provides valuable breeding habitat for Black Stilt and other riverbed birds such as Pied Stilt, Wrybill, Black-fronted Tern, Caspian Tern, S.I. Pied Oystercatcher and Banded Dotterel. Other species reported are Scaup, Southern Crested Grebe and Marsh Crake.

INSECTS: include a flightless undescribed beetle (Odontria sp.) associated with matagouri; a rare short-horned grasshopper Brachaspis robustus first collected beside Ahuriri R.

MODIFICATIONS: district is grazed (extensive sheep and cattle). Introduced mammals include deer, chamois, tahr, rabbits, hares, stoats, ferrets (all in small numbers).

OMARAMA ECOLOGICAL DISTRICT 63.06

Criteria: topography, geology, climate.

TOPOGRAPHY: dry outwash plains below 900m a.s.l., between Diadem and Benmore Ranges.

GEOLOGY: mainly Pleistocene tills and fluvioglacial outwash deposits of the Otira glaciation, overlying Pliocene conglomerate (Glentanner Group); some Holocene alluvial gravels; some Mesozoic Torlesse Supergroup greywacke and argillite.

CLIMATE: semi-arid to humid inland climate, cold winters, warm summers; rainfall ranges from less than 500mm to more than 1600mm p.a.

SOILS: shallow to moderately deep sandy and silty soils from variable thicknesses of loess over till and alluvial gravels on moraines, terraces and fans: in lower rainfall areas in the SE weakly leached, very droughty; in medium rainfall areas moderately leached, deeper soils have compact subsoils; under higher rainfalls moderately to strongly leached with friable yellowish brown subsoils, less droughty in summer.

VEGETATION: mainly degraded fescue tussocklands with adventive sweet vernal, browntop and hawkweed, some oversown and converted to pasture; some wetland vegetation associated with tarns in moraines and swamps near lower Ahuriri R.; scrub including largest stands of bog pine/mountaim toatoa in region, on a basin fill piedmont slope, small areas of manuka and Cassinia (with red tussock), also matagouri, Coprosma propinqua, Olearia and sweet brier.

BIRDS: the virtual absence of forest means there are no forest birds of note. The braided riverbed of the Ahuriri R. and other wetlands provide valuable breeding habitat for Black Stilt; other riverbed birds breeding in the district are Wrybill (c.100 birds), Black-fronted Tern, Caspian Tern and Marsh Crake. Scaup have been reported, Caspian Tern are present along the rivers.

REPTILES: jewelled gecko (Heteropholis gemmeus) and green skink (Leiolopisma chloronoton) (northern limit) have been found near Omarama.

MODIFICATIONS: district is grazed (extensive cattle and sheep).

BENMORE ECOLOGICAL DISTRICT 63.07

Criteria: topography, geology (mainly lower grade Permian rocks)

TOPOGRAPHY: dissected N-S aligned block mountain range reaching 1863m a.s.l. and large man-made Benmore hydro lake.

GEOLOGY: nearly all Mesozoic Torlesse Supergroup greywacke and argillite; some very small areas of Miocene sandstone and mudstone; Holocene alluvial gravels near district boundaries.

CLIMATE: semi-arid to subhumid climate, cold winters, mild to warm summers; rainfall ranges from less than 500mm to more than 1000mm p.a.; soil moisture deficits with prevailing NW wind in spring and autumn.

SOILS: shallow and stony steepland soils from greywacke and related slope deposits forming a leaching sequence with increasing altitude and rainfall: in lower rainfall areas weakly leached, extremely droughty; under moderate rainfalls weakly to moderately leached, droughty in summer; at higher altitudes with high rainfall strongly leached, with more even moisture conditions. All steepland soils have moderate to severe sheet and gully erosion, screes extensive. Small areas of droughty shallow and stony soils on terraces and fans.

VEGETATION/FLORA: attitudinal sequence from short to tall tussockland (mostly Chionochloa rigida, with C. macra above 1000m), strongly depleted and with weeds, sweet vernal and browntop grasses; xeric scrub in shaded sites, matagouri/Olearia sp./sweet brier; fellfields on tops (with endemic Nothothlaspi rosulatum); scattered on montane to subalpine hillslopes are small areas of snow totara and some Hall's totara remnants growing close to the species' ecological limit.

BIRDS: the virtual absence of forest means there are no forest birds of note. Falcon are present on the Benmore Range; Scaup have been reported from L. Benmore; Caspian Tern and shags (Black and Little) are also present.

REPTILES: scree skink (Leiolopisma otagense form waimatense) present on Black Jacks I. (known elsewhere only from the Balaclava, Coleridge, Tekapo and Hawkdun E.D.).

INVERTEBRATES: endemic millipede and flightless tiger beetle on Benmore Peak.

MODIFICATIONS: much of district grazed (extensive cattle and sheep).

KIRKLISTON ECOLOGICAL DISTRICT 64.01

Criteria: topography, climate, vegetation.

TOPOGRAPHY: the steep inland Kirkliston Range, associated hills and two artificial hydro lakes (Waitake and Aviemore) on the Waitaki R.; mostly between 300 and 1500m a.s.l.; highest point 1864m.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite.

CLIMATE: rainfall 800-1200mm p.a.; warm dry summers; cold winters.

SOILS: mainly shallow, stony steepland soils from greywacke and related slope deposits forming a leaching sequence with increasing altitude and rainfall: under lower rainfall in the SW weakly leached, extremely droughty; those under medium rainfalls weakly to moderately leached, droughty in summer; at higher altitudes with higher rainfalls strongly leached, less droughty in summer. All steepland soils have moderate to severe sheet and gully erosion, screes common. Some deeper soils with pale-coloured very compact subsoils on rolling and hilly slopes from loess over greywacke.

VEGETATION: a high, dry, mountain district but contains more woody vegetation than other WAITAKI districts. Former vegetation mostly subalpine grassland (tall tussock - mainly Chionochloa rigida), scrub (mixed Coprosma spp., Olearia odorata etc.) and lowland tussockland (fescue and silver tussock). Streams draining S are rich in scrub and hardwood forest species.

FLORA: district is near southern limit of prostrate kowhai. Subalpine and lower elements contain both Canterbury and Otago species - a "mixing pot".

BIRDS: the only bird species of note reported from this district are falcon and Scaup.

MODIFICATIONS: today most of the district grazed (extensive sheep and cattle); vegetation modified.

ST MARY ECOLOGICAL DISTRICT 64.02

Criteria: topography, climate, vegetation.

TOPOGRAPHY: the steep, inland St Mary Range, drained mostly by the Waimate R. but also via the Taieri R. in the S; mostly between 300 and 2000m a.s.l.; highest point Kohurau, 2008m.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite and Haast Schist.

CLIMATE: a semi-arid climate: rainfall 500mm p.a. to 1400mm near L. Aviemore; warm dry summers; very cold winters.

SOILS: shallow and stony steepland soils from greywacke, schist and related slope deposits with deeper soils on rolling and hilly land where variable cover of loess present: at lower altitudes and rainfalls weakly to moderately leached with pale-coloured, compact subsoils, extremely droughty; at higher altitudes and rainfalls more strongly leached, with browner, more friable subsoils, less droughty. Screes common on steeper slopes, especially at higher altitudes.

VEGETATION: Canterbury type mountains in an arid cold climate: originally forested, particularly in river headwaters and moister slopes; former vegetation mostly subalpine tussockland (tall tussock – Chionochloa rigida with increasing amounts of C. macra), scrub (mixed Coprosma spp., Olearia odorata etc.) and lowland tussockland (fescue and silver tussock). Hall's totara remnants.

FLORA: floristic affinities moving more towards Otago.

BIRDS: few bird species of note in this district. Falcon throughout; Black Stilt and Marsh Crake have been reported from the Waitaki R.

REPTILES: large skinks reported here are probably green skink (Leiolopisma chloronoton).

INSECTS: include rare short-horned grasshopper, Brachaspis robustus (only 3 specimens known from Ahuriri R. and Kurow).

MODIFICATIONS: today most of district grazed (extensive sheep and beef); vegetation modified.

HAWKDUN ECOLOGICAL DISTRICT 64.03

Criteria: topography, geology, climate, vegetation.

TOPOGRAPHY: steep inland Hawkdun Range and associated St Cuthbert, Ewe and Ida Ranges; between 900 and 1800m a.s.l, highest point 1871m; drained to the N via the Waitaki R. Although high, mountains are more flat-topped (like Otago mountains) than those further north; extensive screes in places.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite and minor semischistose Naast Schist; extensive low relief high altitude peneplain remnants; extensive solifluction slopes along southern end of Hawkdun Range, also on eastern slopes above Clear Stm.

CLIMATE: semi-arid, rainfall 600-1600mm p.a.; warm dry summers; cold winters.

SOILS: shallow and stony soils on steep slopes with deeper soils on rolling and hilly slopes where variable cover of loess present: at lower altitudes in the NE with lower rainfall weakly to moderately leached with pale-coloured compact subsoils, very droughty; at higher altitudes and rainfalls more strongly leached with browner more friable subsoils, less droughty; screes common on steeper slopes, areas of bare rock and scree occur at higher altitudes; small areas of silty and sandy shallow to moderately deep droughty soils on terraces and fans in the NE.

VEGETATION: original vegetation included some forest in moister valleys and slopes; now extensive tussockland (Chionochloa rigida, C. macra tall tussocks and fescue tussocks); extensive subalpine and alpine herbfield and fellfield; few introduced species on higher parts; very small remnants of Hall's totara forest in gullies e.g. Ewe Burn; also patches of Hall's and snow totara mixed woodlands; stands of manuka on Tertiary outliers in the S.

FLORA: sequence from Chionochloa rigida at low altitudes to C. macra (drier than many Central Otago ranges); fellfield species include Hectorella caespitosa, Chionohebe thomsonii, Phyllacne colensoi cushions (also Colobanthus sp., Dracophyllum muscoides), scattered Hebe epacridea, Aciphylla dobsonii, Raoulia petriensis, Ranunculus haastii and R. crithmifolius; endemic to fellfield is Nothothlaspi rosulatum; unnamed Hebe sp.(cf. H. pinguifolia) occurs on high rocks, also Leucogenes grandiceps; Aciphylla gracilis, Raoulia eximia (at its southern limit), Poa buchananii, Myosotis suavis. Also present Pimelea traversii (common 1050-1600m), Hebe lycopodioides, H. haastii, H. pinquifolia, Celmisia brevifolia, C. densiflora, C. lyallii, Anistome brevistylus plus 3 other Anisotome spp), Carmichaelia monroi (common 1100m), C. petriei and Corallospartium crassicaule, Coprosma pseudocuneata (high alpine form), Coprosma petriei, Ourisia caespitosa; Oreobolus pectinatus occurs on dry slopes (1200-1400m); Helichrysum selago, Craspedia lanata, Senecio lyallii, S. haastii, S. bellidioides all abundant; Exocarpus bidwillii occurs at 1250m. Plants at risk in district include Myosotis oreophila, Carmichaelia curta.

BIRDS: falcon widespread; Wrybill regularly visit the upper Manuherikia R.and Black Stilt have been reported there.

REPTILES: scree skink (Leiolopisma otagense form waimatense) present on Mt Ida (southernmost limit, known elsewhere only from the Balaclava, Coleridge, Tekapo and Benmore E.D.)

INSECTS: include cicada, Maoricicada phaeoptera on N end of Hawkdun Range (Celmisia lyallii probable favoured host); moths e.g. Perinodaimon pluto (larvae on small Poa sp.), Notoreas insignis, N. anthracias, N. bephasata, Dasyuris anceps, Lythria catapyrrha (at 1000m), Tawhitia pendactyla. Ida Range is type locality for many moths e.g. Orocrambus lindsayi, O. corylanus, Asaphodes ida, A. lindsayi, Harmologa toroterma, Leptocroca asphaltis, Epichorista mimica, Xanthorhoe ida, Lythria fulva; other moths on higher parts of Ida Range include Dasyuris hectori (larvae on Anisotome), Orocrambus melanopetrus (over screes), O. machaeristes (grassmoth), Scoparia sideraspis (1200-1300m), Orophora unicolor (1300m).Also on Ida Range large Lyerobius weevils on Aciphylla gracilis (1300-1500m); cicadas Kikihia augusta and Maoricicada phaeroptera; grasshoppers Sigaus spp.; giant scree weta Deinacrida connectens, smaller scree and rock weta Hemideina maorii.

MODIFICATIONS: most of district grazed (extensive sheep and cattle); much modified grassland.

ST BATHANS ECOLOGICAL DISTRICT 64.04

Criteria: geology, topography, climate, vegetation.

TOPOGRAPHY: steep inland St Bathans and Whether Ranges and northern toe of the Dunstan Range; mostly 900 and 2000m a.s.l., highest point Mt St Bathans, 2087m, highest peak in North Otago; drained to the NE via the Ahuriri R. and to the S via the Manuherikia R.

GEOLOGY: mostly Mesozoic Torlesse Supergroup greywacke and argillite and minor Haast Schist.

CLIMATE: semi-arid at lower altitudes: rainfall 700-1600mm p.a.; warm dry summers; cold winters.

SOILS: shallow, stony soils on steep slopes from greywacke, schist and related slope deposits with deeper soils on rolling and hilly slopes and terraces where variable cover of loess present: soils moderately to strongly leached, may dry out in summer; screes on steeper slopes, areas of bare rock and scree at higher altitudes.

VEGETATION: original vegetation included forest to climatic tree limit in gullies and on moister slopes; now extensive subalpine grassland (Chionochloa rigida and C. macra tall tussocks); extensive subalpine and alpine herbfield, fellfield and boulderfield.

FLORA: rare broom Carmichaelia compacta near Lindis Pass; threatened Coprosma intertexta in Longslip Stream Valley; Chionochloa macra occurs on range tops (drier than many Central Otago ranges), also a low outlier; at Lindis Pass Festuca matthewsii (shady aspects) occurs together with F. novae-zelandae (sunny aspects) and Chionochloa rigida; Nothothlaspi rosulatum endemic in fellfield; Lindis Pass is type locality of Corallospartium crassicaule var racemosum.

BIRDS: the only bird species of note is the falcon.

INSECTS: include carabid beetles, Megadromus new species on Mt St Bathans (in tussocks on rock and scree), M. bullatus at Lindis Pass (tussocks and stones); beetle Holcapsus bathana (Mt St Bathans); weta Hemiandrua focalis; grasshopper Sigaus australis (eastern limit Lindis Pass and Mt St Bathans; in tussocks, shingle screes, high rocky ridges); cicada Maoricicada phaeoptera.

MODIFICATIONS: much of district grazed (extensive sheep and cattle); vegetation modified.

DUNTROON ECOLOGICAL DISTRICT 65.01

Criteria: topography (altitude, aspect), geology, soils, vegetation.

TOPOGRAPHY: small district of downlands and hills, mostly less than 600m a.s.l., drained by E and NE flowing streams and small rivers off the northern dip-slope of the Kakanui Mountains. Dominated in the NE by a limestone plateau with high level terrace remnants and a smaller, lower one of volcanic rock at its NW margin.

GEOLOGY: mainly Paleozoic and Mesozoic Haast Schists and Torlesse Supergroup greywacke on the SW margin, overlain by NE dipping, loess blanketed, late Cretaceous to mid Tertiary quartzose coal measures, marine limestone, sandstone and mudstone intercalated with submarine basaltic tuffs and lavas.

CLIMATE: dry to subhumid climate, cool winters, mild summers; rainfall 500800mm p.a.

SOILS: mainly deep to moderately deep soils from loess or loess over greywacke or sandstone, mudstone or limestone on rolling and hilly land: soils under lower rainfalls have pale-coloured compact subsoils, droughty in summer; those under higher rainfalls have mottled subsoils, less droughty but have impeded winter drainage; small areas of heavy textured, dark-coloured soils (rendzinas) from limestone; in the NW some stony steepland soils.

VEGETATION: formerly mostly lowland short tussockland; remaining indigenous vegetation mainly modified tussockland.

BIRDS: the only bird species of note is the falcon.

REPTILES: large skinks reported here are probably green skink (Leiolopisma chloronoton).

MODIFICATIONS: now mainly farmed (intensive sheep, cattle, some crops).

DANSEY ECOLOGICAL DISTRICT 65.02

Criteria: topography, geology, vegetation, soils, climate (foggy and colder than the lower KAKANUI districts).

TOPOGRAPHY: district of non-glaciated NW-SE trending mountains (Kakanuis); mostly 600 to 1500m a.s.l., maximum altitude Mt Pisgah, 1644m; drained mostly to the NE and SW.

GEOLOGY: mainly Paleozoic and Mesozoic Haast Schists, minor greywacke with Tertiary deposits, Quaternary loess and local basaltic intrusions.

CLIMATE: subhumid, cool winters, mild summers; rainfall 600-1400mm p.a.; snow may lie for several weeks above 1000m in winter.

SOILS: stony steepland soils from schist, greywacke and related slope deposits; those under low rainfall weakly leached and droughty; those under moderate rainfalls moderately leached, less droughty; those at higher altitudes and rainfalls strongly leached, droughts rare; screes common. Soils from deep loess or loess over sandstone on rolling downlands and hills with pale-coloured, compact and mottled subsoils; poor winter drainage, especially on gentler slopes, droughts uncommon. Small, scattered areas of clay textured and dark-coloured soils from basalt.

VEGETATION: formerly mostly tussockland: short fescue tussock on lower slopes, tall snow tussock and scree on upper slopes; minor manuka shrubland and relict forest stands in the E (kowhai, broadleaf, Cordyline, also modified podocarp-hardwood forest and kanuka forest). Vegetation of Danseys Pass includes mainly tussock with few shrubs or trees; rich herb community on steep rock faces and moist hollows; below the pass remnants of shrubland in wet gullies, matagouri and tussock dominate the flat land.

FLORA: Celmisia hookeri occurs here (and in Waianakarua and Nokomai districts); Chionochloa macra occurs on tops of Kakanuis.

BIRDS: no bird species of note.

INSECTS: include a diversity of species in the seemingly barren area of Danseys Pass.

MODIFICATIONS: now mostly grazed (extensive and some intensive sheep and cattle).

WAIANAKARUA ECOLOGICAL DISTRICT 65.03

Criteria: climate (coastal influence, higher rainfall than Duntroon), vegetation (forest/scrub/tussock as opposed to scrub/lowland grassland in Duntroon), geology.

TOPOGRAPHY: small district of downlands mostly less than 600m a.s.l.; drained by NE flowing streams and small rivers off the Horse and Kakanui Ranges N of Palmerston; short coastline with straight beach below loess cliff, shingle in the S, dune-backed white sand in the N, between two rocky headlands.

GEOLOGY: Paleocene and Eocene basalt, pillow lava and tuff on coastal promontories backed by upper Quaternary aggradation (mainly glacial) gravels and hills of Cretaceous sandstone, siltstone, claystone and conglomerate; Paleozoic-Mesozoic schist on inland margin, Triassic interbedded greywacke and argillite and minor volcanics in the S; upper Quaternary loess blankets most deposits apart from present beach sediments.

CLIMATE: subhumid climate with cool winters and mild summers; annual rainfall 600-800mm.

SOILS: stony, shallow to moderately deep soils on steep slopes from greywacke and schist with deeper soils from loess or loess over greywacke or sandstone on rolling and hilly slopes; on steep slopes strongly leached soils with friable yellowish brown subsoils. Soils on rolling and hilly land in lower rainfall areas have pale-coloured compact subsoils, droughty in summer; those under higher rainfalls have impeded winter drainage, less droughty.

VEGETATION/MODIFICATIONS: formerly remnants of podocarp-hardwood forest with extensive tall kanuka, snow tussock on uplands; today extensive kanuka in main valleys; pockets of very modified forest; extensive modified snow, hard and silver tussockland on uplands, extending locally to the coast; low country largely pasture (semi-extensive sheep, cattle, dairying), occasional small patches of scrub, scattered cabbage trees, kowhai etc.; extensive exotic forests in SE hills.

FLORA: Celmisia hookeri (endemic here and in Dansey and Nokomai districts) found in rocky areas of tussock grasslands and woodlands; northern limit of podocarp/hardwood forest in Otago; only area of coastal snow tussockland.

BIRDS: no land bird species of note; Yellow-eyed Penguin, Southern Blue Penguin, Sooty Shearwater and Spotted Shag breed along the coast. Maukiekie I. supports important breeding colonies of Little Shag, Stewart Island Shag (northern limit), Spotted Shag and Royal Spoonbill.

HUXLEY ECOLOGICAL DISTRICT 66.01

Criteria: climate, topography, geology, vegetation.

TOPOGRAPHY: moderately steep mountains ranging from 300m to 2499m a.s.l. (Mt Huxley); major rivers draining to the SW.

GEOLOGY: rocks are mainly Paleozoic Haast Schist and greywacke with Holocene alluvium in the flat valley floors.

CLIMATE: mountain climate, moderately high rainfall (2000-6400mm p.a.), but less rain than ASPIRING region W of Main Divide.

SOILS: mainly shallow, stony steepland soils from greywacke, schist and related slope deposits: at lower altitude strongly leached ; at higher altitudes soils podzolised, those on gentler slopes and basins having peaty topsoils and poorly drained subsoils; sheet, gully and scree erosion common; alpine soils with very extensive areas of bare rock and scree at higher altitudes; limited areas of alluvial soils occur on valley floors.

VEGETATION: includes valley floor grassland, montane and subalpine beech forests (mountain with some red beech and silver beech), montane and subalpine scrub, alpine snow tussock grassland and high-alpine zones; bracken fernland in the S.

BIRDS: the beech forest in the N of this district suports a variety of forest birds including: Brown Kiwi (Hunter R.), kaka, Yellow-crowned Parakeet and Yellowhead; falcon widespread; kea occur above tree line; Wrybill breed on the lower reaches of the Hunter R.

MODIFICATIONS: the forest is discontinuous with eastern limits modified by fire history.

WANAKA ECOLOGICAL DISTRICT 66.02

Criteria: topography, climate (drier than districts to the SW in LAKES region), vegetation, geology, soils.

TOPOGRAPHY: large district including broad glacier formed basins of Lakes Wanaka and Hawea and surrounding steep mountains up to 2350m a.s.l.; ridges of end moraine border southern ends of lakes.

GEOLOGY: rocks mainly Paleozoic Haast Schist with Pleistocene glacial outwash gravels in wide valleys.

CLIMATE: affected by rainshadow of Main Divide: rainfall ranges from 650-3000mm p.a.; warm summers; cold winters; NW winds prevail with occasional gales.

SOILS: mainly stony steepland soils from schist and related slope deposits; in lower rainfall areas in the NF soils droughty in summer; small areas of alluvial soils on valley floors, and shallow to moderately deep, droughty soils on terraces and fans in the SE.

VEGETATION: depleted hard/silver tussockland extensive on mountains, relict depleted snow tussock at higher altitude. Forest generally restricted to gullies and shady slopes: includes silver beech in forests W of L. Wanaka with some red beech and mountain beech e.g. a few stands of silver beech and mountain beech on western shore of L.Wanaka, one of which (S of Minaret Burn) has a few emergent podocarps (matai?); red beech codominant with silver beech to about 900m in Matukituki Valley; mountain beech E of L. Wanaka e.g. Timaru R.; mountain beech/hardwood forest remnants on Mt Burke Station; mixed silver beech and mountain beech forest remnants in headwaters of Spotburn (at 762m) and Timber Creek (at 549m) (other species include Carpodetus serratus, Pseudopanax colensoi, Griselinia littoralis, Fuchsia excorticata, Blechnum fluviatile and small trees of Hall's totara; mountain beech regenerating along creek beds, silver beech encroaching grassland); some hardwood forest with rata, broadleaf and kowhai on Wanaka islands and NE shores; mixed low forest/shrublands near Minaret Burn and Crescent Island contain broadleaf, kowhai, kanuka, lancewood, mahoe, marble leaf, southern rata, mapou with Coprosma linariifolia, C. lucida, C. crassifolia, Melicope simplex, Helichrysum glomeratum, Corokia cotoneaster, Myrsine divaricata, Carmichaelia petriei; S of The Neck between Lakes Wanaka and Hawea small patches of Hall's totara - mountain toatoa treeland in montane areas and mountain beech. Bracken fernland extensive on lower slopes facing lakes; matagouri/Coprosma scrub extensive in lower valleys E of L. Hawea; kohuhu dominated scrub; mixed stands of kanuka and manuka e.g. along slopes above L. Hawea, seral stands at head of L. Hawea. Raupo/niggerhead swamps near The Neck between Wanaka and Hawea; several wetland patches in Matukituki Valley (mostly very modified by drainage) e.g. Big Boggy Scenic Reserve, a spring-fed pond with niggerhead, flax and scrub.

FLORA: an eastern outlier of Chionochloa oreophila occurs on Mt Alta. Rare or at risk plants include Cotula albida on Mt Cadrona (its type locality) forming mats in the herbfield and cushion communities; Poa aea on Mt Cadrona on exposed sites; Pleurosorus rutifolius; Carmichaelia nigrans. Small stands of mountain beech in lower Motutapu and tributaries on W of middle and lower Cadrona Valley are at species' eastern limit; 4 small silver beech stands, with mountain beech, are protected.

BIRDS: forest remnants support a variety of forest species including: Yellow-crowned Parakeet, Rifleman, Brown Creeper and Bellbird; falcon widespread; kea and Rock Wren present at higher elevations; Scaup occur on lakes and ponds; Marsh Crake have been found on lake margins and elsewhere (Dingle Burn); Wrybill and Pied Stilt breed on the braided riverbed of the Matukituki R.

REPTILES: grand skink (Leiolopisma grande) occurs on the N side of L. Hawea (elsewhere known only from the Lindis and Macraes E.D., although there is an old museum specimen from Remarkables E.D.).

INSECTS: include cicada Maoricicada clamitans on Mt Alpha in Aciphylla colensoi and A. aurea between 900-1200m; carabid beetles Megadromus sandageri in Cadrona Valley (stony tussock area), M. bullatus at Diamond Lake, Matukituki Valley; moths Lythria catayrrha (small, diurnal geometrid, lowland or alpine), Asaphodes declarata and Helastia orophylla (colourful, diurnal, above 1450m), Scoparia sideraspis (a restricted Central Otago species, diurnal, near L. Wanaka). Type locality of Coleoptera beetle, Prodontia sp. 8 (new species on Rock Peak, W of Crown Rd). The grass moth Orocrambus clarkei clarkei Philpott is found only on Minaret Peak (44o40'S) above 1400m, and at Franz Joseph.

MODIFICATIONS: much of district grazed (extensive sheep and cattle).

RICHARDSON ECOLOGICAL DISTRICT 66.03

Criteria: strong topography (deeply incised canyons and many bare, naturally eroding slopes and local river flat terraces), vegetation (beech forest scattered).

TOPOGRAPHY: N-S trending Richardson Mountains and northern sector of Lake Wakatipu, ranging in altitude from about 600-2525m a.s.l. (Centaur Peaks).

GEOLOGY: mainly steeply dipping Paleozoic Haast Schist associated with strong natural erosion; some Pleistocene glacial outwash gravels etc. and Holocene alluvium in valley floors.

CLIMATE: generally cool, affected by rainshadow of Main Divide; rainfall ranging from 1000-3000mm p.a.; NW winds prevail with occasional strong gales; snow may lie for weeks in winter.

SOILS: mainly strongly leached to weakly podzolised stony steepland soils passing through podzolised steepland soils to alpine soils with extensive areas of bare rock and scree at higher altitudes; small areas of deeper soils on rolling slopes where cover of loess present and on terraces and fans; well drained alluvial soils on valley floors.

VEGETATION: includes patches of montane beech forest (chiefly mountain beech, some red beech and silver beech), mostly in valleys; elsewhere tussock-shrubland (mostly Dracophyllum uniflorum and Senecio cassinioides with Chionochloa rigida), kohuhu dominated scrub above lake shore (as in Shotover E.D.), bracken fern and tussockland (snow tussock on uplands, short fescue and silver tussock on some lower slopes); podocarp forest (kahikatea, matai) remnants on Pig and Pigeon Islands.

BIRDS: forests in the NW contain Yellow-crowned Parakeet, robin and Yellowhead; falcon occur throughout; kea and Rock Wren are present above tree line; Scaup are on L. Wakatipu.

MODIFICATIONS: much of district grazed (extensive sheep and cattle); goats and hares widespread.

SHOTOVER ECOLOGICAL DISTRICT 66.04

Criteria: topography, climate, geology, soils, vegetation.

TOPOGRAPHY: the catchments of the Arrow and lower Shotover R., ranging from about 600 to 1991m a.s.l. (Mt Motatapu); steep topography, deeply incised canyons.

GEOLOGY: mainly steeply dipping Paleozoic Haast Schist with some Pleistocene outwash gravels etc. and Holocene alluvium in valley floors; extensive geological erosion on upper slopes.

CLIMATE: hot summers, cold winters, dry climate affected by rainshadow of Main Divide; rainfall ranging from 650-1600mm p.a.; NW winds prevail with occasional strong gales; above 1000m snow may lie for weeks in winter.

SOILS: stony, strongly leached to weakly podzolised steepland soils from schist and related slope deposits; shallow to moderately deep droughty soils from loess over alluvium, till and schist on terraces, fans, moraines and easier hills.

VEGETATION: remnants of red beech forest near shores of L. Wakatipu and in Twelve Mile Creek Scenic Reserve; mountain beech forest up gullies to treeline e.g. in Mt Aurum proposed Scenic Reserve and Twelve Mile Creek Scenic Reserve; silver beech also present e.g. in Twelve Mile Creek; extensive bracken fernland on Wakatipu faces with naturalised Douglas fir, larch and other exotic conifers (also around Arrowtown and Skippers); some manuka scrub, extensive kohuhu-dominated scrub above lake shore; tussockshrubland (Chionochloa rigida-Dracophyllum) and some Dracophyllum-Hebe-Senecio subalpine scrub above treeline (C. macra replaces C. rigida above 1400 to 1550m); where forest and scrub are absent, snow tussockland is extensive to lower altitude; also grassland of blue tussock (Poa colensoi)-hard tussock-exotic grasses; low altitude disturbed areas occasionally have shrubland of Olearia odorata - matagouri - Coprosma sp.; alpine barrens, schist screes, and herbfields (Chionochloa oreophila grassland-herbfield important in alpine areas).

BIRDS: Yellow-crowned Parakeet present in beech forest; falcon widespread; Scaup occur on L. Wakatipu and some of the smaller lakes; Marsh Crake reported near Queenstown and at L. Hayes; Australasian Coot also present on L. Hayes (one of the largest populations of this species).

REPTILES: green geckos (Heteropholis sp.) reported.

MODIFICATIONS: much of district grazed (extensive sheep and cattle); goats present, numbers less than formerly.

REMARKABLES ECOLOGICAL DISTRICT 66.05

Criteria: topography (more stable than Shotover, steeper and higher than CENTRAL OTAGO), climate.

TOPOGRAPHY: extremely steep and rugged, strongly glaciated, N-S trending Remarkables and Hector Mountains and the southern sector of L. Wakatipu; ranging from about 500 to 2300m a.s.l. (Double Cone).

GEOLOGY: mainly Paleozoic Haast Schist with small areas of Pleistocene outwash gravels and Holocene alluvium in valleys.

CLIMATE: cool, dry, affected by rainshadow of Main Divide: rainfall 750-1500mm p.a.; NW winds prevail with occasional strong gales; above 1000m snow may lie for weeks in winter.

SOILS: mainly stony steepland soils from schist and related slope deposits passing to alpine soils with extensive areas of bare rock and scree at higher altitudes; deeper soils on easier slopes where variable cover of loess overlies gravelly alluvium, till and schist. Soils mainly strongly leached but those at lower altitudes weakly to moderately leached and droughty in summer.

VEGETATION: little forest: a few small patches of montane mountain beech forest in narrow valleys often with red beech and Hall's totara; some Leptospermum; elsewhere scrub (e.g. Pittosporum colensoi, kowhai etc. near L. Wakatipu and Dracophyllum uniflorum at higher altitudes); bracken fern and tussock associations (,short tussock on lower slopes, snow tussock associations e.g. Chionochloa macra with Dracophyllum musciodes over Poa colensoi, C. rigida with Poa colensoi, C. rigida with Festuca matthewsii and P. colensoi, etc. in subalpine and alpine zones; cushion herbfield (e.g. Dracophyllum muscoides, P. colensoi, the lichen Thamnolia vermicularis); mesic-humid associations include Marsippospermum gracile.

FLORA: species confined to Hectors and Remarkables within Otago include Ranunculus buchananii (fellfield, inaccessible rock ledges), Parahebe birleyi loose debris, rock clefts), Cotula willcoxii, Colobanthus brevisepalus; mosses Bartramia capillare, Philonotis australe. Species confined to western part of Otago include Hebe petriei var. petriei, Scirpus aucklandieus, Aciphylla similis, Uncinia fuscovaginata var. caespitans, Oreomyrrhis colensoi var colensoi, Celmisia hectori, C. petiolata, Anisotome pilifera, Haastia sinclairii var. fulvida. Several plant species reach their eastern limit here, e.g. Chionochloa oreophila, Ranunculus buchananii, Celmisia hectori. Chionochloa macra reaches its altitudinal limit for Otago; eastern outliers of C. oreophila occur at head of Wye Valley. Rare plants include Parahebe trifida, Myosotis glabrescens, Epilobium purpuratum, Carmichaelia compacta.

BIRDS: very little forest remains in this district and consequently there are few forest birds. Yellow-breasted Tit and Bellbird are present in some forest remnants; falcon widespread and relatively common; a small, isolated population of kea on the Remarkables, their easternmost limit in Otago; S.I. Pied Oystercatcher and Banded Dotterel breed in low numbers on top of ranges.

REPTILES: the "mini" and "maxi" forms of common gecko (Hoplodactylus maculatus) occur sympatrically on the Remarkables Range. This is the eastern limit for the "mini" form in Otago. These two forms, which in time will probably be raised to specific status, are widespread in the S.I. The "maxi" form is found throughout but is less common in the higher and drier country along the E side of the Alps; the "mini" form occurs in Marlborough, Canterbury and Otago, along the eastern side of the Alps, where it inhabits screes and outcrops. Old museum specimen of grand skink (Leiolopisma grande) from the Remarkables Range (known elsewhere only from the Wanaka, Lindis and Macraes E.D.).

INSECTS: include on Remarkables Range 4 endemic moths, grasshoppers Sigaus campstris, S. australis and Alpinacris tumidicauda, chafer beetle Scythrodes squalidus, leaf beetle Allocharis subsulcatus, speargrass weevil Lyperobius spedeni, carabid beetles Holcaspus ovatella, H. ogregialis, big striped weevils, Lyperobuis huttonii and L. spedeni (amongst Anisotome and Aciphylla), a large Byrrhid ground beetle (under stones, 1524-1828m); on Hector Range a flightless furry chafer Prodontria pinguis. Alpine cicadas Maoricicada nigra frigida, M. otagensis otagensis probably occur on both ranges. Type localities of 19 Coleoptera beetles occur in the Remarkables.

MODIFICATIONS: apart from some retired areas on upper slopes, the mountains are grazed (extensive sheep and cattle).

LINDIS ECOLOGICAL DISTRICT 67.01

Criteria: topography (characteristic shape and scale of round hills and valley systems, mountains lower than adjoining districts), geology, climate, vegetation (remnant beech forest stands).

TOPOGRAPHY: non-glaciated low mountains surrounding the Lindis Valley and Upper Clutha flats, ranging in altitude from less than 300 to 1600m a.s.l. (Mt Misery). End moraine ridges border southern shores of L. Wanaka and L. Hawea; other moraines form semi-circles across Hawea Valley NE of Hawea Flat township.

GEOLOGY: mountains mainly Paleozoic Haast Schist and semischist; broad terraced valleys with Quaternary glacial outwash gravels and moraine.

CLIMATE: sub-continental climate generally sub-humid with gradient to wetter zone in N; rainfall 450-1500mm p.a.; NW winds prevail; snow may lie above 1000m for weeks in winter.

SOILS: stony steepland soils from schist and related slope deposits on mountain country with shallow to moderately deep soils from loess over alluvial gravels or till on terraces, fans and moraines: in wetter areas of the N, soils moderately to strongly leached with yellowish brown friable subsoils, droughts uncommon; in slightly lower rainfall areas deep soils have pale-coloured compact subsoils, droughty in summer; in drier areas soils weakly leached, extremely droughty with calcium carbonate accumulations in subsoils; some associated saline soils.

VEGETATION/MODIFICATIONS: former vegetation dominated by tussockland: hard and silver tussock at low altitudes (some relict Chionochloa rigida plants on roadside between Hawea Flat and Maungawera indicate that this species was formerly at lower altitudes); snow tussock at higher altitudes, now much modified by pastoral farming and rabbits - at Lindis Pass tall tussocks include Festuca matthewsii (shady areas), F. novae zelandiae (sunny aspects), Chionochloa rigida, an unusual combination. Forest remnants include mountain beech forest (up to 200 ha) in NW, e.g. areas on Mt Maude, near Breast Hill, head of Lindis R. etc.; Hall's totara stands (with Hebe cupressoides) at Hospital Creek near Hawea Flat. Evidence from charcoal shows Hall's totara originally formed closed forest e.g. near Lindis Pass. Scrub includes matagouri, Carmichaelia, sweet brier and manuka-kanuka scrub and forest scattered through lowlands and locally important on montane sunny faces (some Leptospermum trees over 150 yrs old); scattered kowhai trees along lower bends of Hawea R. Substantial irrigated areas on flats.

FLORA: rare plants: Pleurosorus rutifolius on dry sunny rocks, Coprosma intertexta in Longslip Stm. valley, rocky places and debris slopes.

BIRDS: few birds of note in this district. Falcon widespread; Yellow-breasted Tit, Bellbird and robin present in forest remnants; Pied Stilt breed on the Lindis R.

PISA ECOLOGICAL DISTRICT 67.02

Criteria: topography (higher than other CENTRAL OTAGO districts, more extensive glacial features), vegetation (silver beech remnants), flora (endemic high alpine Poa, shared with Dunstan).

TOPOGRAPHY: the NE-SW trending fault-block Pisa Range and flats S of Wanaka, ranging from less than 300 to 1963m a.s.l. (Mt. Pisa).

GEOLOGY: Paleozoic Haast Schist mountains, small glacial cirques mainly at eastern edge of broad summit plateau; Quaternary glacial outwash gravels on flats in Clutha Valley.

CLIMATE: generally dry sub-continental climate with strong altitudinal gradient; rainfall 380-1200mm p.a.; NW winds prevail; small snowbanks persist through summer.

SOILS: stony steepland soils from schist and related slope deposits on mountains with shallow to moderately deep soils from loess, alluvium, till and schist on terraces, fans, moraines and rolling to hilly uplands: in higher wetter areas, soils strongly to very strongly leached with yellowish brown friable subsoils, droughts uncommon; in slightly drier areas soils moderately leached, droughty in summer; in driest areas soils weakly leached, extremely droughty, some have calcium carbonate accumulations in subsoils; saline soils occur.

VEGETATION: former vegetation dominated by tussockland: hard and silver tussock at low altitudes, fescue, blue and snow tussock above, now much modified by pastoral farming; very small forest remnants (tens of trees) of silver beech on S, E and N slopes of Pisa range; (Roaring Meg Creek); Hall's totara forest remnants on E and N slopes of range; kanuka-manuka scrub extensive on E faces of range, formerly extensive at northern end of district; very rare remnants of high-altitude Phyllocladus-Halocarpus (Dacrydium) woodland; extensive cushion and herbfields on summit plateau.

FLORA: rare or endangered plants include Pleurosorus rutifolius and Carmichaelia compacta.

BIRDS: only species of note is the falcon.

REPTILES: green skink (Leiolopisma chloronoton) occurs at Mt Pisa.

INSECTS: the Cromwell flightless chafer beetle, Prodontria lewisi is endangered by expansion of Cromwell township and increased human activities in the area; it lives in stabilised dunes of wind-blown sand; adults feed mostly on scabweed (Raoulia spp.), larvae feed on roots of tussocks, especially Poa laevis; also threatened by predation from Little Owl; natural vegetation threatened by exotics, especially Pinus radiata.

MODIFICATIONS: most fans and terraces now in exotic pasture; sweet brier and matagouri communities widespread on lower slopes, especially in Kawarau Gorge; larch, Douglas fir more or less naturalised near Roaring Meg.

REPTILES: Otago skink (Leiolopisma otagense form otagense) and grand skink (L. grande) known from a few small, scattered sites in the Lindis Pass area (north-western limits, elsewhere extant populations of L. grande are known only from the Wanaka E.D. and Macraes E.D., and L. otagense form otagense from Middlemarch E.D. and Waipori E.D.).

INSECTS: include giant weta Deinacrida connectens near Lewis Pass; cicadas Maoricicada clamitans (on Grand View Ridge 900-1200m, on Aciphylla colensoi and A. aurea), M. phaeopterai (restricted range in Central Otago subalpine tussock); carabid beetle, Megadromus bullatus at Lindis Pass in tussocks and stones; grasshopper Sigaus australis reaches its eastern limit at Lindis Pass, in tussock, screes, high rocky ridges; small leaf beetle Allocharis n. sp. in tussock, scabweed (Raoulia australis); trapdoor spider, Cantuaria sp. at Lindis Pass; fine noctuid moths, Homohadena fortis, Graphania lithias on Hymenanthera alpina and G. nullifera, with larvae on taproot of Aciphylla aurea.
Beetles with type localities at Lindis Pass: Limnichus punctatus, Hypotagea testaceipenne, H. variegata, Adoxia nitidicolle, A. aeneum, A. viridis, Scymnus picinus, Cyphon plagiatus, C. nitidus.

DUNSTAN ECOLOGICAL DISTRICT 67.03

Criteria: topography (lower than Pisa, non-glaciated), climate (marginally drier than adjacent districts of comparable altitude), vegetation (no beech forest remnants), flora (local alpine endemics).

TOPOGRAPHY: NE-SW trending, tilted, block-faulted Dunstan Mountains, ranging from 300m-1692m a.s.l.; soil hummocks widespread on summit plateau of mountains.

GEOLOGY: mostly Paleozoic Haast Schists with minor Quaternary glacial outwash gravels and moraine in Clutha-Lindis valley.

CLIMATE: generally dry sub-continental, (Molyneux faces of Cromwell Gorge in Old Man E.D. are the only truly semi-arid zone in CENTRAL OTAGO; humid zone on Dunstan Mountains above 910m); strong altitudinal gradient; rainfall 380-1000mm p.a.; NW winds prevail; snow may lie for weeks in winter above 1200m.

SOILS: shallow to moderately deep soils from schist with variable cover of loess on rolling, hilly and steep slopes of mountains, shallow to deep soils on terraces and fans in valleys: in wetter higher areas soils strongly leached with friable, yellowish brown subsoils; in slightly drier areas soils moderately leached, droughty in summer, deeper soils have pale-coloured compact subsoils; in drier areas soils weakly leached, extremely droughty, some have calcium carbonate accumulations in subsoils; salty soils (saline soils and solonetzes) and small areas of alluvial soils.

VEGETATION/MODIFICATIONS: formerly predominantly tussockland: hard and silver tussock at low altitudes, snow tussock above; remnants of Hall's totara woodland (with Dacrydium bidwillii, Phyllocladus alpinus, Dracophyllum longifolium) at SE end, also some Podocarpus nivalis; shrub associations include matagouri, native brooms (Carmichaelia, Chordospartium), kanuka; scabweed associations, some with Luzula ulophylla on very eroded land; herbfield dominated by Celmisia viscosa and Poa colensoi marks the lower boundary of the high alpine zone; cushion associations cover most of exposed high alpine zone. Now modified, almost totally on NW slopes by long history of pastoral farming and rabbits: depleted tussockland with scabweed, patches of matagouri and sweet brier scrub on western lowlands; mainly exotic pasture and weed communities on fans and alluviums; extensive snow tussock cover survives on summit area of northern Dunstans; extensive areas of high alpine cushion and herbfield in southern half. Much of district grazed (extensive sheep and cattle); orchards in Comwell Gorge (apricots).

FLORA: local endemic species at southern (Myosotis sp.) and northern (undescribed Gentiana) ends of alpine zone. Species with limited distribution found on Dunstan Mountains: Scirpus aucklandicus, Poa pygmaea, mosses Conostomum australe, Ditrichum brevirostrum, Drepanocladus unanatua (cf. Brachythecium paradoxum), Pohlia nutans or P. novae seelandiae?; good stand of low altitude hard tussock (Festuca novae-zelandiae) up Cluden and Big Spur Stm; good stand of silver tussock (Poa laevis) near Big Spur Creek (sunny faces); patches of Chionochloa macra on summit of Dunstan Mountains. Rare or endangered plants: Pleurosorus rutifolius (rock outcrops), Myosotis albo-sericea (a single site on dry rocks, c 1400m), Lepidium matau (in Cromwell area), Carmichaelia compacta.

BIRDS: few birds of note have been reported from this district. Falcon present; S.I. Pied Oystercatcher and Banded Dotterel (and Black-backed Gull) breed on the top of the Dunstan Range; Black Stilt have been observed near Tarras.

INSECTS: include wetas Hemideina maori and Hemiandrus focalis on range; carabid beetle Megadromus sandageri (smaller size than in drier parts of range); Hepialodae aoria-serix (in cushion herbfields); flightless leaf beetle Allocharis sp 10 (1075m). Moths not found further N include Notoreas chioneres (on Drapetes), Asaphodes n. sp. (in bogs over 1600m), Orocrambus scoparioides (bogs), Scoparia xymatias (moss), Tauroscopa gorgopis, Hierodoris n. sp., Aoraia sexex. Moths not found further S include Notoreas n. sp. (together with N. chioneres), Scoparia sideraspis, Orocrambus melanpterus, O. paraxenus, O. dicrenellus. Other moths include Opophora unicolor, Orocrambus machaeristes, 2 undescribed Torticids, Gelophaula app. larvae in Celmisia stems).
Type localities of 2 moths (Geophaula n. sp., Asaphodes n. sp.) occur in district. Woodshed Creek area includes important habitats for the butterfly Lycaena feredayi, which has a small range: most abundant along banks of a small stream entering Woolshed Creek - mainly closed scrub but also occurs (1) on open ground in creek bottoms around rocky outcrops, slips, eroded ground and in open tussock with Muehlenbeckia axillaris and Rumex flexuosus, and (2) amongst scrub in creek bottoms and tussockland where M. complexa grows (especially in damp hollows and gullies). Cicada Maoricicada phaeoptera common above 1600m.

MANIOTOTO ECOLOGICAL DISTRICT 67.04

Criteria: climate(severe summer droughts), topography (relatively low relief), vegetation, flora, geology.

TOPOGRAPHY: extensive series of inland basins, mostly between 200 and 600m a.s.l., drained by Manuherikia R. in the NW and Taieri R. in the E: low convex ridges with schist outcrops, broad flat plains, meandering rivers; includes a few small inland salt patches and a salt lake.

GEOLOGY: Haast Schist basement, overlain (locally) by Cretaceous breccia and conglomerate, Tertiary sediments (quartz sand, clay, lignite), piedmont gravels and late Quaternary gravels and sand.

CLIMATE: sub-continental, semi-arid; rainfall 300-800mm p.a.; very warm dry summers, cold winters.

SOILS: in lower rainfall areas soils range from shallow to deep, stony weakly leached, very droughty; calcium carbonate may occur in subsoils; areas of salty soils (saline soils and solonetzes). Under slightly higher rainfall soils moderately leached, shallow to deep and droughty in summer; deeper soils have pale-coloured compact subsoils. In higher rainfall areas of the N soils strongly leached with browner, more friable subsoils; droughts uncommon. Soils from basalt with cover of loess have clayey textured dark-coloured subsoils in the E; areas of alluvial soils on river flats.

VEGETATION/MODIFICATIONS: has been burnt frequently: mainly depleted lowland short tussockland (hard and silver tussock with scabweed; snow tussock on lower slopes of Hawkdun Range and Taieri Ridge), often extensive scrub communities: matagouri, Aciphylla aurea over most unimproved lands; sweet brier and thyme abundant especially in W; other scrub species include Coprosma propinqua, C. intertexta, Olearia odorata, O. virgata var. rugosa, O. lineata; Hymenanthera alpina is major shrub of exposed rocks; snow tussock (Chionochloa rigida) occurs where fires less frequent, probably more common originally; mainly exotic pasture species and weeds on lowlands; extensive rush/sedge swamps around Taieri River meanders (now being drained by river straightening), much modified by crack willow. No indigenous forests; some exotic forests near Naseby. Most of district grazed (mostly extensive sheep and cattle); orchards in the Manuherikia Valley.

BIRDS: the almost complete absence of forest remnants means there are no forest birds of note in this district. Falcon present in low numbers in the foothills of the surrounding ranges; Black-fronted Dotterel and Pied Stilt breed on the Manuherikia R.; the upper Taieri wetlands provide important habitat for a wide range of waterfowl.

REPTILES: green geckos, probably jewelled gecko (Heteropholis gemmeus), have been found near Oturehua. Green skink (Leiolopisma chloronoton) occurs near Falls Dam.

INSECTS: include very rare giant carabid beetle (Mecodema laeviceps), endemic to Oturehua area of Ida Valley (under big stones in tussock); the grass moth Orocrambus lindsayi is known only from Mt Ida.

OLD MAN ECOLOGICAL DISTRICT 67.05

Criteria: topography, vegetation, flora, climate, geology.

TOPOGRAPHY: five N-S trending block mountain ranges, three forming a wide alpine area in the S. Plateaux are widespread, tilted, warped vestiges of extensive ancestral surface; drainage chiefly along linear structural weaknesses, with deep antecedent gorges along Nevis, Clutha, Kawarau and Waikaia Rivers, typically asymmetric; Plateau remnants have rectangular, shallowly incised drainage. Mountain for landscapes on high plateaux (periglacial and glacial features); outlier glaciated areas present in the N and SE of high tablelands.

GEOLOGY: basement of Paleozoic Haast Schists, late Tertiary-Recent deformation evidenced by N-S and NE-SW trending fault blocks etc. Tertiary lake, swamp and river sediments are restricted to deep valley basins and smaller depressions on tablelands; these rest on the mid Tertiary erosion surface elsewhere in the district thought to comprise present plateau landscapes. Quaternary deposits include alluvium along major rivers; colluvium on slopes especially below periglacial summits; localised peatbogs and widespread loess.

CLIMATE: continental on northern and eastern ranges and lowlands, reflecting the inland rainshadow location. Rainfall is as low as 330mm p.a. around Alexandra; the sunny Molyneux faces of Cromwell Gorge are the only truely semi-arid area in CENTRAL OTAGO Region. Strong moisture and temperature gradients between the alpine plateaux and northern ranges and lowlands. Precipitation on plateaux up to 2500mm p.a.; occurring chiefly as heavy winter snowfall; long periods of snowlie; high incidence of fog and cloud year round. High summits experience frequent freeze-thaw cycles during snowfree period; persistent high winds all year.

SOILS: mainly hill and steepland soils from variable thickness of loess and solifluvial debris overlying schist: in lower rainfall areas soils predominantly shallow, very droughty; deeper soils have calcium carbonate accumulations in subsoils. With slightly higher rainfall soils moderately leached, droughty in summer; deeper soils have compact subsoils. In higher rainfall areas soils strongly leached with friable subsoils; droughts uncommon.

VEGETATION/MODIFICATIONS: evidence that forest including beech, Hall's totara and mountain toatoa was originally widespread below c.1000m a.s.l. Since European settlement (c.1840) the dominant vegetation has been tussockland with a distinctive altitudinal pattern: montane fescue tussockland and scattered scrub, subalpine mixed fescue-snow tussocklands, alpine snow tussocklands and shrublands with cushion and herbfield communities across the exposed ridge and plateau summits. Snow tussocklands dominated by narrow-leaved snow tussock at lower altitudes and slim snow tussock on upper alpine slopes. The NE-SW climate gradient is reflected by short grasslands dominating the dry northern slopes and extensive wetlands with red tussock stands across the damp southern plateaux. Small remnant stands of kanuka, manuka and kowhai woodland occur along the Clutha faces. An area of mountain toatoa-Hall's totara forest remains sheltered on bluffs at the junction of Blue Creek and West Branch Waikaia R. The snow tussockland belt has been reduced by pastoral developments; scrub communities are confined to gullies and rock outcrops; blue tussock and an extended band of cushion and herbfield communities replace slim now tussock in the periglacial zone. Alpine 68

fescue and Celmisia spp. are prominent where tussock canopy has been disturbed. Below about 1000m fescue tussock and exotic pasture have replaced snow tussock. Low altitude wetland and red tussock communities have been invaded by exotic species. Scabweed, golden spaniard, sorrel, Vittadinia and thyme form sparse communities on exposed ridge crests and north-facing slopes of the driest areas of Carrick, Cairnmuir and Obelisk ranges. Much of the district is grazed (extensive sheep and cattle); rabbits, hares and feral goats are locally abundant.

FLORA: plants of limited distribution occuring in the district include the herb Lepidium kawarau (endemic), the grass Simplicia laxa known only from Castle Rock, the marsh herb Triglochin palustre on Cairnmuir Flats. Rare plants occurring in Old Man Range cushion-herbfield include Cotula albida, Geum pusillum, Luzula crenulata and Carex allanii (latter 3 endemic to this range). The rare native broom Carmichaelia compacta and fern Pleurosorus rutifolius occur on very dry slopes above the Kawerau and Clutha Rivers respectively. The rare whipcord hebe H. poppelwellii is on southern Old Man Range. Large rosette herb Cheesmania wallii occurs on bluffs around L. Laura and below Blue Lake (also in Eyre Mountains). Parahebe trifida occurs in Garvie Mountains and Southern Old Man Range. Celmisia prorepens and C. brevifolia have type localities in upper Old Man Range; Epilobium pictum and Colobanthus brevisepalus have type localities on lower eastern slopes. Hebe dilatata and Pimelea poppelwellii have type localities on Garvie Mountains.
Species at the limits of their known range include Corallospartium crassicaule, Carmichaelia monroi and Lagenifera barkeri (southern limits); Celmisia hectori, Ranunculus buchananii and Aciphylla pinnatifida (eastern limits).

BIRDS: Yellow-breasted Tit present in scrub patches; robin have been recorded in the S of this district; falcon widespread; Black-fronted Tern, Black-billed Gull, Pied Stilt, Banded Dotterel, and S.I. Pied Oystercatcher breed in the Nevis Valley, the latter two also breed on the tops of some of the ranges; Australasian Coot established at Alexandra.

INSECTS: include chafer beetle Scythrodes squalidus, 3 endemic leaf beetles (Allocharis spp.) including Allocharis subsulcatus, speargrass weevil Lyperobius spedeni, green chafer Stethaspis pulchra, blind carabid beetles Pelodiaetus sulcatipennis and P. lewisi, alpine cicadas Maoricicada nigra frigida, M. otagoensis, weta Hemiandrus focalis, about 20 endemic Lepidoptera spp., endemic grasshopper Sigaus obelisci.

MANORBURN ECOLOGICAL DISTRICT 67.06

Criteria: topography (gentle uplands), vegetation (less tussock and scrub in unimproved areas than Maniototo), climate, flora.

TOPOGRAPHY: gently rolling uplands, mostly below 900m a.s.l., with several distinctive block faulted ridges, rising to over 1100m (e.g. Rough Ridge, Knobby Range); rock tors and fretted landscapes present on ranges; terraces formed by discontinuous down cutting of the river.

GEOLOGY: mostly Paleozoic Haast Schists; some Miocene freshwater quartz conglomerate and sandstone, siltstone and mudstone with seams of lignite and oil shale; large area of swamp deposit under Serpentine Flat; Little Valley Flats composed of Pleistocene piedmont and river terrace gravels.

CLIMATE: sub-continental, semi-arid; rainfall 400-800mm p.a.; very warm, dry summers and cold winters.

SOILS: from variable thickness of loess overlying schist and related slope deposits ranging from deep to shallow on terrace, rolling and hill lands: in lower rainfall areas soils weakly leached, very droughty; calcium carbonate accumulations may occur in subsoils. With slightly higher rainfall soils moderately leached, droughty in summer; deeper soils have compact subsoils. In higher rainfall areas at higher altitudes soils have friable subsoils, droughts rare.

VEGETATION: mainly lowland short tussockland grading upwards into mixed red and snow tall tussockland (e.g. red tussock low to mid altitude around Manorburn Dam and extensive area at Serpentine-Pool Burn-South Rough Ridge area; extensive band of snow tussock on lower slopes of Knobby Ranges; blue tussock-hard tussock associations on tops of Knobby Range, Festuca matthewsii in Shanty Creek); some scrub communities (mainly kanuka-manuka in the S, elsewhere matagouri-brier rose); wetlands and peat bogs with sphagnum; no forests.

FLORA: includes rare, endangered inland saline habitats e.g. at Patearoa on eastern boundary, 3 vegetation types: in meander Hordeum jubatum - Scirpus pungens, on adjacent slopes Agrostis stolonifera - Trifolium fragiferum, on flat surfaces Selliera radicans - Puccinellia stricta - Plantago coronopus - Hordeum hystrix - Atriplex novae-zelandiae (rare) - Salicornia australis; Atriplex buchananii on white salt on surface. Wheat grass Agropyron scabrum occurs on Raggedy Range and Rough Ridge.

BIRDS: no forest birds of note. Falcon widespread; Black-fronted Tern, Black-billed Gull, Banded Dotterel, and S.I. Pied Oystercatcher breed along rivers, the latter two also on the range tops.

INSECTS: include flightless beetle Prodontria modesta (at Lower Manor Burn below the dam), new species of Prodontria on Raggedy Range; grasshoppers Paprides dugdalii (in tussocks at 1151m on South Rough Ridge near Linburn Station), Sigaus australis (in tussocks, shingle screes, high rocky ridges between 1219-1524m on South Rough Ridge - its probable eastern limit), Sigaus minutus (rare, found in Graveyard Gully E of Alexandra); endemic moths Dichromodes ida (in small area round eastern Alexandra), Lythria perornata (widespread geometrid, larvae on Pimelea aridula). The type localities of 5 species of Coleoptera (bettles) occur in this district.

MODIFICATIONS: grazed (extensive sheep and cattle).

ROCK AND PILLAR ECOLOGICAL DISTRICT 67.07

Criteria: vegetation (zonation pattern differs from other Central Otago mountains in the upper Hebe odora shrubland), flora (eastern limit of Central Otago high-alpine flora etc.), topography, geology, soils.

TOPOGRAPHY: the NE-SW trending block faulted Rock and Pillar Range, rising steeply in the SE from 400 to over 1400m a.s.l. (Summit Rocks 1450m); drained by the Taieri R. which flows right around the range.

GEOLOGY: mostly Paleozoic-Mesozoic Haast Schists.

CLIMATE: sub-continental; rainfall 500-1700mm p.a.; NW winds prevail; snow may lie for weeks above 1000m in winter.

SOILS: mainly hill and steepland soils from variable thickness of loess overlying schist: at lower altitudes and rainfall moderately leached, droughty; at higher altitudes strongly leached, non-droughty, with friable subsoils; some soils podzolised; in the N small areas of clayey textured, dark-coloured soils from basalt with overlying loess.

VEGETATION: montane short and sub-alpine tall tussockland, upper subalpine Hebe odora shrubland with bog pine, snow totara and mountain toatoa; scrub on lower western slopes above upper Taieri (matagouri, Coprosma intertexta, C. propinqua, Olearia odorata, O. virgata var. rugosa, Hymenanthera alpina). Small remnants of forest in deepest gullies on SE slope - Griselinia dominant.

FLORA: the eastern limit of Central Otago high-alpine flora; Brachycome humile and Abrotanella af. inconspicua endemic to district.

BIRDS: the only birds of note are falcon. Subfossil bones in several localities suggest a rich avifauna, now extinct.

INSECTS: include the large weta Hemideina maori.

MODIFICATIONS: grazed (extensive and semi-intensive sheep and cattle).

MACRAES ECOLOGICAL DISTRICT 68.01

Criteria: climate (rather dry), topography (gentle relief, moderate elevation), vegetation (mostly strongly modified tussockland).

TOPOGRAPHY: the NE-SW trending Taieri Ridge and a series of parallel smaller faulted ridges to the SE; complex dendritic drainage pattern; much of district gently sloping land below 600m a.s.l. with higher ridges rising to over 800m.

GEOLOGY: mostly Paleozoic Haast Schists with small areas of Miocene sediments and basaltic cones and flows.

CLIMATE: cool, dry; rainfall 600-800m p.a.; NW winds prevail; snow may lie for weeks in winter.

SOILS: deep to shallow soils from variable thickness of loess (depending largely on slope) over schist, sandstone: in lower rainfall areas, mainly in the W, soils have pale-coloured compact subsoils, some with poor winter drainage, droughty in summer; in higher rainfall areas soils more strongly leached with friable yellowish brown subsoils, good drainage, droughts uncommon. Soils from basalt with overlying loess have heavy textured, dark-coloured subsoils.

VEGETATION: montane short tussockland grading into subalpine tall tussockland (snow tussock, fescue and silver tussock), with some areas of coprosma-flax scrub, some hardwood forest with minor podocarp element (broadleaf, kohuhu, tarata, rare Hall's totara) and kanuka forest.

BIRDS: the coastal populations of many forest birds reach their western limit in Central Otago in the scrub remnants of this district, including: Rifleman, Yellow-breasted Tit, N.Z. Pigeon and Bellbird; falcon widespread and common.

REPTILES: high reptile diversity with 7 species of lizards (includes 3 sibling species in the skink Leiolopisma nigriplantare species-complex). By far the largest and best populations of the rare skinks, grand skink (Leiolopisma grande) and Otago skink (L. otagense form otagense) occur near Macraes Flat and Nenthorn. Elsewhere L. grande is only known from the Wanaka E.D. and Lindis E.D. although there is an old museum specimen from the Remarkables E.D. Extant populations of L. otagense form otagense are known elsewhere only from the adjacent Waipori E.D. and the Lindis E.D.; old records indicate a wide distribution in Otago and S as far as the Hokonui Hills. Green skink (Leiolopisma chloronoton) present.

MODIFICATIONS: grazed (extensive sheep and cattle).

WAIPORI ECOLOGICAL DISTRICT 68.02

Criteria: topography (gentle slopes, dendritic drainage), climate and soils (foggy peaty uplands, moist, cool to cold), vegetation (originally tussocklands).

TOPOGRAPHY: peaty uplands of the plateau Lammerlaw and Lammermoor Ranges, surrounding hills with L. Mahinerangi in the S; maximum altitude 1211m a.s.l. (Lammerlaw Top); below 600m in the E.

GEOLOGY: mostly Paleozoic-Mesozoic Haast Schists, with extensive loess cover.

CLIMATE: cool, dry to moist; rainfall 500-1200mm p.a.; NW winds prevail; snow may lie for weeks above 900m in winter.

SOILS: deep to shallow soils from variable cover of loess or drift (thickness largely dependent on slope) overlying schist: in lower rainfall areas soils have pale-coloured compact subsoils, moderately leached, droughty in summer; with increasing rainfall and altitude and there is a gradation through strongly leached soils to very strongly leached and podzolised soils; latter may have peaty topsoils, impeded subsoil drainage; small areas of peaty soils in basins.

VEGETATION: low- to mid-altitude short and tall tussockland (Chionochloa rigida , red tussock, hard tussock) with numerous peat bogs, a few small relict stands of silver beech forest and podocarp-hardwood forest (numerous forest dimples occur through the grassland), some manuka and kanuka forest and scrub at lower elevations.

BIRDS: no bird species of note are recorded as resident in this district; Black Stilt have been reported.

REPTILES: jewelled gecko (Heteropholis gemmeus) recorded near L. Mahinerangi and at Hindon. Otago skink (Leiolopisma otagense form otagense) occurs near Sutton (elsewhere extant populations are known only in the adjacent Macraes E.D., and in the Lindis E.D.). Green skink (Leiolopisma chloronoton) at L. Onslow.

MODIFICATIONS: original tussocklands now mostly converted to pasture up to about 600m; mostly grazed (extensive and intensive sheep and cattle); expanding exotic forests in the S.

TAPANUI ECOLOGICAL DISTRICT 68.03

Criteria: vegetation (forested), topography (a small isolated range), flora.

TOPOGRAPHY/GEOLOGY: comprises the Paleozoic-Mesozoic Haast Schist Blue Mountains, rising to 1020m a.s.l.

CLIMATE: cool, moist; rainfall 800-1000mm p.a.; snow may lie on the summit ridge for a week or two in winter.

SOILS: mainly stony steepland soils from schist: on lower slopes soils moderately to strongly leached; with increasing altitude soils grade through very strongly leached and podzolised soils to blanket peats.

VEGETATION: includes beech forest (silver beech forest most common, up to treeline on the W and S sides of Blue Mountains, silver beech and mountain beech on the E side on old terraces by the Clutha R., also kanuka forest/scrub patches; red beech on valley floor extends up to 80m beside the Clutha R.); patches of podocarp forest occur within the beech in gullies (rimu, miro, Hall's totara, kahikatea); montane and subalpine tussockland-shrubland (mainly red tussock on peaty summit of Blue Mountains; smaller areas of Chionochloa rigida and hybrids between C. rigida and red tussock; shrubland mostly manuka at lower altitudes, Dracophyllum at higher altitudes); also on summit plateau are numerous tarns, scrub patches (Dracophyllum longifolium, bog pine and cushion bogs.

FLORA: a species of limited distribution, Gentians lineata, occurs in the cushion bogs. Astelia linearis reaches its eastern limit in these bogs.

BIRDS: Yellow-crowned Parakeet and Yellowhead have been reported from beech forest on the Blue Mountains.

MODIFICATIONS: much of the eastern and western lower slopes are in exotic forest; some localised farming.

LAWRENCE ECOLOGICAL DISTRICT 68.04

Criteria: topography/geology (dissected rolling schist uplands); climate (semi-continental); vegetation (predominantly fire-induced tussock grassland originating in pre-European times).

TOPOGRAPHY: low, rolling, dissected country surrounding Lawrence; maximum altitude 687m a.s.l. on northern boundary; drained by the Clutha, Tuapeka and Waitahuna Rivers.

GEOLOGY: mostly Paleozoic-Mesozoic Haast Schist with some Eocene-Miocene gold-bearing schist and greywacke conglomerate and breccia. Extensive loess cover.

CLIMATE: cool, moist; rainfall 700-800mm p.a.; snow may lie for a few weeks in winter.

SOILS: deep to shallow soils from variable cover of loess (thickness largely dependent on slope) over schist: in lower rainfall areas (mainly in the S and E) soils have pale-coloured compact subsoils, moderately leached, with poor winter drainage on easier slopes, droughts uncommon; in higher rainfall areas soils more strongly leached, with more friable subsoils, better drained.

VEGETATION: mainly snow tussockland with scattered areas of manuka, kanuka, Cassinia and Hebe scrub also Himalayan honeysuckle and bracken, red tussock grassland and small remnants of silver beech forest to the E of Lawrence. Manuka, kanuka, kowhai; red beech, mountain beech and silver beech along Clutha valley slopes; totara/hardwood and matai-kahikatea-pokaka commmunities occur on the eastern side of the Clutha R. between Chinaman Flat and a point opposite Rongahere. In lower parts of Waitahuna gorge kanuka-Hall's totara-broadleaf-kohuhu forest over 5m tall, also rock outcrops and cliffs.

BIRDS: no bird species of note.

MODIFICATIONS: lower parts of district farmed (semi-intensive sheep and cattle); exotic forest plantations have recently been established N and E of Lawrence.

WAIKOUAITI ECOLOGICAL DISTRICT 69.01

Criteria: climate (drier than Dunedin), geology (schist meeting sedimentary with intrusive volcanics), topography (distinctive volcanic cones), vegetation (dry coastal forest).

TOPOGRAPHY: includes the schist hills of the Silver Peak group in the SW (maximum altitude 777m a.s.l.), a broken chain of volcanic peaks, and rolling coastal hills in the NE; beached coastal plains with small estuaries; major slumping on near coastal hills associated with Tertiary mudstone deposits.

GEOLOGY: complex - includes Haast Schists in the western half of the district, scattered late Tertiary basaltic cones from Boulder Hill in the far S to a number of peaks in the middle of the district and on the coast, late Cretaceous-Tertiary Abbotsford mudstone, Burnside mudstone and Cavershem sandstone/limestone in the eastern half of the district and beach and high level marine alluvial deposits.

CLIMATE: relatively dry, coastal; rainfall 500-700mm p.a. evenly distributed; mild summers, cool winters.

SOILS: shallow to deep soils from a variable cover of loess (thickness largely dependent on slope) overlying schist, sandstone, mudstone: soils in lower rainfall north-eastern part moderately leached, with pale-coloured compact subsoils, those on gentler slopes have poor winter drainage; in higher rainfall areas in the W and S soils more strongly leached, some podzolised, generally better drained; some small scattered areas of claytextured, dark-coloured soils from basalt with a thin cover of loess; alluvial soils in valleys.

VEGETATION: includes small remants of Hall's totara/ngaio-lacebark-ribbonwood-kowhai-mahoe coastal forest; matai-totara-rimu/hardwood forest at lower altitudes inland; hardwood, secondary forest; extensive kanuka-manuka scrub; hard, silver and snow tussock grassland at higher altitude in the W; and stands of forest (silver beech, hardwood and kaikawaka forest) in the uplands around the S branch of the Waikouaiti R. and Silverstream.

BIRDS: robin present in forest near the coast (part of the isolated population in the vicinity of Otago Peninsula); falcon widespread in the W of the district.

MODIFICATIONS: most of district farmed (semi-intensive and intensive sheep and cattle, cash crops; exotic forests in the S).

DUNEDIN ECOLOGICAL DISTRICT 69.02

Criteria: geology (volcanic), topography (hilly), vegetation (coniferous/hardwood forest), climate (cool, moist, with frequent fogs above c.400m).

TOPOGRAPHY: well dissected Miocene sunken volcanic terrain with large whale-backed hills, eroded caldera and volcanic skeleton. The long, sheltered non-surge Otago Harbour with its central island chain separates the Otago Peninsula from the mainland. The exposed coast contains several smaller inlets and bays with fine white sand, dune-backed beaches.

GEOLOGY: a complex series of late Tertiary basaltic to trachytic flows, breccias and tuffs. Trachytic breccias and tuffs centred about the Port Chalmers-Portobello sunken caldera. Later basaltic flows were erupted from a line of vents west of Dunedin city. Intrusion of caulifloral phonolitic threloids produced areas of high relief.

CLIMATE: moist, coastal; rainfall 700-1200mm p.a., evenly distributed; mild summers, cool winters, foggy uplands.

SOILS: formed from variable cover of loess and solifluction debris over basalt and sedimentary rocks: on gentler slopes where cover is thickest soils in lower rainfall areas have compact pale-coloured and mottled subsoils and poor winter drainage; with increasing rainfall soils very strongly leached to podzolised. Soils from basalt have dark-coloured heavy textured subsoils and show similar leaching sequence. All gradations between loess/solifluction and basalt soils occur.

VEGETATION: indigenous vegetation mainly podocarp/hardwood forest: matai-totara-rimu/mahoe-lacebark important on coastal hills, very few remnants (Liberton or Pine Hill was originally known as Black Pine Hill); rimu-miro/mahoe-broadleaf forest extensive on mid altitudes, kaikawaka-Hall's totara/hardwood forest above c.400m a.s.l. Snow tussocklands occupy higher altitudes in the W, with kanuka and manuka communities common throughout. Silver beech forest occurs as scattered small stands on and NW of Mt Cargill. There are some extensive salt marshes, including Aramoana saltmarsh of national importance. Isolated and main snow tussock-topped hills and isolated stands of kanuka induced by Maori fires.

BIRDS: robin occur in forest N of the city and on the Otago Peninsula; Fernbird present in scrub on the ranges NW of the city; Yellowhead have been reported from forest near Dunedin (isolated from the nearest populations in Nokomai E.D. and Umbrella E.D., elsewhere absent from E of the Main Divide). The various estuaries and bays around this district (Blueskin Bay, Purakinui, Aramoana, Papanui Inlet, Hoopers Inlet) and the Otago Harbour provide valuable habitat for shore birds and migrant waders. The Northern Royal Albatross colony at Taiaroa Head (15 pairs; one of only two colonies for the subspecies sanfordi, the other in the Chatham E.D.) is unique as the only mainland albatross colony in the world. Otago Peninsula is one of only two major breeding areas for Yellow-eyed Penguin (the other is Auckland Islands E.D.); Southern Blue Penguin also nest there. There are important breeding colonies of Stewart Island Shag near Taiaroa Head; the Otago populations of this species show some differences from those elsewhere. Also large colonies of Spotted Shag. Sooty Shearwater breed at Taiaroa Head and on coastal islets.

REPTILES: jewelled gecko (Heteropholis gemmeus) is widespread (and in places very common) in forest remnants around Dunedin and on the Otago Peninsula.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: mainly farmed (pastoral and dairying); includes city of Dunedin.

TOKOMAIRIRO ECOLOGICAL DISTRICT 69.03

Criteria: vegetation (forest types change from podocarp-rata/kamahi in Balclutha to podocarp/other hardwoods and silver beech, plus kanuka); geology (schist becomes important); topography (wider altitudinal range than Balclutha, includes block-faulted mountains in the W).

TOPOGRAPHY: alluvial plains, wetlands and low coastal hills, higher country in the W, reaching 895m a.s.l. at Mt Maungatua. Coastline consists of sand beaches often backed by cliffed terraces underlain by country rocks, or sand dunes. Extensive low rocky headlands, more common S of Taieri Mouth.

GEOLOGY: includes basement rocks of Permian to Carboniferous greywacke (Taupeka Group) and Otago Schist; upper Cretaceous Henley Breccia and Taratu Formation greywacke and coal seams; Paleocene Wangaloa Formation conglomerate and sandstone; and extensive alluvium, mainly Pleistocene and Holocene flood deposits. Small Miocene basalt hills to the W, surrounded by Eocene Elliotvale Formation silt, sand and conglomerate.

CLIMATE: moist, coastal; rainfall 600-700mm p.a., evenly distributed; warm summers, cool winters.

SOILS: on terrace, rolling and hilly lands from variable cover of loess overyling schist and sedimentary rocks: most loess soils have pale-coloured compact subsoils; those on gentler slopes with deeper loess have poor winter drainage; with increasing altitude and rainfall (mainly in the N and NE) soils more strongly leached, more friable, better drained. Podzolised soils and podzols with peaty topsoils on Mt Maungatua. Fertile gleyed alluvial soils, many with poor drainage, extensive on Taieri Plains, peaty soils in low-lying swamps; some areas subject to flooding.

VEGETATION: remnants of indigenous vegetation include rata/kamahi forest as far north as Akatore Creek; podocarp/kamahi forest beside the Taieri R. near Taieri Mouth; coastal podocarp/hardwood forest (rimu, miro, Hall's totara/mahoe, broadleaf, Pittosporum spp.) in the hills from Taieri Mouth to Saddle Hill; silver beech forest on the eastern flank of Maungatua, in the Waipori Gorge and at Taieri Mouth; podocarp/hardwood forest in the Waipori Gorge (miro, matai, totara, some rimu/mahoe, broadleaf, Pittosporum spp.), at Woodside (same, but with more rimu), in the Taieri Gorge upstream of Outram (matai, totara, kahikatea/the same hardwood species) and on eastern slopes of the hills between Outram and North Taieri (matai, kahikatea/the same hardwood species). Kanuka stands of varying stature are scattered throughout. Remnants of snow tussock grassland occur along the western high country with low alpine cushion bog and scrub on the summit of Maungatua. Silver tussock (mostly induced) and small areas of hard tussockland remnants occur throughout the lower hills.
Flax-crack willow dominated swamps are extensive around Lakes Waipori and Waihola; highly modified swamps occur elsewhere on the plains.

BIRDS: Brown Creeper occur at L. Waipori; falcon present in low numbers. The Waipori-Waihola wetlands complex is an extremely valuable habitat for waterfowl and wetland birds with most duck species present in large numbers. Species of note are Marsh Crake, Spotless Crake, Banded Rail and Fernbird.

REPTILES: jewelled gecko (Heteropholis gemmeus) is known from the Waipori Gorge. Green skink (Leiolopisma chloronoton) on Green Island.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: much of district farmed (sheep, cattle on hill country; dairying, stud farms (horses, cattle, sheep) on plains; orchards and market gardens at Outram and East Taieri; some cropping); exotic forest extensive on hills around Waipori Gorge and on coastal hills between Brighton and southern boundary - still increasing rapidly.

BALCLUTHA ECOLOGICAL DISTRICT 69.04

Criteria: soils, geology, topography, vegetation.

TOPOGRAPHY: small district of fertile alluvial lowlands and adjacent low hills around the mouth of the Clutha R.

GEOLOGY: Permian (Arthurton Group) volcanic greywacke, argillite and tuff round Kakapuaka; Permian to Carboniferous (Tuapeka Group) greywacke; upper Cretaceous (Taratu Formation) conglomerate with interbedded sands, greywacke and coal seams; Paleocene (Wangaloa Formation) conglomerate and sandstone; extensive Holocene floodplain, lacustrine and estuarine deposits, some alluvium preceeding last glaciation.

CLIMATE: dry to moist, coastal; rainfall 600-700mm p.a., evenly distributed; mild summers, cool winters.

SOILS: from a variable thickness of loess on terrace, rolling and hilly land mainly have pale-coloured compact subsoils with deeper soils on gentler slopes having poor winter drainage, may be droughty in dry summers; in wetter hill country to the W soils from thin loess over conglomerate have more friable subsoils, more even moisture conditions. Alluvial soils, many with poor drainage, are extensive bordering lower reaches of Clutha R.; peaty soils in low-lying swamps where water-tables are high; flooding occurs in some areas.

VEGETATION: includes remnants of rata-kamahi forest on the higher hills behind Kaitangata, podocarp/hardwood forest on the foothills above L. Tuakitoto; small remnants of totara-dominant forest along the banks of the Clutha R. and between Romahapa and Waitepeka; remnant of kahikatea-totara dominant forest at Otanomomo; remnants of non-forest vegetation include red, hard and silver tussockland, bracken, toetoe and cabbage tree scattered over much of the low hill country, with extensive flax/Carex secta/crack willow swamps around L. Tuakitoto and Otanomomo-Paretai.

BIRDS: the L. Tuakitoto wetland is a significant habitat for waterfowl with most species present in large numbers totalling over 10,000 ducks. Other species of note are: Marsh Crake, Spotless Crake, Banded Rail and Fernbird. Some of these wetland birds (e.g. Marsh Crake, Fernbird) are also present S of the Clutha R. Estuaries at the mouth of the Clutha R. are important for shorebirds.

REPTILES: green skink (Leiolopisma chloronoton) occurs on the coast near the Clutha R.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: farmed (semi-extensive sheep and cattle in the north and dairying with sheep and cattle in the south); exotic forests on parts of the coastal hills between Kaitangata and Toko Mouth, also near northern boundary.

WAIPAHI ECOLOGICAL DISTRICT 70.01

Criteria: vegetation, climate (less forested and drier than Tahakopa), topography.

TOPOGRAPHY/GEOLOGY: inland district characterised by a series of parallel hills and valleys formed by folded Jurassic marine and estuarine sediments (sandstones and mudstones) of the Southland Syncline; mostly below 600m a.s.l., maximum altitude 719m; drained by the Waipahi R. and other small waterways.

CLIMATE: moist cool, cloudy; rainfall 800-1200mm p.a. evenly distributed.

SOILS: well drained soils from variable cover of loess over tuffaceous sandstones and related slope deposits, yellowish brown firm clayey-textured subsoils with blocky structure, mainly moderately leached, moderately fertile; at higher altitudes soils more strongly leached with more friable subsoils; on highest parts soils have poor drainage (gleyed) and peaty topsoils.

VEGETATION: originally forested (silver beech around Catlins R. in the SE, podocarp/kamahi forests to the N and W); replaced further west by red tussocklands induced by Polynesian fires between c.1200 and 1800 AD; now these tussocklands either heavily modified or replaced by exotic pasture except on southerly faces, higher altitudes and more remote areas. Some Cassinia, manuka, Dracophyllum and flax scrub, mainly on S faces in southern part of district. Bracken common on sunny faces in the E.

BIRDS: highly modified by farming; only species of note Fernbird.

REPTILES: green skink (Leiolopisma chloronoton) common in the hills S of Clinton.

MODIFICATIONS: much of district grazed (semi-extensive sheep and cattle); exotic forest (Slopedown) near boundary in the SW, and being established in the N.

TAHAKOPA ECOLOGICAL DISTRICT 70.02

Criteria: climate (wetter than Waipahi), vegetation (more forest), topography (irregular, often steeper, more broken than Waipahi).

TOPOGRAPHY/GEOLOGY: a coastal district of parallel low hills and valleys formed by folded Jurassic marine and estuarine sediments (sandstones and mudstones) of the Southland syncline; mostly below 600m a.s.l., reaching 720m at Mt Pye; hills of the Southland syncline form impressive cliffs and promonitories at the coast, separated by wide, bay-head sandy beaches.

CLIMATE: moist, cool, cloudy, with coastal influence of frequent light showers; rainfall 800-1400mm p.a.

SOILS: range of soils from variable cover of loess over tuffaceous greywacke and related slope deposits: at lower altitudes soils moderately leached with firm to friable silty or clayey subsoils; at higher altitudes under cooler, moister conditions soils with pale-coloured subsurface horizon and iron/humus pans; on higher crests of ranges poorly drained soils with peaty topsoils; small areas of alluvial soils in valleys.

VEGETATION/FLORA: extensive low-altitude podocarp/kamahi forests now largely cleared for agriculture; valley-side podocarp/kamahi forests also largely cleared or logged. Montane rata/kamahi forests mostly intact. Localised silver beech forest occupies Beresford Range, Catlins and Maclennan River valleys in the NE; scattered small stands mainly S and W of main body; riparian stands on most waterways draining the Beresford Range. Sub-alpine rata-Hall's totara-kaikawaka-pink pine forests on and surrounding the tablelands of main ranges. Areas of impeded drainage on tablelands carry Dracophyllum-manuka scrub, red tussock, wire rush and cushion bog containing Astelia subulata; red tussockland remnants on valley flats.

BIRDS: this district has the only large forested area remaining on the east coast of the South Island. This area still contains a diverse forest avifauna including isolated (and easternmost) populations of kaka (one of the few populations E of the Main Divide), Yellow-crowned Parakeet (widespread), Red-crowned Parakeet (near Fortrose), and Yellowhead (near Otara, Tautuku, Catlins R., Rata Range, isolated from populations in Nokomai, Umbrella and Tapanui E.D.); also of Blue Duck (all other populations in Otago and Southland are W of the Main Divide). Falcon and Fernbird widespread in suitable habitats; Yellow-eyed Penguin, Variable Oystercatcher and the now rare Reef Heron breed along the coast; there is a small gannet colony on The Nuggets; petrels are reported to breed on some of the inland peaks.

REPTILES: jewelled gecko (Heteropholis gemmeus) has been found at Nugget Point. Forest gecko (Hoplodactylus granulatus) occurs throughout the forests of the Catlins region. This is the north-eastern limit for this species which is not known anywhere else in eastern Marlborough, Canterbury or Otago. Green skink (Leiolopisma chloronoton) present at Progress Valley.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: all accessible lowlands and lower valley sides farmed; extensive plantations of Pinus radiata and a few other exotic species, replacing silver beech forest in the Catlins River valley and podocarp/kamahi forest or various secondary scrub types elsewhere. Possums, rats, mice, stoats, widespread; deer rapidly increasing, damage localised so far; goats localised; pigs in low numbers; rabbits on farmland and dunes.

CASCADE ECOLOGICAL DISTRICT 71.01

Criteria: geology, landform, vegetation (extensive areas of ultramafic mountains and derived moraines; corresponding areas of stunted forest, scrub and barrens).

TOPOGRAPHY/GEOLOGY: a complex area: the lower Paleozoic Greenland Group greywacke and argillite Burmeister and Stafford Ranges (reaching 1000m a.s.l.) form the NE rim, with the Cascade Plateau, a system of parallel moraine ridges largely of ultramafic rocks lying to the W of this. A wide alluvial valley, mostly occupied by post glacial alluvium and swamps lies W of the plateau and runs to the coast. To the S the Hope Blue River Range flanks the west side of the Cascade valley, along the middle of which passes the Alpine Fault. The ultramafic Red Hill Range SE of this fault reaches 1704m a.s.l. and the W flank of the ultramafic and red and green banded argillite Olivine Range rising to 1904m. These two ranges form the southern and eastern rims of the district.

CLIMATE: mild temperatures, extremely high rainfall, 4000-8000mm p.a.
SOILS: very strongly leached to podzolised infertile soils on rolling, hilly and steep land from mafic and ultramafic rocks and greywacke; more fertile but poorly drained alluvial soils on river flats; very strongly leached and stony soils from till occur on rolling and hilly moraines. Stony and shallow strongly leached steepland soils on steep slopes of ranges, rock bluffs common; more fertile but poorly drained alluvial soils on river flats of the Cascade River.

VEGETATION: forests consist of silver beech with mountain beech appearing regularly on poorest soils; podocarp-hardwood forest on lower slopes especially towards coast; red beech important in Upper Cascade and present in a few other places; vegetation of Cascade Plateau modified by burning but related to that on high plateaux in Waiho (small Dacrydium species and pakihi species).

FLORA: the western Fiordland Chianochloa acicularis is present. The Hope Blue River Range is the only range seaward of the Alpine Fault south of Latitude $42^{0}50'$ which rises substantially above tree limit: subalpine species include Raoulia buchananii and certain Celmisia species also found on mountains to the SE.

MAMMALS: N.Z. fur seals breed at Jackson Head.

BIRDS: mostly forested except for rough swampy cleared land in Cascade R. catchment; low fertility (ultramafics) of hill country and poor drainage and high rainfall of low country appear to influence the diversity and density of the avifauna. Species include: falcon, kaka (highest N.Z. mainland densities), Yellow-crowned Parakeet (widespread), Rifleman (localised, scarce on Red Hills and Cascade Plateau), robin (scarce) and Fernbird (especially abundant in lower Cascade R.); Yellowhead are conspicuously absent. Kea present above tree line but Rock Wren are not known. Southern Crested Grebe present on some lakes (e.g. L. Ellery); Blue Duck on some rivers (e.g. Jackson and Cascade Rivers). Fiordland Crested Penguin nest along the coast between Cascade Point and Jackson Head; Mottled Petrel breed on an islet between Cascade and Awarua Points.

MODIFICATIONS: some rough grazing on alluvial flats.

PYKE ECOLOGICAL DISTRICT 71.02

Criteria: topography (less steep, lower than Darran), geology (less ultramafic than Cascade), climate, vegetation.

TOPOGRAPHY: a geologically diverse district with wet, forested ranges rising to 1650m a.s.l. and drained by short incised streams and rivers to the coast, to the broad valleys of the Pyke and Hollyford Rivers and through the extensive swampy lowland behind Big Bay. Deeply dissected terrain of isolated ranges diagonally bisected by the Alpine Fault. In the N the high level George River Plateau is dominant with its systems of parallel moraine ridges largely of ultramafic rocks. A smaller but comparable plateau occurs on Awarua Point on the northern margin of Big Bay. From the mouth of Pyke R. gorge two major low-level contiguous alluvial flats are developed, one due west to Big Bay and the other south along the river towards L. Wilmot. The coastline is mostly boulder or gravel beaches, backed by an uplifted marine terrace then steep hillslopes; sandy beaches with dunes occur in bay heads, notably at Big Bay.

GEOLOGY: complex - mostly Upper Paleozoic volcanogenic meta-sediments with basic igneous intrusives to the E of the Alpine Fault by L. Wilmot; Skippers Range comprises early Paleozoic Fiordland diorite and gneiss plus various Te Anau Group volcanic rocks; to the W are Lower Paleozoic greywackes, fringed on the seaward margin by mid-late Tertiary conglomerates, limestone and mudstone and capped by predominantly ultramafic component glacial till, and morainic deposits, including high level plateau of ultramafic moraine around Gorge R. Miocene sediments outcrop near the coast.

CLIMATE: very high rainfall, increasing rapidly with altitude, mild along the coast; rainfall 4000-8000mm plus p.a.; minimum rain in winter.

SOILS: very strongly leached to podzolised steepland soils from indurated siliceous rocks and basic volcanic rocks; infertile, mainly shallow; soil rock bluffs common. On hilly and rolling land deeper, stony soils, many soils podzolised; more fertile but generally poorly drained gleyed alluvial soils in valleys with areas of peat; strongly leached, podzolised sand soils on coastal dunes.

VEGETATION: forests near the coast are mostly kamahi and southern rata, with scattered podocarps. Silver beech predominates on hillslopes, and grows with red beech on some alluvial terraces. Mountain beech-pink pine low forest occurs on poorly drained old moraine surfaces and outwash terraces. Lowland swamps, bog and lagoon behind Big Bay comprise sedge swamp, manuka and kahikatea swamp forest. Silver beech treelines grade through a narrow subalpine scrub zone into tussocklands of Chionochloa cf. rigida, C. pallens and C. crassiuscula.

BIRDS: forest birds recorded include kaka and Yellow-crowned Parakeet; falcon widespread; Fernbird present; kea occur above tree line; Scaup have been observed on L. Wilmot; Blue Duck present on some rivers. Fiordland Crested Penguin nest along the coast.

REPTILES: skinks have been observed on Awarua Point (all lizards, except for forest gecko (Hoplodactylus granulatus), are very scarce on the West Coast).

MODIFICATIONS: red deer present; possums absent at least from parts of the district. No roads; no farming now that cattle grazing has ceased.

DARRAN ECOLOGICAL DISTRICT 72.01

Criteria: topography (altitude and steepness, existing glaciers).

TOPOGRAPHY: very steep glacier-carved mountains and valleys; maximum altitude 2765m a.s.l. at Mt Tutoko; several small glaciers; includes L. McKerrow, several smaller lakes, Milford Sound and Poison Bay. A rugged exposed coastline: gravel and stony beaches, some rock headlands on outer coast, sandy beaches in bay heads.

GEOLOGY: mostly coarsely crystalline Paleozoic and Mesozoic igneous intrusive and metamorphic rocks; ultramafic rocks occur alongside the S end of the Alpine Fault N of Poison Bay; moraine and alluvium on valley floors.

CLIMATE: very high rainfall climate; rainfall 5000-8000mm p.a.; milder towards the coast; mountain climate inland.

SOILS: mainly shallow, stony very strongly leached to podzolised steepland soils from granite and metamorphic rocks on steep and very steep mountain slopes; on gentler slopes at lower altitude and rainfall soils show podzol features; at higher altitudes topsoils peaty, subsoils have impeded drainage (gleyed); many bare slip scars present; at higher altitudes extensive areas of bare rock and scree.

VEGETATION: altitudinal sequence: the steep lowlands are forested (rimu-kamahi-silver beech forest along the sea coast with silver beech forest at higher altitudes and inland); subalpine scrub and tussocklands and alpine zone; seral scrub and forest communities descend from treeline to low altitude on steep valley walls, avalanche chutes and waterfall sides.
FLORA: high-alpine Achiphylla leighii is endemic.

MAMMALS: N.Z. fur seal - large breeding area at Yates Point.

BIRDS: the Milford catchment and Transit Valley are some of the last places on the mainland where Kakapo have been seen and a few may persist (10, probably all males). Wide diversity of forest birds including: Brown Kiwi (northern limit except for isolated populations in Arawata E.D. and Waiho F.D.), Western Weka (northern limit of Fiordland population, very scarce between here and Hokitika E.D.), kaka, Yellow-crowned Parakeet, Yellowhead and robin (scarce, especially in the W); falcon widespread; Fernbird in Hollyford Valley, on coast near Yates Point and Transit Valley; kea and Rock Wren occur above tree line; Southern Crested Grebe (e.g. L. Ada, L.Ronald) and Scaup present on lakes; Blue Duck on some rivers; Fiordland Crested Penguin nest along the coast.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: there are few modifications to the vegetation; red deer are common in the N but some valleys near Milford remain deer-free; wapiti occur at the southern edge; possums are present but not abundant.

DOUBTFUL ECOLOGICAL DISTRICT 72.02

Criteria: topography (lower altitude than Darran, no glaciers, higher than Preservation), geology, climate, soils, flora.

TOPOGRAPHY: very large district with fiords, lakes and steep glacier-carved mountains, mostly less than 1700m a.s.l.; steep, rocky, exposed coastline.

GEOLOGY: mostly Paleozoic metamorphic and intrusive igneous rocks.

CLIMATE: very high rainfall, 5000-8000mm p.a.

SOILS: shallow, stony, very strongly leached and podzolised steepland soils from igneous and metamorphic rocks on steep and very steep mountain slopes; on gentler slopes at lower altitudes and rainfall soils show podzol features; at higher altitudes topsoils more peaty, subsoils have impeded drainage (gleyed); bare slip scars common; at higher altitudes bare rock and scree extensive.

VEGETATION: shows an altitudinal sequence: valley-floor swamps and swamp forests are common; the steep lowlands lining the coast and fiords are forested - podocarp-hardwood-beech forest (rimu with miro and Hall's totara, kamahi, southern rata, silver beech) with silver beech forest at higher altitudes apart from thin soils which carry mountain beech; subalpine scrub, low-alpine tussocklands and high-alpine zone.

BIRDS: the whole district is essentially unmodified except by introduced mammals and still contains a diversity of indigenous birds. The only surviving natural population (c. 180 birds) of Takahe is in the Murchison and Stuart Mountains on the boundary between this district and Te Anau E.D. The headwaters of Doubtful Sound are one of the last places on the mainland where Kakapo have been found and a few may persist (less than 5, probably all males). Wide variety of forest birds including: Brown Kiwi (present also on Secretary Island), weka (widespread), kaka, Yellow-crowned Parakeet, Yellowhead, robin (scarce, especially in the W) and Rifleman; falcon widespread; kea and Rock Wren occur above tree line; Blue Duck widespread and relatively common on rivers; Brown Teal present in Herrick Creek and Seaforth Valley; Scaup occur on lakes; Marsh Crake are present at Milford and Sutherland Sounds. Sand dunes and sand flats at Sutherland Sound and provide habitat for waterfowl and shore birds such as Variable Oystercatcher (breeding) (sand dunes also occur elsewhere e.g. Coal R.); Fiordland Crested Penguin breed along the coast.

REPTILES: the skink Leiolopisma acrinasum occurs only on a few rat-free islands along the exposed outer coast. The northern limit is at Nancy Souns; L. acrinasum also occurs in the adjacent Preservation E.D.

INSECTS: the Osariine beetle, Paratrochus fiordensis n.sp., has been collected from moss and litter beneath beech and broadleaf (at Wilmott Pass), silver beech, rata, and miro (at Wilmot Pass), silver beech, pepperwood, kamahi and tree ferns (Deep Cove), Olearia ilicifolia (Wilmott Pass), and swards of a small tussock grass (Mount Grey Turrett Range); altitudinal range: between sea level (Thompson Sound) and 1200m (Mount Grey, Turrett Range).

MODIFICATIONS: there are few modifications to the vegetation: low possum numbers, moderate deer population, wapiti in northern part.

TE ANAU ECOLOGICAL DISTRICT 72.03

Criteria: topography, climate (drier than rest of FIORD), geology.

TOPOGRAPHY: long, narrow district including most of Lakes Te Anau and Manapouri, with the Hunter Mountains and L. Monowai in the S; western mountains reach c.1900m a.s.l.

GEOLOGY: mainly Mesozoic metamorphic and igneous intrusive rocks and extensive area of Tertiary limestone, sandstone and mudstone.

CLIMATE: the lower parts of the district are drier than the western districts of FIORD region: rainfall about 2000mm p.a.; much higher rainfall (up to 8000mm) in the Hunter Mountains and along western boundary.

SOILS: mainly strongly leached to podzolised shallow, stony steepland soils, differences due to altitude, rainfall, parent material; small areas stony friable yellowish brown loam soils from till and alluvial gravels; alluvial soils on river flats.

VEGETATION: much of district forested with mountain beech forest with scattered emergent rimu around lake shores, some red beech in Te Anau area at low to mid altitude, silver beech increasing towards treeline and the wetter west. Subalpine scrub and tussockland at higher altitudes; some significant wetlands in the SE.

BIRDS: the only surviving population (c. 180 birds) of Takahe is in the Murchison and Stuart Mountains on the boundary between this district and Doubtful E.D. Wide diversity of forest birds including: Brown Kiwi, kaka, Yellow-crowned Parakeet, Yellowhead (very abundant in Eglinton Valley), robin and Rifleman; falcon widespread; kea and Rock Wren occur above tree line; Blue Duck occur on some rivers; Scaup (common) and Southern Crested Grebe present on L.Te Anau, L. Manapouri, L. Monowai, Island Lake and Green Lake. Marsh Crake and Fernbird are present in suitable habitat, mostly in the E of the district (e.g. near L. Manapouri); Black- billed Gull and Black-fronted Tern (rare) nest in the Eglinton R. Banded Dotterel breed in Eglinton Valley.

MODIFICATIONS: deer and possums present.

PRESERVATION ECOLOGICAL DISTRICT 72.04

Criteria: topography (lower altitude than Doubtful, presence of coastal plateau), climate (cool and exposed), geology (abundance of granite).

TOPOGRAPHY: glacier-carved fiords, lakes and mountains; lower terrain than the northern districts, mountains generally 1100-1500m a.s.l.; non-glaciated coastal plateau (100-500m) of marine terrace origin borders ocean coast in the S and W.

GEOLOGY: Paleozoic-Mesozoic sedimentary, metamorphic and intrusive rocks (granite conspicuous), with some Cretaceous and Tertiary sediments in the S and Pleistocene terrace deposits.

CLIMATE: cool, cloudy and windy: high rainfall, 3200-8000mm p.a.

SOILS: mainly stony, shallow very strongly leached and podzolised steepland soils from metamorphic and granite rocks; on easier slopes soils are podzolised, some with poor drainage (gleyed with peats near the coast).

VEGETATION: much of the district is forested with beech-kamahi-rimu forest on warmer slopes and predominantly beech forest elsewhere (silver beech and mountain beech). Depressed treeline with "Dacrydium" -mixed scrub characteristic on granite. Scrub and tussocklands an s at higher altitudes and on the gentler slopes of the non-glaciated region. Manuka and Chionochloa acicularis important in the lowlands mostly on peat, Dracophyllum and mixed snow tussock in the uplands.

FLORA: many endemic species, e.g. Senecio bifistulosus.

MAMMALS: N.Z. fur seals breed on Breaksea I. and on outer Gilbert I.

BIRDS: the whole district is essentially unmodified other than by introduced mammals and still contains a diversity of indigenous bird species. Wide variety of forest birds including: Brown Kiwi (also on Resolution, Parrot, Long and Cooper Islands) weka (present on many islands), kaka, Yellow-crowned Parakeet, Yellowhead, robin (only in the E apart from populations on Breaksea I. and in Long Sound), Yellow-breasted Tit and Rifleman; falcon widespread; kea and Rock Wren occur above tree line; the Brown Teal populations in Doubtful and Preservation E.D.s are the only ones remaining in the South Island; Blue Duck not as common as further N in Fiordland; Southern Crested Grebe on Lakes Hakapoua and Poteriteri; Scaup present on lakes; Marsh Crake present at L. Monowai. Mottled Petrel breed on an island in L. Hauroko, on the Front and Shag Islands in Dusky Sound, an inlet in Isthmus Sound and possibly on some of the more remote headlands. Sooty Shearwater breed on Breaksea I., as do Fiordland Crested Penguin and Southern Blue Penguin; Sooty Shearwater and Broad-Billed Prion breed on the inner Gilbert Islands and outer islands in Dusky Sound. Southern Great Skua breed in Breaksea and Dusky Sound. Eastern breeding limit for Fiordland Crested Penguins is between the Big and Aan Rivers.

REPTILES: the skink Leiolopisma acrinasum present on Resolution I. and a number of smaller, rat-free islands around the entrances to Breaksea and Dusky Sounds. The southern limit of L. acrinasum is at the south side of Dusky Sound; the species also occurs in the adjacent Doubtful E.D. There is a record of unidentified skinks living in screes above the bush line in the Jane Burn. Green geckos (Heteropholis sp.) have been

found at L. Poteriteri. Forest gecko (Hoplodactylus granulatus) reaches its south-western limit at Puysegur Point.

FISH: giant kokopu (Galaxias argentus) occurs on Resolution I.

MODIFICATIONS: very few apart from introduced mammals.

LIVINGSTONE ECOLOGICAL DISTRICT 73.01

Criteria: vegetation of great diversity (Chionochloa macra dominates high mountains), climate (moderately wet), geology, topography (steep).

TOPOGRAPHY: the steep eroding Livingstone and Thomson Mountains, basin flats and North Mavora Lake; altitudinal range 600 to 2008m a.s.l. (Mt Mavora).

GEOLOGY: variable, including Mesozoic basic volcanics, schistose sandstone, mudstone and siltstone, conglomerate, intrusives including ultramafics etc. and Tertiary sediments in the W including sandstone, siltstone and mudstone.

CLIMATE: cool temperate; moderately wet, between rainshadow and rainbarrier climates, rainfall 1600-5600mm p.a.; NW winds prevail; snow may lie for some weeks above 1000m in winter.

SOILS: mainly strongly leached steepland soils from a wide range of rocks: soils on siliceous rocks have yellowish brown friable and stony subsoils; slightly deeper soils on fans and terraces; on more basic rocks soils clayey with darker subsoils; scree erosion severe in some areas, bare rock and scree occupies higher parts of mountains.

VEGETATION/FLORA: originally mainly beech forest; now large, semi-continuous patches of beech forest (mountain beech and silver beech; red beech in favourable sites) in the W, with some podocarps (Hall's totara, mountain toatoa, Podocarpus nivalis); tussocklands elsewhere - mostly fescue and red tussock in basins and swamps, one or more snow tussocks in subalpine and alpine zones-differentiated from districts to the W by Chionochloa macra in alpine zone; but strong western influence (patchy C. oreophila, C. crassiuscula, Celmisia hectori, C. walkeri, C. semicordata; also Marsippospermum rushlands in higher alps, Chionochloa rigida with scrub in lower alpine zone; wetlands; bracken fernlands; some scrub (mostly manuka) at lower elevations in the N, vicinity of L. Wakatipu.

BIRDS: much of district unmodified; still retains a good forest cover. Wide diversity of forest birds including: kaka, Yellow-crowned Parakeet, Yellowhead, robin and Rifleman; falcon widespread (low in numbers); kea occur above tree line; Scaup; Paradise Shelduck (numerous); Marsh Crake and Bittern.

MODIFICATIONS: much of district unmodified but land development extensive in the S (low fertility exotic pastures); hares, deer, possums present in moderate numbers.

EYRE ECOLOGICAL DISTIRCT 73.02

Criteria: flora (endemics and presence of certain Canterbury scree species), vegetation, topography (steep), geology, climate (humid).

TOPOGRAPHY: highly dissected, steep, eroding Eyre Mountains, hills, narrow valley floors; altitudinal range 600 to 2025m a.s.l. (Jane Pk).

GEOLOGY: mostly Paleozoic Haast Schists with younger partly schistose greywacke, breccia, tuff etc. in the W (Caples Group) and local ultramafic outcrop near Mossburn.

CLIMATE: cool, moderately wet, temperate; rainfall 800-2400mm p.a.; NW and SW winds; snow may lie for weeks above 1000m in winter.

SOILS: mainly strongly leached stony steepland soils from schist and greywacke; in the SW steepland soils from more basic rocks; many areas of bare screes; limited areas of shallow, stony soils on terraces in the S with alluvial soils, some with poor drainage (gleyed) on river flats.

VEGETATION: originally mainly beech forest; now mainly tussockland including fescue and red tussock with manuka in lowlands; Marsippospermum rushland and several snow tussock species in subalpine and alpine zones - Chionochloa macra, C. rigida with scrub including western species: Celmisia verbascifolia, C. semicordata, Chionochloa crassiuscula (and a form resembling C. teretifolia on West Dome); shrubland with patchy beech forest more common in the SW but also remnants (mostly mountain beech and silver beech, also red beech and hybrid black and red beech) in valleys throughout; also mountain toatoa, Podocarpus nivalis; some Empodisma bogs.

FLORA: several endemic alpine species, e.g. Celmisia spedenii (on ultramafics), C. philocremna, C. thomsonii, Aciphylla spedenii, Cheesemania wallii, Ranunculus haastii ssp. pilifera; scree plants also include Stellaria roughii.

BIRDS: Yellow-crowned Parakeet, Yellowhead (in S) and robin present in forest habitats; falcon throughout; Black Stilt have also been reported.

REPTILES: common gecko (Hoplodactylus maculatus) "mini" form reaches its southern limit in this district. The two forms of H. maculatus, which in time will probably be raised to specific status, are widespread in the South Island. The "maxi" form is found throughout but is less common in the higher and drier country along the E side of the Alps; the "mini" form occurs in Marlborough, Canterbury and Otago, along the eastern side of the Alps, where it inhabits screes and outcrops. Green gecko (Leiolopisma chloronoton) present in Gorge Burn.

INSECTS: the only known sighting of the grass moth, Orocrambus cultus Philpott, was at Cecil Peak, L. Wakatipu.

MODIFICATIONS: intensively grazed exotic pastures in the E and S (sheep and cattle), extensive sheep elsewhere; hares, deer, possums widespread.

UPUKERORA ECOLOGICAL DISTRICT 73.03

Criteria: topography (gentle), vegetation (stunted, nutrient starved), geology, poor moraine/outwash soils, climate.

TOPOGRAPHY: low gentle hills and rolling country of low fertility, mostly below 900m a.s.l., crossed by the SW flowing Upukerora, Whitestone and Mararoa Rivers.

GEOLOGY: includes large areas of Pleistocene outwash gravels, moraines and till, smaller areas of very weathered Pliocene gravels and some Tertiary (Landon Series) sediments in the SE.

CLIMATE: cool temperate, rainfall 900-1600mm p.a.

SOILS: mainly very strongly leached, stony, shallow to moderately deep soils with very friable yellowish brown subsoils on moraines and outwash terraces; deeper soils on loess-covered terraces in the S and E and on rolling and hilly land in the E; small areas of heavy textured deep coloured soils (rendzinas) on steep limestone hills in the SE; small areas of alluvial soils, some with poor drainage, on river flats.

VEGETATION/MODIFICATIONS: includes beech forest (mountain beech common, red beech and silver beech also present), widespread in the N, scattered in the S; tussockland (red tussock formerly widespread - Gorge Hill Reserve will be one of last remnants - some fescue but most tussockland converted to pasture; snow tussock on higher slopes); scrub (mostly manuka); also bog pine shrubland e.g. reserved at The Wilderness; Hall's totara and mountain toatoa also present); wetlands common (some extensive raised peat bogs in the W and SW). Much of district grazed, farmland developed in the SW (semiextensive sheep and cattle); deer and hares present in low numbers.

BIRDS: of forested habitats include: Yellow-crowned Parakeet, Yellowhead and robin; falcon widespread; kea at higher elevations; Scaup present on lakes and ponds; Southern Crested Grebe present on L. Thomas; Fernbird and Marsh Crake present in suitable habitats; bittern breed near Manapouri; Black Stilt have been reported near L. Manapouri; Black-billed Gull breed on the Whitestone, Mararoa and Waiau Rivers; Black-fronted Tern sometimes breed on Whitestone R.; Pied Stilt and Banded Dotterel breed on the Whitesonte and Mararoa Rivers; Black-fronted Dotterel occur on the lower Mararoa R.

REPTILES: jewelled gecko (Heteropholis gemmeus) has been found at Te Anau. Green skink (Leiolopisma chloronoton) occurs at various sites on the E side of L. Te Anau.

NOKOMAI ECOLOGICAL DISTRICT 74.01

Criteria: climate (receives SW rain), topography (gentle, less dissected, lower altitude than Eyre), vegetation (lacks extensive upland bogs and very wet tall tussocklands of Umbrella), flora (E limit of Fiordland-centred species).

TOPOGRAPHY: broad plateaux and hills, the south-facing end of the Garvie Mountains and associated ranges and uplands, ranging from less than 600m to 1500m a.s.l.

GEOLOGY: complex: from N to S, a transition from Upper Paleozoic Haast Schist with meta volcanics and marble to Lower Mesozoic volcanic greywackes and back again into Upper Paleozoic volcanogenic sediments of the Lintley Range with its basic plutonic intrusive complex; minor Tertiary and Quaternary sediments.

CLIMATE: cool temperate, rainfall 800-1200mm p.a. NW and SW winds prevail; snow may lie above 800m for weeks in winter after S-SW blizzard conditions.

SOILS: mainly strongly leached shallow to moderately deep hill and steepland soils from schist and greywacke; deeper soils from loess on terrace and rolling land with compact, pale-coloured subsoils and poor winter drainage; small areas of well drained alluvial soils on river flats.

VEGETATION/MODIFICATIONS: mostly modified lowland short tussockland on foothills, some red tussock and subalpine to alpine tall tussockland (Chionochloa rigida and mixed scrub, C. macra, sparse C. crassiuscula at eastern limit) and induced herbfields of Celmisia semicordata and other western species e.g. Marsippospermum, Celmisia hectori, C. verbascifolia and Aciphylla pinnatifida; valley beech forests in the S an E (mountain beech, red beech and silver beech plus hybrids; some Hall's totara, mountain toatoa, Podocarpus nivalis). Grazed throughout (extensive and semi-extensive sheep and cattle); some exotic pastures reverting to manuka.

BIRDS: forested areas in the Waikaia catchment contain Yellow-crowned Parakeet, Yellowhead and robin (isolated between those in the FIORD E.R. and OTAGO COAST E.R., robin not known from Tahakopa E.D.); falcon present in low numbers.

REPTILES: green skink (Leiolopisma chloronoton) near Nokomai.

UMBRELLA ECOLOGICAL DISTRICT 74.02

Criteria: vegetation (red tussock), soils, topography, geology, climate (moist), flora (south eastern limit), fauna.

TOPOGRAPHY: block-faulted landscape with extensive upland plateaux, the southern continuation of the Old Man Range, with low - to mid-altitude rolling foothill country. Minor glaciation has occurred on the Whitecoomb Range (above 1300 m). Drainage patterns are largely superimposed, some structural (along faults) in places incised. Altitude varies from c. 65 m (Clutha Valley) to 1455 m (Mt Whitecoomb).

GEOLOGY: mainly Paleozoic Haast Schist with minor Quaternary sediments.

CLIMATE: cool temperate; annual rainfall 500-1500mm, frequent fogs; NW and SW winds prevail; snow may lie above 1000m for weeks in winter, patches commonly remain until December.

SOILS: mainly hill and steepland soils from schist with variable cover of loess, thickness dependent on slope: in drier areas of the E soils droughty, weakly to moderately leached with pale-coloured compact subsoils on low terraces; with increasing rainfall a gradation through deep soils from loess on terraces with mottled subsoils and poor winter drainage to moderately to strongly leached soils with yellowish brown friable subsoils and more even moisture conditions, to strongly and very strongly leached steepland soils from schist at higher elevations; some of these soils podzolised. Poorly drained peaty soils on rolling crests of ranges; small areas of alluvial soils on river flats.

VEGETATION/MODIFICATIONS: consists mostly of modified lowland tussockland and poorly drained upland, subalpine to alpine tussockland (red tussock once extensive in the E and S, some short tussock, large areas of exotic pasture; in alpine zone Chionochloa rigida, C. macra); snowbanks; mixed scrub; extensive bogs; some small remnant stands of silver beech in the E, more widespread on the western and southern slopes of Umbrella Mountains (mountain beech, silver beech, some red beech) some remnants of lowland mixed shrubland. District mostly grazed (extensive and semi-extensive sheep and cattle); hares occur throughout in moderate numbers.

FLORA: southeastern limit for many alpine species. Florisitic affinities appear closer to Garvie Mountains than to the Old Man Range.

BIRDS: forest in the Waikaia R. catchment and on the western and southern slopes of the Umbrella Range still supports a diversity of forest species including: Yellow-crowned Parakeet and Yellowhead (Waikaia S.F. and Leithen Bush); robin (isolated between those in the FIORD E.R. and OTAGO COAST E.R., robin not known from Tahakopa E.D.); falcon widespread (in very low numbers); kea present at Gem Lake (eastern record; breeding not confirmed).

REPTILES: green skink (Leiolopisma chloronoton) at Dusky Forest on the Pomohaka R.

INVERTEBRATE FAUNA: abundant, diverse, affinities with Garvie Mountains and Old Man Range.

CRUSTACEA: aquatic habitats (particularly above 1300m) largely unmodified; one species of copepod has apparently unique features.

SNAILS: several colonies of the land snail Powelliphanta spedenii ssp. spedenii.

GORE ECOLOGICAL DISTRICT 75.01

Criteria: topography (low rolling country and plains), soils, vegetation (formerly mainly red tussockland, no beech forest, relic patches of podocarp dominated forest), geology.

TOPOGRAPHY: this large irregular shaped district covers the plains and downlands of inland Southland.

GEOLOGY: occupies part of the Southland syncline; rocks include Mesozoic (and Paleozoic in the E) sediments related to the syncline and underlying the northern slopes of the Hokonui Hills, and Tertiary and Quaternary sediments forming the plains. Areas in the W and centre consist of the Oreti, Mataura, Waikaka and Waimea flood plains: dissected loess-capped higher terraces underlain by either Tertiary quartzose conglomerates, sandstone, mudstone, lignite and small areas of limestone, or Permian to Mesozoic greywacke; mudstone and limestone in the E is largely mantled by loess or terrace gravel deposits.

CLIMATE: humid-subhumid with dry summers and cold winters; rainfall 650-950mm p.a.

SOILS: on higher terraces and rolling land soils have compact, pale-coloured mottled subsoils and generally poor winter drainage; those in lower rainfall areas droughty in dry summers; on low terraces, associated shallow and stony soils droughty in summer; on river flats fertile alluvial soils, some with poor drainage (gleyed); in higher rainfall hill country limited areas of yellowish brown silty soils with good drainage.

VEGETATION/MODIFICATIONS: formerly mostly red tussockland (areas of snow tussock x red tussock hybrids) with localised podocarp and podocarp-hardwood forest. Now extensive, highly modified red tussocklands on rolling low country around Clinton; small less-modified remnants near Pukerau, associated with retarded drainage; swamps; Empodisma bogs in the E; on drier country short-tussock, matagouri; small remnants of podocarp hardwood forest (kahikatea, rimu, matai, rata) on hills near Clinton, and of podocarp-dominated forest (kahikatea, matai, totara) on alluvial soils near Clinton and N of Tapanui. District mostly farmed (semi-intensive sheep and cattle); some exotic forest plantations.

BIRDS: most of district highly modified for farming. (Yellow-crowned?) Parakeet have been observed in forest remnants on the Pomohaka R.; falcon have been reported; Fernbird and Marsh Crake occur at scattered sites (mostly along the larger rivers such as the Mataura, Pomohaka and Oreti); Caspian Tern and Black-fronted Tern present along major rivers; Pied Stilt breed on the Mataura R.; Black Stilt have been reported; S.I.Pied Oystarcatcher and Spur-winged Plover widely distributed, breed throughout.

REPTILES: green skink (Leiolopisma chloronoton) present on foothills of Hokonui Hills.

FISH: include giant kokopu (Galaxias argenteus).

TAKITIMU ECOLOGICAL DISTRICT 76.01

Criteria: topography (steep, eroding), geology (volcanics), vegetation (silver beech), flora (many western species), climate (moist).

TOPOGRAPHY: an isolated block of generally steep eroded mountains reaching 1694m a.s.l. (Brunel Peaks).

GEOLOGY: mountains of Permian Takitimu volcanics fringed by Mesozoic sediments in the E and Tertiary and Quaternary sediments in the W. Present bouldery screes on mountain sides are natural phenomena but all fine screes and gully erosion induced, chiefly by fire and subsequent over-grazing.

CLIMATE: cool temperate, moist; rainfall 1000-1400mm p.a.; mountains subject to wind erosion.

SOILS: on steep slopes of Takitimu Mountains strongly leached stony steepland soils: soils at higher altitudes have peaty topsoils, bare screes patchy to extensive; at lower altitudes on the SE flanks of mountains weakly to moderately leached shallow to moderately deep soils from basic volcanics and tuffaceous greywacke; hill soils from calcareous sediments, weakly to moderately leached with firm to friable yellowish brown subsoils; more strongly leached soils develop on non-calcareous sedimentary rocks; strongly leached deep, well drained soils from loess and alluvium on high terraces; moderately deep friable soils on low terraces from silty over gravelly alluvium; well drained silty and sandy alluvial soils on river flats.

VEGETATION/FLORA: includes variable sized patches of beech forest (mostly silver beech, rare red beech, mountain beech and hybrid beech); small isolated groves of broadleaf; sparse conifers (mountain toatoa, Hall's totara, Podocarpus nivalis, Dacrydium bidwillii). Where forest has been destroyed an alpine zone of transition occurs between Fiordland and rainshadow tussockland: extensive tussocklands (red tussock and short tussock) including Chionochloa macra, C. rigida (sparse), C. crassiuscula and Chionochloa teretifolia (an alpine snow tussock common in southern Fiordland) at its eastern limit; Marsippospermum rushlands; other western species include Olearia colensoi, Celmisia semicordata, C. traversii, C. walkeri, C. hectori, Dracophyllum menziesii in subalpine scrub; some other plant species widespread in Fiordland reach their eastern limits here, e.g. Euphrasia integrifolia.

BIRDS: (Yellow-crowned?) Parakeet and Yellowhead have been recorded from forest remnants in the N; falcon widespread; Marsh Crake and Fernbird present in the W along the Waiau R.; Scaup occur on ponds and lakes and on Redcliff Wetland Reserve, where Grey Teal, Grey Duck, Paradise Shelduck and Canada Goose are also present. Paradise Shelduck moult and flock at Redcliff in high numbers (up to 3600). S.I. Pied Oystercatcher and Spur-winged Plover breed on the riverbeds and open country.

INSECTS: include a dark form of weta Deinacrida connectans on range.

MODIFICATIONS: much of lower part of district grazed (intensive or extensive); several exotic forest plantations.

TARINGATURA ECOLOGICAL DISTRICT 76.02

Criteria: topography (gentle, hilly), geology.

TOPOGRAPHY: the low rolling Wairaki and Taringatura Hills lying either side of the Aparima River. Wide flat valleys with swamps mark the courses of rivers and major streams.

GEOLOGY: the hills are Mesozoic volcanic greywackes related to the Southland Syncline and the main valleys are mostly occupied by Quarternary outwash gravels although some have small areas of Tertiary sediments within them. Coal measures form the base of the Tertiary sequence N of the Aparima River towards Mt Hamilton and a limestone outlier lies in a shallow depression which separates the North Range from the Taringatura Hills.

CLIMATE: cool temperate, humid to subhumid, droughty summers; rainfall 800-1000mm p.a.

SOILS: in lower rainfall areas soils from deep to moderately deep loess on terrace, rolling and hilly land, strongly leached with compact, pale-coloured subsoils, those on easier slopes with poor winter drainage, some soils droughty in summer; deep loess soils in higher rainfall areas, well drained with friable yellowish brown subsoils; weakly leached soils with dark brown firm subsoils from basic volcanic rocks in the SE; at higher altitudes soils strongly leached; on low terraces very friable strongly leached loam soils; alluvial soils, some with poor drainage (gleyed) on river flats.

VEGETATION: formerly much red tussockland, also short tussock, fern, manuka; some remnants of podocarp-hardwood forest in hills with small isolated stands of pure broadleaf; silver beech in the eastern foothills of the Takitimu Mountains; poor drainage in many basins leads to swamp and peat formation.

BIRDS: (Yellow-crowned?) Parakeet have been reported from forest remnants; Black-fronted Tern breed on the riverbeds and winter adjacent to the Aparima R.; Black-billed Gulls breed on the riverbeds.

REPTILES: green skink (Leiolopisma chloronoton) near Mossburn.

MODIFICATIONS: parts intensively developed for exotic pasture (sheep and cattle).

HOKONUI ECOLOGICAL DISTRICT 76.03

Criteria: topography, geology, climate.

TOPOGRAPHY: the rolling Hokonui Hills, some scarp faced, reaching 757m a.s.l.

GEOLOGY: part of the Southland Syncline of Mesozoic volcanic greywackes.

CLIMATE: cool temperate, humid to sub-humid; rainfall 800-1200mm p.a.

SOILS: on rolling downlands in the E under moderate rainfall soils from deep to moderately deep loess, moderately leached with pale-coloured compact subsoils, poor winter drainage; in the W strongly to very strongly leached well drained soils on rolling and hilly land with yellowish friable to firm subsoils; some soils at higher altitudes podzolised.

VEGETATION/MODIFICATIONS: formerly mostly podocarp-hardwood and podocarp forest in the S and E, and red tussockland in the northern and western uplands. Remaining forest includes kahikatea, matai, rimu, miro, rata, kamahi; silver beech pockets in the W; elsewhere forest replaced by extensive red tussock, some short tussock, mixed scrub, manuka, and now exotic pasture. Some Chionochloa rigida snow tussock on highest eastern hills, with red tussock; some Empodisma bogs. Much of district grazed (semi-extensive sheep and cattle .

BIRDS: Fernbird and falcon present; Yellow-crowned Parakeet have been recorded in the Dunsdale catchment.

REPTILES: green skink (Leiolopisma chloronoton) present in Hokonui Hills; record of Otago skink Leiolopisma otagense form otagense) from eastern end of Hokonui Hills.

WAITUTU ECOLOGICAL DISTRICT 77.01

Criteria: topography, vegetation (includes lowland terrace podocarp forest) geology, soils, climate

TOPOGRAPHY/GEOLOGY: an irregular lowland basin comprising terraces of Pleistocene marine, glacial outwash and alluvial origin, with Eocene feldspathic conglomerate, sandstone and mudstone hills including the rugged, glaciated Hump Ridge rising to 1067m a.s.l.; a series of marine terraces rises in steps from the cliffed south coast to 400m a.s.l.; alluvial terraces flank rivers; gravelly beaches on tidal platforms; some small sand dunes; no evidence of extensive glaciation.

CLIMATE: moist, cool; rainfall gradient W-E, higher on Hump Ridge, 1200-4000mm p.a.

SOILS: strongly leached to podzolised soils from sedimentary rocks on rolling and hilly land; podzols, some with poor drainage on river and marine terraces, from loess and river outwash gravels; blanket peats on crests of ranges; alluvial soils in valleys.

VEGETATION: a mosaic of forests: podocarp dominant forests on low altitude marine terraces near coast (rimu dominant, also miro, Hall's totara, yellow-silver pine, kahikatea; rata important locally); mixed beech-podocarp forests on low and mid-altitude, flat or rolling country away from coast (from almost pure tall silver beech on alluvial flood plains, to almost pure mountain beech on poorly drained sites; rimu in varying amounts, kahikatea on some wet terraces; miro and Hall's totara scattered); beech forests (mostly silver beech or mountain beech dominant) on steep and high altitude country above about 450m; tree line about 900m; extensive heath-forest and scrub on podzols in the W; herb communities on exposed rocks, cliff tops, coastal fans, terraces; scrub on headlands, mudstone cliffs, seaward edge of forest along coast; sand-dune communities with abundant pingao; hardwoods (e.g. southern rata, kamahi, broadleaf) dominate forests near coast.

FLORA: rare plants include pingao, Crassula acutifolia, Ourisia modesta, Tetrachondra hamiltonii, Ranunculus ternatifolius, Abrotanella filiformis; endemiss of The Hump include Pimelea crosby-smithiana. Mistletoes abundant (no possums): Peraxilla (Elytranthe) colensoi, P. tetrapetala, Alepsis (Elytranthe) flavida and Ileostylus (Loranthus) micranthus.

BIRDS: the extensive, relatively unmodified forests support a diverse and abundant avifauna. Forest birds of note include: kaka (abundant), Yellowand Red-crowned Parakeets (rare), Yellowhead and robin; falcon (southern race) widespread; kea present above tree line. Brown Kiwi, weka and Blue Duck, although common further N in Fiordland, appear to be absent. Scaup present on L. Hauroko; significant breeding colonies of Black and Pied Shag on the Waitutu and Wairaurahiri Rivers; Fiordland Crested Penguin and Southern Blue Penguin breed along the coast.
FISH: up to 8 species in a single catchment, including giant kokopu (Galaxias argenteus) and short-jawed kokopu (G. postvectis) the latter an apparently isolated southern population.

INSECTS: high level of invertebrate endemism. The Hump is type locality for 21 species of beetles, about 10 species of moths; other insects include several with very restricted distribution, e.g. the large flightless stag

beetle, Dorcus philpotti, several ground beetles including Mecodema femorale and Taenarthrus philpotti. The stag beetle Dorcus helmsii and large weevil Rhynchodes sp. occur in the district.

SNAILS: district important for land snail fauna because not glaciated; so far poorly sampled but 30 species currently known.

MODIFICATIONS: introduced mammals include stoats, ship rat (probably Norway rat and kiore), red deer, pig; possums absent; some areas apparently free of herbivorous mammals.

TUATAPERE ECOLOGICAL DISTRICT 77.02

Criteria: geology, topography, vegetation, climate.

TOPOGRAPHY/GEOLOGY: low hills of Tertiary sediments and poorly drained terraces of Quaternary outwash gravels with a straight, cliffed coastline; maximum altitude 778m a.s.l. Tertiary rocks comprise mainly soft to moderately indurated sands, silts and muds. Limestone beds form conspicuous light-coloured bluffs at Helmet and Goldie Hills.

CLIMATE: moist, cool temperate and windy; rainfall ranges from 1000mm p.a.to 4800mm in the western hills.

SOILS: mainly moderately to very strongly leached and podzolised soils with yellowish brown firm clayey subsoils; well developed podzols with pale subsurface horizons and iron/humus pans in higher rainfall areas; podzolised soils with poor drainage (gleyed) on marine terraces; on low terraces strongly leached well drained soils with friable subsoils; alluvial soils (some gleyed) on river flats.

VEGETATION/MODIFICATIONS: formerly mostly forested: podocarp/hardwood and beech forests - matai and kahikatea dominate on alluvial soils and glacial outwash terraces, silver beech, mountain beech, red beech and hybrid beech on poorer soils and hills (unusual "reversed patterns" between podocarpssilver beech-mountain beech); rimu, miro, Hall's totara also occur; hardwoods include broadleaf, pokaka, lemonwood, lancewood, fuchsia, wineberry, marbleleaf, mapou, etc. Some lowland red tussockland and manuka occur in the NE. Today forest mostly restricted to the hills and modified by logging, deer and possums; lowlands cleared for farming (dairying and semi-intensive sheep and cattle).

BIRDS: falcon, Yellow-crowned Parakeet, Yellowhead (Rowallan SF) and robin are known from the forests in the W of this district. S.I. Pied Oystercatcher and Spur-winged Plover breed along the riverbeds and on the open country.

LONGWOOD ECOLOGICAL DISTRICT 77.03

Criteria: topography, soils, climate, vegetation, geology, flora (western connections).

TOPOGRAPHY: hilly to steep country reaching 804m a.s.l. (the Longwood Range, Woodlaw Hills), surrounding plains with an indented, mainly rocky (partially cliffed) coastline; also includes a large estuary and extensive higher level wetlands on old marine terraces.

GEOLOGY: the hills to the E comprise Permian-Carboniferous intrusive rocks and volcanics, margined by Tertiary and Quaternary sediments and the main range to the W, a basic plutonic intrusive complex.

CLIMATE: moist, windy, cool-temperate; rainfall 1000-1600mm p.a.

SOILS: mainly strongly leached to podzolised soils and podzols on flattish, rolling and hilly land from variable thickness of loess over a range of rocks: soils under moderate rainfalls moderately to strongly leached with yellowish brown friable to firm subsoils; generally drainage is good but soils in the N, around Ohai on flattish to rolling land have impeded drainage. With increased altitude and rainfall soils show podzol features such as bleached subsurface horizon and iron/humus pans; soils on easier slopes have poor drainage (gleyed); small areas of poorly drained alluvial soils, notable around Lake George.

VEGETATION/FLORA: the Longwood range is forested: mainly residual beech-podocarp-hardwood forest: silver beech (rare mountain beech) with small areas of abundant podocarps (mostly rimu, miro, Hall's totara, mountain toatoa, pink pine) with supplejack, pokaka, rata and kamahi on the lower slopes; upland silver beech forest at higher altitudes; seral manuka; some areas of wet tussock uplands on the summit ridge of the range - Empodisma bogs, red tussock, Chionochloa teretifolia, C. crassiuscula, Celmisia coriacea.

BIRDS: good forest on the Longwood Range still supports Yellow-crowned Parakeet and Yellowhead; Fernbird and Marsh Crake also present. Red-billed Gull colony at Riverton estuary; Black-billed gulls congregate on Riverton Estuary in autumn; high numbers of pukeko in wet areas; western limit of Stewart Island Shag.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: lower parts of district farmed - swampy pastures (semi-intensive sheep and cattle, with dairying near Riverton); exotic forest plantations in the N and E.

SOUTHLAND PLAINS ECOLOGICAL DISTRICT 78.01

Criteria: topography, soils, vegetation, geology.

TOPOGRAPHY/GEOLOGY: large district comprising most of the outer flat lowland Southland Plains and rolling downlands all below 300m a.s.l., with extensive wetlands; mostly on Quaternary sediments underlain by Tertiary sediments including extensive lignite deposits and limestone in the vicinity of Forest Hill; a sandy coastline.

CLIMATE: moist cool temperate, with cloudy, windy conditions and frequent showers near the coast; rainfall 800-1200mm p.a.

SOILS: from deep loess on higher terraces and rolling land in higher rainfall areas of the E and S have yellowish brown friable to firm silty subsoils and good drainage; soils in slightly lower rainfall areas in the N, have poor drainage, more compact subsoils with clayey textures; soils on lower terraces are well drained, moderately deep over gravels; fertile silty to sandy alluvial soils on river flats, drainage ranging from good to poor (gleyed); minor areas of peaty soils in swamps; sandy soils on coastal dunes and sand plains; dark-coloured, heavy textured soils (rendzinas) on limestone hills E of Winton.

VEGETATION: includes lowland red tussockland, swamps (manuka/flax/Carex secta/toetoe; kahikatea/pokaka hardwood swamp forest) and some pockets of podocarp-hardwood forest (totara dominant) - all on alluvial lowlands; kahikatea-matai/hardwood forest and rata/kamahi forest with pokaka and supplejack on limestone hills; kahikatea, miro, rimu (with less frequent matai, Hall's totara, mountain toatoa (rare))/kamahi forest on southern and eastern wetter soils; seral manuka; salt marshes; sand dunes.

FLORA: rare plants include Crassula acutifolia recorded at Winton.

BIRDS: highly modified for farming. Fernbird and Marsh Crake present in the New River estuary, Marsh Crake also on the Oreti R; Banded Dotterel breed on gravelled beds in tree nurseries on the Edendale plain and Black-fronted Dotterel breed on the Aparima and Oreti Rivers; large colonies of Black-billed Gull (up to 25,000 per colony) breed on the main rivers and moult at river mouths; Pukeko are present on wet areas in high numbers (e.g. flocks of 300+); a few New Zealand Dotterel winter on Oreti Beach; S.I. Pied Oystercatcher and Spur-winged Plover breed throughout.

REPTILES: green geckos (Heteropholis sp.) have been found on Bluff Hill.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: today district mostly farmed (dairying with sheep and cattle for finishing and some cropping); wetlands drained for pasture; some, generally small exotic forest plantations in the N and S.; includes Invercargill city. Small remnants of indigenous forest, swamps and red tussock remain.

WAITUNA ECOLOGICAL DISTRICT 78.02

Criteria: topography, (swampy) soils, vegetation, climate.

TOPOGRAPHY/GEOLOGY: small flat district of extensive wetlands and spit-bound lagoons and harbours, on Quaternary sediments underlain by extensive Tertiary lignite deposits; a smooth and sandy or gravelly coastline.

CLIMATE: moist cool temperate, with cloudy, windy conditions and frequent showers; rainfall 1000-1200mm p.a.

SOILS: large area of poorly drained deep acid peats with strongly leached to podzolised soils on surrounding undulating, rolling and hilly land from loess and sands; some soils have impeded drainage; areas of sand soils, some with poor drainage, on coastal dunes and flats; alluvial soils, generally poorly drained border the Mataura River.

VEGETATION: mostly peat swamps, seral manuka and flax, red tussock, cushion bogs and stunted lowland forest remnants - podocarp-hardwood (kamahi) forest; extensive salt marshes fringe the bays and lagoons; sand dune vegetation.

BIRDS: only small remnant areas of forest are left in this district; no forest birds of note remain (although species such as Brown Creeper and Yellow-breasted Tit are still present); falcon rare; Fernbird widespread in swampland habitats near the coast, common in places; Scaup are rare. The major estuaries and lagoons (New River, Awarua Bay, Waituna Lagoon, Fortrose) and their surrounding marshlands are valuable sites for wetland species, shore birds and waders. The marshland contains a variety of species including: Marsh Crake, Spotless Crake (southernmost locality in N.Z.), Fernbird and bittern, and very significant populations of these species are at Waituna Lagoon. Numbers of migrant waders visit the estuaries including some that are rare elsewhere in N.Z. Some of these (e.g. Far-eastern Curlew and Golden Plover) are also found on the peat bog bordering Waituna Lagoon. A Caspian Tern colony breeds on New River Estuary; White-fronted Tern breed on Awarua Bay and the New River and Fortose Estuaries; large colonies of Black-backed Gull breed on peat bogs and salt marshes; Grey Teal, Grey Duck, Paradise Shelduck and Canada Goose are present; New Zealand Dotterel are found on Awarua Bay in autumn and winter.

REPTILES: green skink (Leiolopisma chloronoton) present along coast.

FISH: include giant kokopu (Galaxias argenteus).

MODIFICATIONS: about half the area has been drained and developed to pasture.

FOVEAUX ECOLOGICAL DISTRICT 79.01

Criteria: climate, vegetation, fauna, landforms and geology.

TOPOGRAPHY: small islands and headlands generally of low relief, all below 300m a.s.l., scattered in a broad, open strait; much of the land area planed to between 40 and 70m a.s.l., but with abrupt rocky coastlines; some bouldery, shingly and sandy beaches, lagoons, very small streams.

GEOLOGY: Paleozoic Bluff complex and Anglem complex ultrabasic, basic and intermediate intrusives.

CLIMATE: extremely oceanic, cool temperate, humid, frequently cloudy; windy, prevailing W and SW winds; rainfall approx. 1000-1600mm p.a. evenly spread; only intermittent, light winter snowfalls, light frosts.

SOILS: mainly strongly leached acid and infertile podzolised soils from a range of intrusive and sedimentary rocks and coastal sands; topsoils tend to be peaty and iron-cemented pans present in subsoils.

VEGETATION: chiefly coastal scrub and low forest with woody composites (Olearia spp., Senecio spp.) predominant and Myrsine chathamica and M. australis locally important; transitions inland into taller podocarp-hardwood forest (rimu, miro, southern rata, kamahi) on larger islands; kahikatea common on Ruapuke Island. Distinctive coastal associations of turf (Selliera, Samolus, Plantago, Cotula, Gentians saxosa), grassland (Poa astonii) and rock crevice plants (Anisotome lyallii, Asplenium obtusatum, Myosotis rakiura, Disphyma australe).Induced scrub of Coprosma repens and Hebe elliptica on some islands; induced extensive heath, rough pasture, rushland on Ruapuke, Dog and Centre Islands and on Omaui-Bluff coast.

FLORA: species composition of scrub and low forest differs from island to island; Senecio stewartiae occurs on some islands (elsewhere only in Solanders and Snares districts); Stilbocarpa lyallii also endemic to RAKIURA. Olearia oporina common. Southern species at or near northern limit include Asplenium scleroprium, Poa foliosa, P. poppelwellii, Olearia lyallii and Urtica australis (also in Chathams district). Pittosporum eugenioides reaches its southern limit on Bluff Hill, and Urtica ferox on Bench Island. Lepidium oleraceum (Cook's scurvy grass) persists on islands unmodified by browsing mammals.

MAMMALS: fur seals breed on Ruapuke I. and Green I.; dolphins common; whales sometimes sighted.

BIRDS: land birds of note on the islands in this district are kaka, parakeets (both Red- and Yellow-crowned on Ruapuke I, and islands closer to Stewart Island), robin and Stewart Island Weka. S.I. Saddleback have been re-introduced to some islands. Important breeding locality for many seabirds and large populations of penguins, petrels, shags and other seabirds occur on most islands including: N.Z. White-faced Storm Petrel, Broad-billed and Fairy Prion, Mottled Petrel, Sooty Shearwater, N.Z. Diving Petrel, Stewart Island Shag and Blue Shag; Yellow-eyed Penguin breed sparsely along Bluff coast.

REPTILES: green geckos (Heteropholis sp.) have been found on some of the islands in Foveaux Strait (southern limit for the genus Heteropholis). Forest gecko (Hoplodactylus granulatus) common on some islands, those

in the Rakiura region are quite distinct from mainland animals. Green skink (Leiolopisma chloronoton) present.

INSECTS: weta Deinacrida carinata occurs on Herekopare Island. The Stilbocarpa weevil, Hadramphus stilbocarpae Kuschel, occurs on small rat-free islands in Foveaux Strait.

MODIFICATIONS: vegetation modified by large populations of sea birds and sea mammals; partly modified by many centuries of muttonbirding; extremely modified locally (Ruapuke, Dog and Centre Islands, and between Omaui and Ocean Beach) by burning and grazing. Introduced mammals include sheep, cattle, wild horses.

To the north lie the largely modified southern extremities of the South Island (Longwood, Southland Plains, Waituna, Mataur); to the south the lightly modified northern parts of Stewart Island (Anglem).

ANGLEM ECOLOGICAL DISTRICT 79.02

Criteria: climate, vegetation, geology, landform and soils.

TOPOGRAPHY: thickly forested hills of pronounced relief from sea level to lightly glaciated cirques near scrubline in the summit area of Mt Anglem (980m a.s.l.), a few prominent rock outcrops, a few small lakes, many permanent streams. Coastline to the E and S relatively sheltered: a drowned valley system of long inlets, tidal flats, beaches and rocky headlands; to the exposed W and NW the land is eroded to much steeper, higher, less indented coasts.

GEOLOGY: Paleozoic, Anglem complex, ultrabasic, basic and intermediate intrusives. Small areas of alluvium on valley floors.

CLIMATE: oceanic, cool temperate, humid, frequently cloudy; windy, exposed on W to prevailing W and SW winds; rainfall 1600-4000mm p.a. evenly spread; intermittent snow-lie on tops, light frosts on coasts, heavier inland.

SOILS: predominantly acid and infertile podzolised yellow-brown earths and podzols from diorite with thick dark coloured humus-rich topsoils and iron-rich B horizons; with increasing altitude, above 350m, these grade through transitional soils with thick peaty topsoils and weakly developed subsoil iron pans to subalpine blanket peats with weakly differentiated peat up to 1.5m thick, in weakly dissected uplands above 450m; moderate areas of soils from coastal sands ranging from raw sands near coast through yellowish brown soils to limited areas of podzolised sands and sand podzols further inland; alluvial soils occur on river flats and terraces - those on flats generally well drained with silty to clayey textures, those on terraces have poor drainage with pale grey silty and clayey subsoils.

VEGETATION: predominantly podocarp-hardwood forest lacking beech (rimu/kamahi forest with much southern rata) from sea level to about 400m; in many places a coastal fringe of low forest and scrub with prominent Senecio reinoldii; Olearia oporina also prominent with coastal tussockland, turf and rock vegetation on exposed coasts; small areas of sand dune dominated by pingao but with marram locally common; smaller areas of saltmarsh. Above about 400m extensive scrub dominated by Olearia colensoi and/or Leptospermum scoparium. Above 800m areas of open subalpine vegetation with tussock of Chionochloa flavescens and cushions of Dracophyllum politum dominating grassland and herbfield; rock outcrops support other alpine species.

FLORA: forest, scrub, grassland flora fairly diverse but lacks Nothofagus, Phyllocladus, Libocedrus, Sophora, Pittosporum eugenioides, Melicytus ramiflorus. Endemic species include Gentiana gibbsii, Aciphylla traillii. Species not found in adjacent districts include Archeria traversii, Coprosma pseudocuneata, Cyathodes dealbata, Raoulia grandiflora, R. tenuicaulis, Dracophyllum menziesii. Shares some RAKIURA endemics with Mt Allen district e.g. Chionochloa pungens (maybe in FIORD region also), Celmisia clavata, Abrotanella muscosa, Raoulia goyenii, Bulbinella gibsii var. gibbsii. Yellow-silver pine local; matai occurs locally in valleys. Auckland Island species Schizeilema reniforme present on Mt Anglem; Abrotanella pusilla also present here. RAKIURA region endemic Stilbocarpa lyallii very restricted, rare.

MAMMALS: long -tailed bats are only found round Half Moon Bay on Stewart Island; N.Z. fur seal prominent around coasts.

BIRDS: most of this district is still forested and suports a wide diversity of forest species including: Brown Kiwi (common), weka, kaka, Yellow- and Red-crowned Parakeet, Brown Creeper and robin. There is evidence that the S.I. Kokako may survive in the headwaters of the Freshwater R. Falcon (southern race) uncommon; Fernbird occur in swamp or scrub habitats; Spotless Crake present in Leask Bay. The kiwi, weka, robin and Fernbird are endemic Stewart Island subspecies. Brown Teal were present in Paterson Inlet and near Halfmoon Bay until the early 1970's and may still persist. Yellow-eyed Penguin, Southern Blue Penguin, Stewart Island Shag, and Blue Shag breed along the shore. N.Z. Dotterel occur along the coast and breed on the mountain tops.

REPTILES: population of unusually marked "Leiolopisma nigriplantare" skinks on top of Mt Anglem requires further study.

MODIFICATIONS: locally modified by fire and clearing especially near Halfmoon Bay, more extensively by introduced mammals including whitetail and red deer, possum; cat, black and Norway rat, kiore present; no mice or mustelids.

FRESHWATER ECOLOGICAL DISTRICT 79.03

Criteria: landform, soils, geology, vegetation and climate.

TOPOGRAPHY: low-lying country, gradually sloping down from the W where islands and low hills of outcropping schist are bounded by rocky coasts, beaches and sand dunes, blanketed by terraces, steps and gullies on the E. Hollows occupied by swamps, pools, shallow lakes; Freshwater River is the largest stream on Stewart Island; maximum altitude about 280m a.s.l.; includes offshore steep-sided Rugged Island.

GEOLOGY: Paleozoic low-grade quartzo-feldspathic and chlorite schist closely associated with intensely crushed granite, overlain across much of the area by Pleistocene terrace sand and Recent stream alluvium, estuary and swamp deposits and sand.

CLIMATE: cool temperate with marked oceanic influence, humid, frequently cloudy; windy with prevailing W and SW winds; rainfall 2000-2400mm p.a., evenly spread; only light intermittent snowfalls, light to moderate frosts.

SOILS: alluvial soils occur on floodplains and low terraces - those on floodplains have silty and clayey textures, little profile differentiation, and range from well to poorly drained; those on terraces are mainly poorly drained with thick peaty topsoils, silty and clayey textures and iron/humus pans. Soils on rolling and hilly foothills are low fertility, very strongly leached and podzolised soils from granite, diorite and schist; they have deep, dark-coloured humic to peaty topsoils and reddish, iron-rich B horizons; a distinct iron pan often present.

VEGETATION: extensive mosaic of heath-like manuka/wire-rush shrublands, manuka scrub and swamps (with Baumea, Lepidosperma and Leptocarpus), small lakes and some red tussockland; comparatively small areas of rimu/kamahi forest with much totara, some kahikatea along streams, yellowsilver pine on terraces.

FLORA: district represents barrier to certain upland species endemic to the Anglem and Mt Allen districts respectively. Many species found in latter two districts lacking here; at least 2 in spite of apparently suitable habitat: pygmy pine and Gentiana lineata. Some species occur here but not elsewhere in Region e.g. Lindsaea linearis, Mecodium atrovirens, Pennantia corymbosa. Numerous Thelmytra spp. orchids and Herpolirion novae-zelandiae. Acquatic flora of lakes is depauperate.

BIRDS: large areas of this district are still forested and support a wide diversity of forest species including: Brown Kiwi, weka, kaka (now uncommon), Yellow- and Red-crowned Parakeets, Brown Creeper and robin; Fernbird occur in swamp or scrub habitats. The kiwi, weka, robin and fernbird are endemic Stewart Island subspecies. Banded Dotterel breed on beaches in the W.

MODIFICATIONS: forest reduced by European and probably some Polynesian burning; introduced mammals include whitetail deer, red deer, possum, cat, three species of rat.

MT ALLEN ECOLOGICAL DISTRICT 79.04

Criteria: climate, vegetation, geology, soils, fauna.

TOPOGRAPHY: dissected hill country, diverse coasts and islands, of marked relief, 0-750m a.s.l.; in places granite exposed in exfoliating domes and tors. Some basins, valleys, flats and sand dunes. Trellissed drainage pattern controlled by prominent joints in granite, conspicuous in parts; largest stream (Rakeahua) tidal for several km. Drowned topography characterises the E and SE coasts; W coast mainly strongly cliffed apart from a few prominent beaches e.g. Mason Bay, c.12km long. Small lake basin on the E flank of Mt Allen may be glacial in origin.

GEOLOGY: mainly coarse-grained Paleozoic biotite granite, gneissic in some places; schist occurs along southern flank of Paterson Inlet and on Tin Range with tin- and tungsten-bearing veins.

CLIMATE: cool temperate oceanic, humid, frequently cloudy; exposed coasts and tops subject to very strong winds; rainfall 1600-3200mm p.a., evenly spread; only intermittent snowfalls, persistent snow-lie rare; moderate frosts.

SOILS: at lower altitudes on rolling, hilly and steep slopes acid, infertile podzolised soils from granite, diorite or schist, with thick dark-coloured humic to peaty topsoils and reddish iron-rich subsoils often with distinct iron pans; with increasing altitude these grade through soils with thick peaty topsoils to subalpine blanket peats with up to 1.5m of peat (thinner on steeper slopes); in places skeletal soils with thin sandy topsoils over granite occur. In central areas, on rolling and undulating high country above about 250m, intergrades to subalpine yellow-brown earths occur, with weakly differentiated sandy profiles. Moderate areas of well drained sand soils occur in coastal areas and valleys, ranging from unstable sands near the coast through soils with distinct topsoils and yellowish brown subsoils to sand podzols with bleached subsurface horizons and iron/humus pans. Minor areas of alluvial soils with sandy textures and good drainage occur in valleys; deep peaty soils with poor to very poor drainage occur in low-lying hollows and raised bogs in river valleys.

VEGETATION: original vegetation patterns exist over most of district: rimu/kamahi forest grading into low forest and scrub over extensive areas with yellow silver pine, manuka, leatherwood (Olearia sp.) and pink pine in many places; coastal fringe of low forest and scrub with prominent Senecio reinoldii, Olearia lyallii, O. oporina; some coastal tussockland, turf and rock vegetation; extensive dunes with pingao, marram, scrub and rata forest; heath-like manuka/wire rush shrublands and red tussock in some basins and valley floors. Above 600m open subalpine vegetation with tussocks, Chionochloa "fine" aff. teretifolia, boggy cushion vegetation e.g. Dracophyllum politum, Oreobolus spp. and Carpha alpina prominent. Rock outcrops support other alpine species.

FLORA: fairly diverse forest, scrub and upland flora but notably lacking Nothofagus, Phyllocladus, Libocedrus, Sophora, Pittosporum eugenioides and Melicytus ramiflorus. Several endemics: Aciphylla cartilaginea, A. stannensis, Celmisia polyvena, Chionochloa "fine" aff. teretifolia, Ranunculus viridis, R. stylosus, plus RAKIURA endemics: Stilbocarpa lyallii, Raoulia goyenii, Abrotanella muscosa, Celmisia clavata, Bulbinella gibbsii var. gibbsii, Gingidia flabellata. Southern limit for

many important New Zealand taxa such as rimu, matai, Hall's totara, miro, kamahi, Metrosideros diffusa, supplejack. Only known habitat of Gunnera hamiltonii in Mason Bay. Extremely rich bryophyte and lichen flora.

MAMMALS: N.Z. fur seal common around coast; sea lions and sea leopards rarer. The vulnerable short-tailed bat was formerly on Codfish Island.

BIRDS: large areas of this district are forested or scrub covered and support a wide diversity of forest species including: Brown Kiwi (common), falcon (southern race), weka, Kakapo (less than 25 birds, the only truly wild population surviving that is still breeding), kaka, Yellow- and Red-crowned Parakeets, Brown Creeper and robin; Fernbird occur in swamp or scrub habitats; Banded Rail occur on weka-free islands off the SW coast. South Island Saddleback survive on some of the islands in the Muttonbird group, off the SW of Stewart Island. The kiwi, weka, robin and fernbird are endemic Stewart Island subspecies and there is an endemic subspecies of fernbird on Codfish I. N.Z. Dotterels breed on the open ridge-tops and have been observed on dunes in Masons Bay. This district is an important breeding locality for many seabirds and a wide variety of shore birds. Petrels, penguins and shags breed along the coast and on the smaller islands. Of particular note are: Northern Giant Petrel (on an island in Port Pegasus), South Georgian Diving Petrel (40 pairs on Codfish I., only breeding site in the N.Z. region), Cooks Petrel (100 pairs on Codfish I., elsewhere now breeds only on Little Barrier and Great Barrier Islands), Antarctic Tern (breed on an island in Port Pegasus and on a few of the islands off the SW coast, northern limit). Other species breeding in the district include: Sooty Shearwater (abundant on some islands), Broadbilled and Fairy Prions, N.Z. White-faced Storm Petrel, Yellow-eyed, Southern Blue and Fiordland Crested Penguins, (all 3 penguins breed on Codfish I) Stewart Island and Blue Shag, Reef Heron, White-fronted Tern, and Variable Oystercatcher.

REPTILES: harlequin gecko (Hoplodactylus rakiurae) is known only from the southern part of Stewart Island. Forest gecko (Hoplodactylus granulatus) and green skink (Leiolopisma chloronoton) are common on rat-free islands; common gecko (Hoplodactylus maculatus) has been found on an island in Port Pegasus; and the skink Leiolopisma nigriplantare occurs in low numbers throughout. This is the southern limit for these species and also the genera Hoplodactylus and Leiolopisma. The Hoplodactylus granulatus in the Rakiura region are quite distinct from mainland animals.

INSECTS: the Anthribid beetle, Lichenobius littoralis (Holloway) occurs on Big South Cape Island (and Snares) only; lives amongst crustose lichens on rocks in sea spray zone. Largest N.Z. Anthribid beetle, Cacephatus aucklandicus (Brookes) occurs on Big South Cape I., Big Stage I. (also Snares and Auckland Islands Districts); found from sea level to 200m a.s.l. on dead branches of Olearia lyallii, Carex trifida, Myrsine divaricata, Dacrydium cupressinum, Coprosma lucida, Hebe eliptica and various other native shrubs. The Stilbocarpa weevil, Hadramphus stilbocarpae Kuschel, became extinct on Big South Cape I. following the introduction of Ship Rat; common on some small islands without rats off Big South Cape (also small islands in Foveaux District and on Snares).

MODIFICATIONS some modification by introduced mammals and fires: some species eliminated from wide areas by introduced animals, notably Asplenium bulbiferum and Stilbocarpa lyallii; introduced mammals include whitetail deer, some red deer, opossum, cat and three rat species (mice, mustelids, hares, rabbits, pigs and goats appear to be absent); limited farming abandoned in Rakeahua Valley, continued in Mason Bay area.

SOUNDERS ECOLOGICAL DISTRICT 79.05

Criteria: topography (isolated islands), geology (isolated andesitic volcanism), climate (coastal, very exposed to strong W and SW gales), vegetation (tree daisy scrub and coastal grasslands), fauna (seals, sea lions, sea birds). Animal and plant affinities with both FIORD and RAKIURA; most similar to Snares.

TOPOGRAPHY: two islands, Big Solander and Little Solander, 2 km apart, steep sided with more gentle crests, the larger 1.5 km across, rising to 340m a.s.l.

GEOLOGY: erosional remnant of andesitic volcano.

CLIMATE: coastal climate, very windy from W and SW. Rainfall not measured.

SOILS: saline, coastal peat.

VEGETATION: scrub of Olearia lyallii, Senecio reinoldii, S. stewartiae and Hebe elliptica on crests and faces; grassland of Poa astonii on dry spurs and of Poa foliosa on talus fans.

MAMMALS: several thousand fur seals breed on Big Solander; also sea lions.

BIRDS: few land birds; only Red - crowned Parakeet (both islands) and Banded Rail (Little Solander I.) are of note; weka (introduced) are abundant on Solander I. Important breeding locality for seabirds: small gannet colony (southernmost in world); Southern Buller's Mollymawk 4000-5000 pairs on Solander I. and 300 pairs on Little Solander I; elsewhere breeds only on Snares Islands); Fiordland Crested Penguin; Southern Great Skua; and a variety of petrels (including: Fairy and Broad-billed Prions, N.Z. Diving Petrel, Mottled Petrel, (significant colony of 250,000 plus pairs on Little Solander I.), Mottled Petrel Sotty Shearwater).

REPTILES: no terrestrial reptiles reported.

SNAILS: include one endemic micromollusc.

WORMS: large terrestrial leech (Ornithobdella sp.) known elsewhere only from Snares E.D., are found in association with Bullers Mollymawk on Little Solander I.

SNARES ECOLOGICAL DISTRICT 79.06

Criteria: isolation, endemism, unmodified vegetation.

(Overall the island is of international importance because of its unique ecosystem - an island environment with very few plant species, but a highly endemic fauna. The entire biota has developed in isolation, many species are flightless and very susceptible to environmental disruption. The effects of rats, mice or other vermin, should they be inadvertently introduced, would be disastrous and certain to lead to extinction of some species: birds, insects, worms or plants.)

TOPOGRAPHY/GEOLOGY: a main island of 242.8 ha (North East Island), a small off-lying island (Broughton) and a number of stacks (Western Chain) at latitude $48^{0}5$. Larger islands: steep cliffs, few large boulder beaches, intensive wave action on exposed shores, sloping plateaux cut by shallow valleys. North East and Broughton Islands consist of fairly uniform, somewhat gneissic granite, with mica and muscovite crystals; biotite mica schist occurs on Rua islet, crushed muscovite granite and mica schist on outermost islet, Rima.

CLIMATE: cool, uniform, humid with much cloud and wind: temperature range 5o-18^{0}C summer, to-IOOC winter; frosts few, snow rare, hailstorms common; rainfall evenly distributed, approximately 1200mm p.a.; short dry period late spring - early summer; high percentage rain days, generally light rain, mists and drizzles common; moderate to strong westerly winds common; gales frequent.

SOILS: the climate, proximity to sea and abundance of birds determine the nature of the soil - predominantly strongly to extremely acid peaty soils from a variable thickness of blanket peat, coarse textured and very friable when dry. Some areas of podzolised soils from granite and schist, with deep, dark-coloured peaty topsoils and iron-rich subsoils. Muttonbirds excavate burrows and drag surface litter underground; insects and earthworms burrow through the soil which is mostly aerobic; anaerobic conditions occur in the wet, mucky penguin colonies.

VEGETATION/FLORA: unmodified: consists mostly of 3-5m canopy Olearia lyalli forest with Senecio stewartiae on margins in the E and Hebe elliptica patches on abandoned penguin colonies and slopes; understory of ferns (mainly Polystichum vestitum), the endemic punui (Stilbocarpa robusta) (also on Little Solander Is.) and sparse grasses (Poa tennantiana); open tussockland (Poa tennantiana and P. astonii) dominate exposed cliff tops; endemic Anisotome acutifolia occurs at 5 (2 major) cliff top sites; islets of Western Chain devoid- of vegetation except grassland on Rua. Only 22 higher plant species.

MAMMALS: New Zealand fur seals (up to 1200 in 1970) breed on boulder beaches and ledges adjacent to deep water; elephant seals and Hookers sea lions are regular visitors (a few of the latter breed, one or two pups per year).

BIRDS: the most important indigenous land birds are the endemic subspecies of tit, fernbird and snipe, all of which are common. A small number of Grey Duck breed and one of the most abundant land birds is Silvereye. Fantail have very recently colonised the island and are now abundant. Other land birds recorded (but probably not breeding here) are Red-crowned Parakeet, Tui, Grey Warbler, silvereye and Welcome Swallow. The Snares Islands are an important breeding locality for pelagic seabirds, the most significant of which are the Sooty Shearwater (C. 2.75 million pairs), the endemic Snares Crested Penguin (c. 21,000 pairs), and Southern Buller's Mollymawk (c. 1,200 pairs, elsewhere breeds only on the Solander Islands). Numerous other seabirds breed there including: Antarctic Tern, Southern Great Skua, Mottled Petrel (major breeding colony for this species), Broadbilled and Fairy Prions Fulmar Prion (only on Western Chain), N.Z. Diving Petrel, Snares Cape Pigeon (major colony, other small colonies at Antipodes, Bounty, Auckland and Campbell Islands), and some Salvin's Mollymawk (only on Western Chain, elsewhere breeds only on the Bounty Islands).

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

INSECTS: a diverse fauna; high proportion of some groups endemic, including two wetas, Zelandosandrus subantarcticus (burrowing) and Insulanoplectron spinosum (jumping). The Anthribid beetle, Lichenobius littoralis (Holloway) occurs here (and on Big South Cape I.), amongst crustose lichens on rocks in the sea spray zone. Also present are a large scavenging beetle (the largest N.Z. Anthribid beetle, Cacephatus aucklandicus (Brookes), also in Mt Allen and Auckland Islands E.D.s.), several weevils (e.g. the Stilbocarpa weevil, Hadramphus stilbocarpae, also in Mt Allen and Foveaux E.D.s), a large scarab related to several in the Otago highlands, and numerous minute beetles and flies. These endemics make a very large proportion of the island's fauna.

SNAILS: several endemic land snail species, one endemic genus.

WORMS: several endemic worms, one species 150-200mm long, and thick; a terrestrial bird leech occurs on Snares I; also found recently on Little Solander I.; this endemic species has only one relative, in Australia.

MODIFICATIONS: no introduced mammals.

BOUNTY ECOLOGICAL DISTRICT 81.01

Criteria: isolation, endemism.

TOPOGRAPHY/GEOLOGY: the small islets in the Western and Eastern Bounty Islands: more than 20 barren windswept granite islets and rocks at $47^{0}45'$ S, reaching 88m a.s.l., totalling about 135 ha.

CLIMATE: oceanic, windy.

SOILS: most areas covered by deposits of guano from nesting sea birds; some areas of bare rock and shallow and stony skeletal soils.

VEGETATION: no terrestrial vegetation except lichens and green algae.

MAMMALS: important fur seal colony (now over 1600).

BIRDS: no land birds are known from the Bounty group but it is an important locality for seabirds, including a rare endemic species of shag (less than 300 pairs). The world's main breeding localities for Erect-crested Penguin (115,000 pairs), Salvin's Mollymawk (c. 76,000 pairs) and Fulmar Prion. Snares Cape Pigeon (elsewhere breeds only at Snares, Antipodes, Auckland and Campbell Islands), and Antarctic Tern breed in small numbers.

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

INSECTS: many endemics e.g. Lichenobius maritimus - flightless beetles on exposed coastal rock at sea level (only 2 specimens found).

MODIFICATIONS: no introduced predators.

ANTIPODES ECOLOGICAL DISTRICT 82.01

Criteria: isolation, endemism.

TOPOGRAPHY/GEOLOGY: Antipodes I, Windward Is, Bollans I, Leeward I and South Islet: a group of basaltic volcanic islands at 49^0 41' S, totalling about 611 ha; main island a dissected plateau reaching 403m a.s.l., rugged coastline.

CLIMATE: cool, strong persistent westerly winds.

SOILS: mainly acid, low fertility peaty soils from blanket peats; some areas of more fertile reddish soils from basaltic lava and scoria also occur.

VEGETATION/FLORA: mainly tussockland, Poa litorosa, and scrub, Coprosma sp., with some fern in gullies. 60 plant species including several endemic plants, (Gentiana antipoda, Senecio antipodus and Coprosma antipoda) and rare Pleurophyllum criniferum. Enormous plants of giant bull kelp round coast.

MAMMALS: numbers of N.Z. fur seals are slowly building up after their near annihilation last century: several thousand occur, as well as a few elephant seals.

BIRDS: the only indigenous land birds present in the Antipodes I. group are: Antipodes Island Parakeet (endemic species, less than 3,000 birds), Reischek's Parakeet (endemic subspecies, less than 5,000 birds), Antipodes Island Snipe (endemic subspecies, common), and Antipodes Island Pipit (endemic subspecies, abundant). The group is an important breeding locality for many seabirds, most notable are: Soft-plumaged Petrel (rare) and Southern Black-browed Mollymawk (c. 150 pairs, only other breeding locality of this subspecies in the N.Z. region is Macquarie I.); the large breeding colonies of Wandering Albatross (less than 2,000 breeding pairs, total population c. 8,000, elsewhere breeds only at Auckland and Campbell Islands in N.Z. region), Rockhopper Penguin, and Erect-crested Penguin (one of only four breeding colonies). Other breeding seabirds are: Southern Great Skua, Antarctic Tern, Sub-antarctic Diving Petrel, Black-bellied Storm Petrel (elsewhere in N.Z. region breed only at the Auckland Islands), Grey-backed Storm Petrel, Sub-antarctic Little Shearwater (abundant, elsewhere in N.Z. region breeds only at the Chatham Islands), White-headed Petrel (abundant, also breeds at Auckland and Macquarie Islands), Sooty Shearwater, White-chinned Petrel (elsewhere in N.Z. region breeds only at Auckland and Campbell Islands), Grey Petrel (only other breeding locality in the N.Z. region is at Campbell I.), Fulmar Prion, Fairy Prion, Snares Cape Pigeon (elsewhere breeds only at the Snares, Bounty and Campbell Islands), Northern Giant Petrel (c. 300 pairs), and Light-mantled Sooty Albatross (one of only four breeding localities in N.Z. region).

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

INVERTEBRATES: several endemic including land snails.

MODIFICATIONS: mice are the only introduced animal.

AUCKLAND ISLANDS ECOLOGICAL DISTRICT 83.01

Criteria: isolation, endemism.

TOPOGRAPHY/GEOLOGY: Auckland I, Adams I, Disappointment I, Enderby I, Rose I, Friday I, Ewing I, Yule I, Green I, Dundas I, and Figure-of-eight I: a group of volcanic islands with scoria and lava flows, at latitude $50^{0}5$, reaching 670m a.s.l.; the land area totals 62,564 ha and there are strikng contrasts in the topography and vegetation of the group.

CLIMATE: cloudy, cool, with persistent westerly wind.

SOILS: organic soils predominate, formed from deep blanket peat deposits, averaging about 2 metres, fairly uniform despite differences in slopes; thicker deposits in depressions in lowlands where raised bogs and convex basin peats occur; the peat is moderately decomposed, extremely acid (pH 3.7 to 4.6) and strongly leached; drainage generally good except in low-lying hollows where drainage waters collect and basin peats have developed.

VEGETATION: wind-blown low southern rata coastal forest at sea level, replaced by dense scrub (Dracophyllum longifolium, Myrsine divaricata, Pseudopanax simplex, Coprosma foetidissima), capped with tussockland (Chionochloa antarctica, two Poa species, Bubinella rossii and several bog plants); a few Cyathea smithii (most southern tree ferns).

FLORA: a rich flora with 170 species including 6 endemics and other species confined to the sub-Antarctic (e.g. three species of rare Pleurophyllum).

MAMMALS: important breeding area for marine mammals including N.Z. fur seals and Hooker's sea lions.

BIRDS: the large size of the group, and the diversity of habitats available support a variety of indigenous land birds not encountered on other sub-antarctic islands elsewhere in the world. These include endemic subspecies of teal (less than 600 birds, no longer occur on the main island but are otherwise widespread), rail (rare, only on Adams I.), Banded Dotterel (less than 200 birds), snipe (only on Rose, Ewing, Enderby, Dundas, Figure of Eight, Disappointment, and Adams Islands), pipit (common), and tit (common in forested habitats). Other indigenous land birds present include: falcon (southern race), Red- and Yellow-crowned Parakeet, Tui, Bellbird, Welcome Swallow and Silvereye. The Auckland Islands are the world southern breeding limit for all these species except the pipit, which occurs further S on Campbell I. Auckland Island Shag (endemic species, c. 5,000 birds) are common around the coast. The Auckland I. group is a significant breeding locality for pelagic seabirds, particularly petrels and penguins. It supports the largest world breeding population of Yellow-eyed Penguin, Wandering Albatross (c. 7,500 pairs), and White-capped Mollymawk (c. 65,000 pairs). There are c. 10,000 pairs of Rockhopper Penguin. Other seabirds breeding in the group include: White-fronted Tern (southern limit), Antarctic Tern, Subantarctic Diving Petrel, Black-bellied Storm Petrel (elsewhere in N.Z. region breeds only at Antipodes Islands), N.Z. White-faced Storm Petrel (southern limit), Grey-backed Storm Petrel, Sooty Shearwater, White-chinned Petrel, Southern Fulmar Prion (Ewing I.) (only N.Z. locality), White-headed Petrel, Antarctic Prion, Northern Giant

Petrel, Light-mantled Sooty Albatross, Southern Royal Albatross (less than 60 pairs, elsewhere breeds only at Campbell I.) and Erect-crested Penguin.

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

INSECTS: include the weevil, Oclondius laeviusculus (Brown), abundant on Adams I. on Pleurophyllum criniferum and also on other plants; apparently less common on Auckland I. itself. The largest N.Z. Anthribid beetle, Cacephatus aucklandicus (Brookes), occurs from sea level to 200m on dead branches of various native shrubs.

SNAILS: several endemic land snails.

MODIFICATIONS: some islands are unmodified (e.g. Adams I, Disappointment I), others have feral herbivores: pigs, goats, rabbits, cattle (liberated as food for castaways) and also mice and cats; introduced animals have significantly affected the indigenous fauna and flora, causing elimination of several species. There are no rats.

CAMPBELL ECOLOGICAL DISTRICT 84.01

Criteria: isolation, endemism.

TOPOGRAPHY: includes Campbell I., Dent I., Bull Rock, Cossack Rock, Jacquemart I. and other small rocks, at 52^0S. Campbell I. 11,300 ha, reaching 567m a.s.l, mainly cliffed coastline, several fiord-like harbours on the E.

GEOLOGY: Campbell I. comprises a dissected remnant of a glaciated volcanic dome on a basement of Palaeozoic schist, overlain by Cretaceous sandstone, conglomerate and carbonaceous mudstone, with some Tertiary limestone and Miocene gabbro.

CLIMATE: cool, uniform: persistent strong westerly wind, less cloudy than Auckland Island, rainfall 1453mm p.a., evenly distributed, 325 raindays, usually light rain, drizzle; snow may fall any month, usually light and ephemeral.

SOILS: predominantly peaty formed from blanket peat deposits; peat thickness modified by topography and altitude; soils thickest (over 2m) on flat to rolling land at lower altitudes, becoming thinner over weathered rock as slope and altitude increases; peat strongly decomposed, soils moderately to poorly drained, strongly leached and strongly to extremely acid. Shallower peaty soils (less than lm) have a slightly higher nutrient status and contain more mineral matter due to erosion and downslope mixing of the country rocks; fertility is also higher on nesting sites of sea birds. Some downslope slipping of the deeper peaty soils occur; wind erosion is present on shallower soils where vegetation has been disturbed by grazing sheep.

VEGETATION: predominantly tussockland, shrubland and herbfield, some modified by sheep grazing; Dracophyllum spp., Coprosma spp. and Myrsine spp. approach tree size (5m) in sheltered places; herbs include Pleurophyllum speciosum, Anisotome antipoda, Stilbocarpa polaris and Bulbinella rossii.

MAMMALS: marine mammals including New Zealand fur seal and Hooker's sea lion breed on the islands.

BIRDS: only three indigenous land birds are resident on Campbell I., two of them endemic subspecies. Pipit (endemic subspecies) now survive only on Jacquemart and Dent Islands where they are relatively common; Campbell I. Teal (endemic subspecies) are found only on Dent I., population is less than 30 birds; Grey Duck also resident (southern limit). Other indigenous land birds occasionally visit Campbell I. including: harrier, falcon, and Pukeko (southern limit for all these species). Campbell Island Shag (endemic species) are still relatively common (less than 10,000 birds). Campbell I. is a significant breeding locality for pelagic seabirds, particularly petrels and penguins. N.Z. Black-browed Mollymawk (endemic subspecies) breed only on the northern cliffs of Campbell I. (c. 75,000 pairs). It is also the major breeding locality for several other species including: Southern Royal Albatross (c. 7,500 pairs, only other locality is Auckland Islands); Grey-headed Mollymawk (c. 11,500 pairs) and Rockhopper Penguin (c. 1.5 million pairs). Other species of petrel known to breed in the group include: Black-bellied Storm Petrel, Grey-backed Storm Petrel, Subantarctic Diving Petrel, Sooty Shearwater, Snares Cape Pigeon, Northern Giant Petrel, Light-mantled Sooty Albatross, and Wandering Albatross (less than 20 pairs). Most burrowing petrels are

largely confined to the smaller islands. Campbell I. is the southernmost breeding locality for Yellow-eyed Penguin and Erect-crested Penguin (both breed in low numbers).

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

INSECTS: include the large endemic ground-dwelling weevil Heterexis seticostatus (Brookes), common on Campbell I. especially at base of Bulbinella rossi, on roots of which the larvae probably feed, (species unlikely to be host specific). Also the large Campbell Island weta, Notoplectron campbellensis.

SNAILS: include several endemic land snails.

MODIFICATIONS: sheep present on fenced block at SW corner of island, good regeneration occurring elsewhere. Norway rats and feral cats present.

MACQUARIE ECOLOGICAL DISTRICT 85.01

Criteria: isolation, endemism.

TOPOGRAPHY/GEOLOGY: includes Macquarie I, Judge and Clerk Islands to the N and Bishop and Clerk Islands to the S: solitary glaciated volcanic island and islets at 54^0 30' S, 159 E; about 12,000 ha in area, reaching 434m a.s.l.

CLIMATE: cold, wet and windy (at 6m a.s.l. mean monthly temperature range 2.8^0C-6.2^0C, rainfall 926mm p.a., mean wind velocity 8.6m sec^{-1}; plateau climate more severe, often shrouded in cloud).

SOILS: predominantly strongly acid and infertile peaty soils from blanket peats but thickness of peat and admixture with mineral matter is variable.

VEGETATION/FLORA: plant communities include wet tussockland (tall tussock on beach terraces, steep coastal slopes, sheltered stream gullies and up to 300m, dominated by Poa foliosa, other species include herbs, grasses, bryophytes and large herb Stilbocarpa polaris; short tussock on upper coastal slopes and plateau uplands, dominated by Agrostis magellanica, Luzula crinita and Uncinia species), herbfields (dominated by large rosette-forming Pleurophyllum hookeri, in areas with relatively high water table, moderate wind exposure, up to about 330m, though P. hookeri occurs in many habitats and associations; Acaena species may also dominate herbfields), fen (dominated by Juncus scheuchzerioides), bogs (dominated by bryophytes and hepatics), mires with a slightly lower water table (include some vascular plants e.g. Acaena magellanica, Festuca contracta, Agrostis magellanica, Corybas sp.), fernbrakes (with Polystichum vestitum, Blechnum penna-marina), and fellfields covering nearly half the plateau above 170m, exposed to high winds, less than 50% plant cover (dominated by cushion forming mosses and Azorella selago); no woody plants; few endemic plants.

MAMMALS: sea mammals include approx. 100,000 southern elephant seal; 1,000 N.Z. fur seal use the island (but only 5-10 pups born each year).

BIRDS: no indigenous land birds remain (endemic subspecies of Banded Rail and Red-fronted Parakeet now extinct) but the Stewart Island Weka, introduced in 1867, is abundant. Emperor Shag (c. 700 pairs; endemic subspecies) are common along the coast of all islands in the group. Macquarie I. is an important breeding locality for pelagic seabirds, especially petrels and penguins, but only the Royal Penguin (more than 1 million pairs) are endemic (at the subspecies level). Other particularly significant species are: White-headed Petrel (less than 8,000 pairs, elsewhere breeds at Antipodes and Auckland Islands), Antarctic Prion (c. 50,000 pairs), Southern Giant Petrel (c. 4,000 pairs, only breeding locality in N.Z. region), Rockhopper Penguin (more than 100,000 pairs), and King Penguin (more than 70,000 pairs, only breeding locality in the N.Z. region). Other breeding species present include: Antarctic Tern, Black-backed Gull, Southern Great Skua, Subantarctic Diving Petrel, Sooty Shearwater (less than 2,000 pairs), Fairy Prion, Thin-billed Prion (only N.Z. breeding locality), Blue Petrel (less than 600 pairs, only N.Z. breeding locality), Northern Giant Petrel (c. 1,000 pairs), Light-mantled Sooty Albatross (less than 700 pairs, one of only four breeding localities), Grey-headed Mollymawk (less than 60 pairs, elsewhere breeds only at Campbell I.), Black-browed Mollymawk (rare, elsewhere breeds only at Antipodes I.), Snowy Albatross (rare, only N.Z. breeding locality),

and Gentoo Penguin (less than 10,000 pairs, only N.Z. breeding locality), Southern limit for Black Shag.

REPTILES: terrestrial reptiles not known from sub-antarctic islands.

SNAILS: include one endemic species of land snail, a member of a N.Z. endemic genus.

MODIFICATIONS: vegetation modification occurs at penguin colonies, elephant seal haul-out and wallow sites etc. Rabbits, cats, ship rats, house mice present; wekas introduced.

MAP APPENDIX

50 WHATAROA (Cont.)

50.03 Harihari

Alluvial valleys, moraine hills, terraces, plateaux, greywacke hills, granite outcrops, coastal lagoons, lakes; mild, high rainfall; loamy to gravelly alluvial soils on river flats, very strongly leached poorly drained low fertility soils on terraces, stony strongly leached and podzolised soils on hill slopes; originally forested: beech absent, valley swamps; lower forest logged, flats cleared, farmed, gorse on gravel floodplains.

50.04 Wilberg

Glaciated mountains to 2600m a.s.l. with present day glaciers; greywacke in E, schist in W; high rainfall - strongly leached stony steepland soils grading to alpine soils; large areas of scree and bare rock; indigenous vegetation: altitudinal sequence; beech absent.

50.05 Waiho

High moraine plateaux, wide alluvial valleys, granite, greywacke hills, reaching 1000m a.s.l., small coastal lagoons; mild, high rainfall; strongly leached, low fertility soils on hills, very strongly leached poorly drained and podzolised on terraces and moraines, stony strongly leached steepland soils on steeper slopes, alluvial soils on river flats; originally forested: beech absent; forests of valley flats partly logged, partly cleared and farmed or in low vegetation.

50.06 Glaciers

Highest peaks W of divide, to 3500m a.s.l., large glaciers; schist; very high rainfall; stony alpine soils with large areas of bare rock and scree, strongly leached stony steepland soils at lower altitudes; indigenous vegetation: beech absent; lowland chrono-sequences below retreating glaciers.

50.07 Karangarua

Alluvial terraces, extensive swamps, moraine ridges; mild, high rainfall; poorly drained alluvial soils on river flats, deep peaty soils in swamps, very strongly leached, poorly drained soils on terraces, moraines, alluvial soils; forested: beech outliers in S, kahikatea important; some flats grazed.

50.08 Mahitahi

Schist mountains to 2600 a.s.l., alluvium filled river valleys; high rainfall; strongly leached stony steepland soils, many serees, bare rock outcrops; forests isolated beech stands in N, continuous in S.

51 ASPIRING

51.01 Paringa

High rugged hills to 975m a.s.l., river flats, lake; greywacke, argillite, small granite intrusions, sediments, coal measures near coast; mild, high rainfall; strongly leached stony, steepland soils with deeper soils on Tertiary sediments, very strongly leached poorly drained gley podzols on terraces, poorly drained alluvial soils, sand soils; forested, beech increasing southward; flats grazed.

51.02 Mataketako

Glaciated schist mountains to 2000m a.s.l.; high rainfall; mainly strongly leached to podzolised steepland soils; small glaciers; altitudinal vegetation sequence, unbroken beech forests.

51.03 Landsborough

Major river valleys, high glaciated schist ranges to 2730m a.s.l.; valleys in relative rain shadow, severe winter frosts; mainly strongly leached to podzolised stony and shallow steepland soils, bare rock, scree, ice, glaciers; indigenous vegetation with eastern and western floral affinities.

51.04 Haast

Alluvial plains, arcuate dunes, granite outcrops, swamps; mild, high rainfall; mainly poorly drained soils on terraces, swamps and river flats; forests, beech decreasing northwards, wetlands; flats grazed, some forests logged.

51.05 Okuru

Schist mountains to 2423 a.s.l., flat alluvium filled valleys; high rainfall, but E flowing valleys in partial rain shadow; altitudinal sequence of stony steepland soils; mostly beech forest; some flats grazed.

51.06 Arawata

High, moderately steep, glaciated schist mountains to 3000m a.s.l., flat, alluvium filled valleys, c.150m; very high rainfall; altitudinal sequence of stony steepland soils; bare rock, scree, ice, small glaciers; beech forest; some flats grazed.

51.07 Dart

Moderately steep, N-S trending mountains to 2819m a.s.l., flat, alluvium filled valley floors; schist in NE, Humboldt and Ailsa Mountains comprise sandstones, argillite, siltstones, greywacke etc.; very high rainfall; mainly shallow, stony steepland soils with altitudinal sequence, bare rock, debris slopes; modified tussocklands on valley floors, beech forest, subalpine scrub, alpine tussockland, high-alpine zones; some flats grazed.

58 D'ARCHIAC

58.01 Browning
Heavily glaciated, rugged greywacke and argillite mountains to 2400m a.s.l., high rainfall; small areas permanent snow, ice; mainly bare rock, scree, with areas of shallow, stony alpine soil; alpine vegetation, subalpine scrub, tussockland, forest; western limit of beech.

58.02 Armoury

Heavily glaciated greywacke and argillite mountains, some over 2500m, wide valleys, braided streams; high rainfall, large areas of permanent snow, ice, glaciers, moraines, snow avalanches; mainly bare rock, scree, with areas of shallow, stony alpine soils; alpine vegetation, subalpine scrub, tussockland; very little forest.

58.03 Mt Cook

Heavily glaciated, very high; steep greywacke and argillite mountains including NZ's highest mountain, Mt Cook, 3764m a.s.l., large areas occupied by glaciers and ice; alluvium and till in valleys; high rainfall mountain climate; mainly bare rock, scree, with areas of stony, shallow alpine soils grading to podzolised soils at lower altitudes; complex vegetation patterns: montane and lower subalpine forests and grasslands, upper subalpine scrublands, scrub, alpine grassland, herbfield.

59 HERON

59.01 Mathias

Glaciated, rugged greywacke and argillite mountains to 2194m a.s.l., braided rivers, wide floodplains; moist, snow lies several months in winter at high altitudes; extensive areas of bare rock, scree, with stony, shallow

alpine sails, some podzols and alluvial soils at lower altitudes; now mainly modified tussockland, scrub, extensive forests, alpine communities; much former forest burnt, grazed.

59.02 Mount Hutt

Moderately glaciated greywacke and argillite ranges, to 2831m a.s.l., glacial outwash deposits and alluvium, in valleys, some sedimentaries including limestone, some volcanics, conglomerate and coal; subhumid to humid, snow lies several months in winter at high altitudes: large areas of bare rock, scree, strongly leached and podzolised steepland soils; more fertile soils at lower altitudes; modified tussocklands, alpine communities, areas of beech forest, other forests, scrub; grazed.

59.03 Arrowsmith

High, moderately glaciated greywacke and argillite mountains to 2100m a.s.l., wild braided river valleys, extensive fluvio-glacial and glacial deposits; subhumid to humid climate, some small valley glaciers; large areas of bare rock, scree, some alpine soils, leached steepland and high country soils, some alluvial soils, modified tussocklands, alpine communities; small areas of forest.

59.04 Hakatere

Glacial intermontane basin, moraines, low hills to 1360m a.s.l., braided riverbeds; mostly till, alluvium, some sedimentaries and greywacke; subhumid climate; shallow to moderately deep soils from variable thickness of loess; mainly tussockland, scrub, wetlands; burnt and grazed.

59.05 Two Thumb

Steep greywacke and argillite mountain range to 2545m a.s.l., glaciated in N; humid climate, permanent snow persists on highest peaks; extensive areas of bare rock, scree, some shallow, stony alpine soils, strongly leached steepland soils at lower altitudes; tussocklands and alpine communities originally Hall's totara-mixed forest on lower slopes, some beech forest, small remnants of both in E, scrub; repeatedly burnt, grazed.

60 TASMAN

60.01 Godley

High greywacke and argittite mountains to 3000m, broad, till and alluvium filled, glaciated valleys c.540m; in rain shadow, semi-continental climate, low humidity; small glaciers, extensive areas of bare rock, scree, some stony, shallow alpine soils, mainly strongly leached steepland soils at lower altitudes; tussocklands, matagouri, limited scrub, forest.

60.02 Dobson

High, steep, greywacke and argillite mountains to over 2100m a.s.l., with schists E and W, broad glaciated valleys, some till, alluvium; high rainfall, mountain climate, strong winds; ice, moderate sized glaciers, extensive bare rock, scree, some alpine soils, strongly leached stony steepland soils at lower attitudes; beech forest tussocklands, scrub.

61 PAREORA

61.01 Orari

A non-glaciated "refuge" district, low mountain to 1833m a.s.l.; mainly weakly indurated sandstones and mudstones, some volcanics, Tertiary and Quaternary deposits; subhumid hill climate; mainly steepland soils, differing with altitude and rainfall; areas of forests, tussocklands, mountain flax, scrub and extensive subalpine vegetation; most of district grazed, some exotic forests in the S.

61.02 Fairlie

Non-glaciated basin and low hills to 660m a.s.l.; large areas of Pleistocene tills, loess-covered gravels etc., some Tertiary deposits; subhumid climate; mainly loess derived soils on rolling downs and hills, those in lower rainfall areas droughty in summer, some alluvial soils, former vegetation mostly tussockland with forest remnants in gullies scrub and wetlands; some forest remnants, mixed scrub, wetlands, red tussockland etc. survive, district largely farmed.

61.03 Geraldine

Downlands between 100 and 300m a.s.l.; large areas of Pleistocene tills, loess-covered gravels, some Tertiary deposits and recent alluvium, subhumid climate; mainly loess derived soils, those in lower rainfall areas droughty in summer, some alluvial soils; former vegetation mostly lowland tussockland and forest remnants; now largely famed, some exotic forests in the W, small forest remnants.

61.04 Hunters

Non-glaciated low ranges to 1525m a.s.l., trending NW-SE; mostly greywacke and argillite; some schists, Tertiary gravels and marine deposits, Pleistocene loess-covered gravels; subhumid hill climate; stony steepland soils on hills, showing altitudinal sequence, some deep silty soils from loess; former vegetation extensive tussocklands with forest remnants, now mostly grazed, some isolated beech stands, scrub in gullies.

61.05 Waimate

Downlands between about 150 and 600m a.s.l.; complex geology including schists, basalt, Pleistocene tills and loess-covered gravels in the E and various Tertiary deposits; subhumid climate; mainly deep loess soils, some with poor drainage, some fertile alluvial soils and calcareous soils on lime rich sediments; former vegetation mostly lowland tussockland with gully forest remnants, now largely farmed, some forest in gorges an elsewhere.

61.06 Hakataramea

River basin and nearby hills to 1021m a.s.l.; geology includes greywacke and argillite, schist, Pleistocene deposits, some Tertiary deposits and recent alluvium; dry climate; loess derived soils, varying depths on rolling and hilly land, shallow, stony soils on steeper slopes, some alluvial soils; formerly tussockland with some gully forest remnants, now farmland, short tussockland at low altitudes, tall tussockland and scrub elsewhere with forest pockets.

62 WAINONO

62.0.1 Makikihi

Coastal downlands, small coastal plain, mostly below 150m a.s.l., with estuarine lagoon and long unbroken coastline; mainly Pleistocene gravels and loess, some basalt and conglomerate; low rainfall; mainly deep loess derived soils on rolling to hilly downlands, silty and sandy alluvial soils, varying depths, on river flats; former vegetation mostly lowland tussockland, remnant scrub and minor forest, some coastal forest remnants survive, also woodlands, coastal dune, swamp, gravel beach, lagoon and other vegetation types; includes Timaru city, elsewhere largely farmed.

62.02 Glenavy

Waitaki River floodplain, mostly below 150m a.s.l., long sandy coastline; mainly Pleistocene gravels, some Tertiary conglomerate; low rainfall; free draining alluvial soils on river flats, etc., shallow, stony, droughty soils on terraces, deep silty soils on downlands and hills; former vegetation mostly lowland tussockland and scrub; now largely farmed, some modified tussocklands and minor scrub.

62.03 Oamaru

Coastal downlands below 300m a.s.l.; piedmont terraces N and S, limestone topography between, varied coastline; some marine basalts; tuffs; low rainfall; mainly Loess derived deep silty soils and dark heavy textured soils from limestone downlands; formerly mainly short tussockland; now mostly farmed, some areas modified tusssockland, scrub, woodland.

63 MACKENZIE

63.01 Tekapo

Extensive moraines and lakes; tills derived from greywacke, argillite ranges in the N; humid to subhumid; majnly shallow to moderately deep silty and sandy soils from variable thickness of loess, some alluvial soils; highly modified tussocklands; grazed.

63.02 Pukaki

Fluvioglacial outwash and basin fill deposits, isolated greywacke hills; subhumid to semi-arid; soils from variable thickness of loess, most droughty in summer, some shallow, stony steepland readily eroding soils, screes common; depleted tusstcklands, weeds, bare ground; grazed.

63.03 Ben Ohau

Glaciated greywacke and schist mountain range, valley moraines, glacial lake; shallow, stony steepland soils, alpine soils, extensive screes, bare rock, at lower altitudes loess derived soils, some alluvial soils; tussocklands, forest and scrub remnants, large areas of scree and fellfield.

63.04 Grampians

Dissected greywacke block mountains; semi-arid to subhumid; shallow, stony steepland soils on steep slopes, droughty at lower altitudes, droughty silty and sandy and stony soils on fans and terraces; modified and depleted tussocklands with heavy weed infestation, scrub in gullies; grazed.

63.05 Ahuriri

Glaciated mountain range and large river valley with extensive wetland areas; greywacke and argillite, some schists, till, alluvium; humid; mainly stony steepland soils, alpine soils, bare rock, scree, with stony, sandy and silty soils on terraces and fans, some alluvial soils; wide range of vegetation types: developed river flats, tussocklands, forest remnants, scrub associations, fellfields, rock, scree.

63.06 Omarama

Glacial till, outwash and basin fill deposits; humid to semi-arid; silty sandy and stony soils from variable thickness of loess over gravels showing rainfall sequence; degraded tussocklands, some wetlands, scrub, extensive agricultural development.

63.07 Benmore

Dissected greywacke and argillite block mountain range and large man-made lake; semi-arid to subhumid; shallow, stony steepland soils forming a leaching sequence with altitude and rainfall, severe erosion; altitudinal sequence from short to tall tussockland, scrub in gullies, fellfield on tops.

64 WAITAKI

64.01 Kirkliston

Steep inland range to 1864m a.s.l., hills, two artificial hydro lakes; mostly greywacke and argillite; warm dry summers, cold winter; mainly shallow, stony steepland soils forming a leaching sequence with altitude and

rainfall, former vegetation mostly lowland and subalpine tussockland, subalpine scrub; now mostly grazed, vegetation modified.

64.02 St Mary

Steep inland range to 2008m a.s.l.; mostly greywacke, argillite and, schist; semi-arid climate, wetter in the N; shallow, stony steepland soil, deeper loess derived soils on rolling and hilly land, leaching sequence with rainfall and altitude; former vegetation mostly lowland and subalpine tussockland and scrub; now mostly grazed, vegetation modified.

64.03 Hawkdun

Steep inland ranges to 1871m a.s.l., extensive high altitude peneplain remnants; mostly greywacke and argillite, minor schist; semi-arid at lower altitudes, cold winters; shallow, stony soils on steep slopes, deeper loess derived soils on rolling and hilly slopes, leaching sequence with rainfall and altitude; tussockland, subalpine grassland, herbs, scrub and fellfield; higher parts largely still in indigenous vegetation, most of district grazed, grassland modified.

64.04 St Bathans

Steep inland ranges to 2087m a.s.l., mostly greywacke and argillite, minor schist, semi-arid at lower altitudes, cold winters; shallow, stony soils on steep slopes, deeper loess derived soils on rolling and hilly slopes; subalpine grassland and scrubland, extensive subalpine fellfield and boulderfield; most of district grazed, vegetation modified.

65 KAKANUI

65.01 Duntroon

Downlands, hills, mostly below 600m a.s.l.; varied geology: limestone and volcanic plateaux, coal measures, other deposits, overlying schist and greywacke in the SW; low rainfall; mainly soils of different depths from loess and various parent materials; formerly short tussockland, now mainly farmed, some modified tussockland remains.

65.02 Dansey

Non-glaciated, NW-SE trending schist mountains (some greywacke and Tertiary deposits) to 1644m a.s.l.; low to moderate rainfall, foggy; mainly stony steepland soils showing gradient of leaching with altitude and rainfall, deeper loess soils on rolling and hilly slopes; formerly short and tall tussockland, now mostly grazed, some shrubland and relict forest stands in E.

65.03 Waianakarua

Downlands mostly below 600m a.s.l., cliffed beach between rocky headlands; varied geology: schist inland, some greywacke, argillite in S, Cretaceous deposits form hills, aggradation gravels back volcanic coastal promontories; low rainfall; stony, shallow to moderately deep soils on steep slopes, deeper soils from loess and various parent materials on rolling and hilly slopes showing leaching sequence with rainfall; formerly extensive scrub, forest remnants, tussocklands; now scrub in valleys, forest remnants, modified tussockland, low country mostly farmed.

66 LAKES

66.01 Huxley

Moderately steep schist and greywacke mountains 2499m a.s.l.; alluvium in flat valley floors; moderately high rainfall mountain climate; mainly shallow, stony steepland soils showing gradient of leaching and podzolisation with altitude and rainfall, some alpine soils, bare rock, scree; valley floor grassland montane,

subalpine beech forest, scrub, alpine tussockland, high alpine zones; eastern forest limits modified by fire history.

66.02 Wanaka

Broad glacier formed basins of Lakes Wanaka and Hawea, surrounding steep mountains to 2350m a.s.l.; mainly schist, glacial outwash gravels in wide valleys; wide rainfall gradient; mainly stony steepland soils, droughty in summer in NE, some alluvial soils; depleted tussockland extensive on mountains, beech forests mostly in gullies, bracken fernland on lower slopes, scrub; much of district grazed.

66.03 Richardson

N-S trending, schist mountains to 2525 a.s.l., strong natural erosion, glacial outwash gravels, alluvium in valley floors; in rain shadow of Main Divide; mainly strongly leached to podzolised stony steepland soils, alpine soils, extensive areas of bare rock, some steeper soils, on terraces etc. some alluvial soils; tussockland, fernland, scrub, patches of beech forest mostly in valleys; much of district grazed.

66.04 Shotover

Steep, deeply incised schist mountains to 1991m a.s.l., strong natural erosion, glacial outwash gravels, alluvium in valley floors in rain shadow of Main Divide; stony, strongly leached to weakly podzolised steepland soils, shallow to moderately deep droughty soils from loess over gravels on terraces, fans etc.; small beech forest remnants only, elsewhere extensive fernland with naturalised exotic conifers, scrub, subalpine scrub and tussockland, alpine herbfield, barrens; much of district grazed.

66.05 Remarkables

Extremely steep, rugged, strongly glaciated N-S trending schist mountains to 2300m a.s.l., outwash gravels, alluvium in valleys; in rain shadow of Main Divide; mainly stony steepland soils, alpine soils, bare rock, scree, with deeper loess derived soils on easier slopes; few, small beech forest remnants in narrow valleys only, elsewhere scrub, fernland, tussockland and alpine cushion, snowbank and barrens; mostly graded, some upper slopes retired.

67 CENTRAL OTAGO

67.01 Lindis

Non-glaciated low round schist hills, mountains to 1700m a.s.l., broad terraced valleys, glacial outwash gravels, moraine; sub continental climate, subhumid, snow lies above 1000m for weeks in winter; stony steepland soils on mountains, shallow to moderately deep soils from loess over gravels on terraces, fans etc.; formerly mostly tussockland, beech forest remnants in NW, shrubland; local endemics; grazed, rabbits a problem, irrigated areas on flats.

67.02 Pisa

Block-faulted schist range to 1963m a.s.l., small cirques, surrounding flats, glacial outwash gravels; dry, subcontinental climate, sail snowbanks persist; stony steepland soils on mountains, shallow to moderately deep soils from loess and other parent materials on terraces, fans etc. showing leaching sequence with rainfall and altitude; formerly mostly tussockland, small beech, kanuka and Hall's totara forest remnants, N and S, scrub, cushion and herbfields on summit plateau; grazed, irrigated areas on flats.

67.03 Dunstan

Tilted, block-faulted schist range to 1692m a.s.l., surrounding lowlands, glacial outwash gravels, moraines; dry, subcontinental climate, snow lies for weeks in winter; shallow to moderately deep soils with variable loess cover on rolling, hilly and steep slopes, shallow to deep soils on terraces and fans in valleys formerly mostly tussockland, no beech forest, rare small Hall's totara remnants E, extensive kanuka shrubland SW; local endemics; burnt, grazed, rabbits.

67.04 Maniototo

Broad flat plains, 200-600m a.s.l., meandering rivers, low convex ridges with schist outcrops; includes Cretaceous, Tertiary an late Quaternary deposits; subcontinental semi-arid climate, severe summer droughts; mainly droughty to very droughty soils from variable thicknesses of loess over gravels and other parent materials, soils show leaching sequence with rainfall, localise saline soils; mainly depleted short tussockland, scrub, wetlands history of burning exotic pasture and weeds on lowlands, most of district grazed, exotic forest near Naseby, orchards near Alexandra.

67.05 Old Man

Block-faulted schist mountains, extensive tablelands, local sediments; dry, subcontinental climate, intense frosts, extensive snow; mainly hill and steepland soils from variable thickness of loess and solifluvial debris, showing leaching sequence with altitude and rainfall; altitudinal sequence of grasslands, tussocklands, scrub, herbfield, cushionfield; most grazed.

67.06 Manorburn

Gently rolling uplands, several distinctive ridges rising to 1100m a.s.l.; mostly schist, some sediments; subcontinental; semi-aric climate; soils from variable thickness of loess ranging from deep to shallow, showing leaching sequence with altitude and rainfall mainly tussockland, some scrub, wetlands, peat bogs with sphagnum; grazed.

67.07 Rock and Pillar

NE-SW trending block faulted schist range rising steeply to 1450m a.s.l.; some basalt in the N; subcontinental climate; mainly hill and steepland soils from variable thickness of loess over schist showing leaching sequence with altitude and rainfall, some basalt derived soils in the N; tussockland, upper subalpine shrubland, scrub; eastern limit of CENTRAL OTAGO high alpine flora.

68 LAMMERLAW

68.01 Macraes

NE-SW trending schist ridge (to over 800m a.s.l.) plus series of parallel, smaller faulted ridges to SE, dendritic drainage; some sediments and basalts; cool dry climate; deep to shallow soils from variable thickness of loess, showing leaching gradient with altitude and rainfall; mostly tussockland, some scrub, minor forest remnants; grazed.

68.02 Waipori

Peaty upland schist plateaux reaching 1211m a.s.l., surrounding hills; lake in S; cool, moist climate; deep to shallow soils from variable cover of loess or drift over schist, showing leaching gradient with altitude and rainfall; tussockland, numerous peat bogs, few relict forest stands, some scrub; grazed, exotic forests in the S.

68.03 Tapanui

Schist mountain range reaching 1020m a.s.l.; cool, moist climate; mainly stony steepland soils showing leaching gradient with altitude and rainfall, most soils strongly leached with some blanket peats; forest, montane and subalpine tussockland-shrubland, scrub, cushion bogs; exotic forests on lower slopes, some farming.

68.04 Lawrence

Low, rolling, dissected country reaching 687m a.s.l. in the N; mostly schist, some conglomerate and breccia; cool, moist climate; deep to shallow soils from variable cover of loess over schist, showing leaching gradient with altitude and rainfall; mainly fire induced tussockland, scattered areas of scrub, small forest remnants; lower parts farmed, exotic forests N and E of Lawrence township.

69 OTAGO COAST

69.01 Waikouaiti

Schist hills in SW, reaching 777m a.s.l., chain of volcanic peaks and rolling coastal hills in NE coastal plains, estuaries; complex geology; relatively dry coastal climate; shallow to deep soils from variable loess cover overlying different parent materials showing leaching gradient with rainfall; includes small remnants of coastal and lowland forest, extensive scrub, tussockland at higher altitude in the W, some stands of upland forest.

69.02 Dunedin

Well dissected sunken basaltic to trachytic volcanic terrain, large whale-backed hills, eroded caldera, volcanic skeleton, sheltered harbour inlets, bays, dunes; moist coastal climate; soils from variable cover of loess showing leaching gradient with rainfall and solifluction debris over different parent materials; includes forest remnants, tussocklands at higher altitudes in the W, scrub common throughout, some extensive salt marshes; mainly farmed, includes Dunedin city.

69.03 Tokomairiro

Alluvial plains, wetlands, low coastal hills, reaches 895m a.s.l., sand beaches backed cliffs or dunes; various basement rocks; moist coastal climate; soils from variable loess cover over different parent materials showing leaching gradient with rainfall, alluvial soils on Taieri Plains; forest remnant, scattered kanuka stands, tussock remnants in western high country, subalpine bog, scrub at highest altitudes; mostly farmed, lowland swamps modified, exotic forests extensive.

69.04 Balclutha

Fertile alluvial lowlands and low hills; various basement rocks coastal climate; soils from variable thickness of loess on terrace, rolling and hilly land, alluvial and peaty soils on fiver flats and in swamps; remnants of forests and tussocklands, extensive modified swamps; farmed, some exotic forests.

70 CATLINS

70.01 Waipahi

Series of parallel hilts and valleys, folded sediments of the Southland Syncline, mostly below 600m a.s.l.; moist, cool; cloudy; well drained, soils from variable loess cover over tuffaceous greywacke etc.; originally forested, formerly fire induced tussockland, now modified tussockland, pasture, some scrub, bracken; grazed, exotic forest in the SW.

70.02 Tahakopa

Parallel low hills and valleys, some tablelands, folded sediments of the Southland Syncline, mostly below 600m a.s.l., cliffed coast with promontories, wide bays, sandy bay-head beaches; moist, cool, cloudy; range of hill soils from variable loess cover over tuffaceous greywacke etc.; formerly forested, low altitude forests cleared for farming, valley side forests logged or cleared, some beech forest remnants, montane forests, scrub, tussockland, cushion bog; lowlands farmed, extensive exotic forests.

71 OLIVINE

71.01 Cascade

Complex area including greywacke and argillite ranges, moraine ridges, a wide alluvial valley running in part along the Alpine Fault, with the ultramafic Red Hill Range on the SE and Olivine Range on the W reaching 1904m a.s.l.; extremely high rainfall; very strongly leached to podzolised soils on rolling, hilly and steep land

from mafic and ultramafic rocks etc., more fertile, poorly drained alluvial soils on river flats; beech forests, plateau vegetation, pakihis etc., some subalpine vegetation; some alluvial flats grazed.

71.02 Pyke

Deeply dissected terrain, isolated ranges to 1650m a.s.l., bisected by Alpine Fault, high level plateaux, alluvial flats, small lakes; complex geology; very high rainfall; mainly very strongly leached infertile, stony, shallow steepland soils from various parent materials, small areas of alluvial, organic, sandy and stony soils; mostly forested, low forest on poorly drained old moraines etc., lowland swamps, bog, lagoon, above treeline subalpine scrub and tussockland.

72 FIORD

72.01 Darran

Very steep glacier-carved mountains to 2756m a.s.l., valleys, fake large fiord, rugged exposed coastline; mostly igneous intrusive and metamorphic rocks; very high rainfall; mainly shallow, stony, very strongly leached to podzolised steepland soils on steep slopes, podzolised soils on gentler, lower slopes, slips, screes, bare rock extensive; altitudinal sequence: forests, subalpine scrub, tussocklands, alpine zone.

72.02 Doubtful

Large districts of fiords, lakes, steep glacier-carved mountains, mostly less than 1700m a.s.l., steep, rocky exposed coast; mostly metamorphic and igneous intrusive rocks; very high rainfall; shallow, stony, very strongly leached and podzolised steepland soils on steep slopes, deeper podzolised soils on gentler, lower slopes, slips, screes, bare rock extensive; altitudinal sequence: valley floor swamps, forests, subalpine scrub, tussocklands, alpine zone.

72.03 Te Anau

Long narrow district dominated by glacier-excavated lakes, mountains reach c.1900m a.s.l.; mainly metamorphic and igneous intrusive rocks; drier at low altitudes than districts to the W; very strongly leached to podzolised soils from various parent materials, some alluvial gravels and alluvial soils on river flats; mostly forested, subalpine scrub and tussockland at higher altitudes, lowland wetlands in the SE; takahe in Murchison Mountains.

72.04 Preservation

Glacier-carved fiords, lakes and mountains, mostly below 1500m a.s.l, coastal marine terrace plateau in the S and W; sedimentary, metamorphic and intrusive rocks; cloudy, windy, high rainfall; mainly stony, shallow, very strongly leached and pozolised steepland soils with podzols and gley podzols on easier slopes; mostly forested, depressed treeline on granite, scrub and tussocklands at higher altitudes and some lowland sites.

73 MAVORA

73.01 Livingstone

Steep mountains to 2008m a.s.l.; geology varied; Mesozoic basic volcanics, schistose sandstone etc., Tertiary sediments in the W; moist climate; mainly strongly leached steepland soils from various parent materials, some screes and bare rock; originally mainly beech forest, now large patches of beech forest in the W, minor podocarps, tussockland elsewhere; mostly grazed.

73.02 Eyre

Steep, eroding mountains and hills to 2025m a.s.l.; Paleozoic schists, younger partly schistose greywacke etc. in the W; cool, humid; mainly strongly leached stony steepland soils from various parent materials, many screes, some shallow, stony soils on terraces, alluvial soils on river flats; originally mainly beech forest, now

confined to SW plus remnants in valleys, minor podocarps, mainly tussockland and shrubland, fellfield, scree and alpine barrens; high level of endemism; partly grazed.

73.4 Upukerora

Low gentle hills, rolling country, mostly below 900m a.s.l.; glacial outwash gravels, moraines, tills, some older weathered gravels and Tertiary sediments in SE; cool, moderate rainfall; mainly very strongly leached, stony, shallow to moderately deep soils some rendzinas in the SE, some alluvial soils on river flats; beech forest in N, tussock grassland, scrub elsewhere; mostly grazed.

74 WAIKAIA

74.01 Nokomai

South facing slopes of ranged uplands to about 1500m a.s.l.; transition N-S from Paleozoic schist etc. to younger volcanic greywackes, back to U. Paleozoic volcanogenic sediments etc.; cool, humid, moderate rainfall; mainly strongly leached shallow to moderately deep hill and steepland soils, some loess derived soils and alluvial soils; mostly modified tussock grasslands, patches of beech forest; eastern limit of some Fiordland centred species; mostly grazed.

74.02 Umbrella

Broad gentle southern end of low schist range and uplands, to 1453m a.s.l., minor Quaternary sediments; cool moist climate, frequent fogs; mainly hill and steepland soils from variable thickness of loess; red tussock formerly extensive; now mostly pasture and subalpine to alpine plateaux with extensive bogs, tussockland, mixed scrub, some beech forest remnants; mostly grazed.

75 GORE

75.01 Gore

Inland plains and downlands of Southland syncline mostly below 300m a.s.l.; Mesozoic sediments underlie northern slopes Hokonui Hills, Tertiary and Quaternary sediments form plains; humid-subhumid, dry summers; mainly poorly drained deep loess soils on high terraces and rolling downlands, shallow, stony soils on low terraces, alluvial soils on river flats; formerly mostly red and short tussock grassland and shrubland, localised forest, no beech; now mostly pasture and cropping, swamps, matagouri, small forest remnants; mostly farmed, some exotic forests.

76 SOUTHLAND HILLS

76.01 Takitimu

Steep, eroded, isolated mountains to 1694m a.s.l. of Paleozoic volcanics fringed by various sediments; natural bouldery screes, induced screes; cool temperate, moist; wide range of soils related to parent material, altitude and rainfall, variable sized beech forest patches, some broadleaf, podocarps, extensive red and short tussock grasslands, some subalpine scrub; many western plant species; much of lower area grazed, several exotic forests.

76.02 Taringatura

Low gentle rolling volcanic greywacke hills to 1080m a.s.l., outwash gravels in wide flat valleys, swamps; some Tertiary sediments, coal measures; cool temperate, humid to subhumid; range of weakly leached to podzolised soils from variable cover of loess over different parent materials, formerly red and short tussockland, podocarp-hardwood forest remnants, some beech forest, scrub, peat swamps in poorly drained basins, parts farmed extensively.

76.03 Hokonui

Rolling volcanic greywacke hills to 757m a.s.l., some scarp faced; moist, cool temperate; range of soils from variable cover of loess showing leaching gradient with altitude and rainfall; formerly mostly podocarp-hardwood and podocarp forest, some-beech pockets in W; now extensive red and some short tussock, some mixed scrub, exotic pasture: mostly grazed.

77 TE WAEWAE

77.01 Waitutu

Irregular lowland basin, marine, glacial outwash and alluvial terraces, sedimentary hills to 1067m a.s.l.; moist, cool, rainfall gradient W-E; strongly leached to podzolised soils on rolling and hilly land, some podzols on terraces, blanket peats on range crests, alluvial soils, in valleys; mosaic of forests, scrub on podzols, headlands, cliffs, dunes with pingao, little modification.

77.02 Tuatapere

Low hills to 778m a.s.l., of Tertiary sediments, poorly drained terraces of Quaternary outwash gravels; moist, windy; mainly moderately leached to podzolised soils with firm clayey subsoils, some with poor drainage; formerly podocarp and beech forests, manuka, red tussocks; now logged forests on hills, lowlands farmed.

77.03 Longwood

Hilly to steep low ranges to 804m a.s.l., plains, rocky coast, large estuary; Paleozoic intrusives and volcanics, Tertiary and Quaternary sediments; moist, windy; mainly strongly leached to podzolised soils and podzols on flattish and hilly land from variable thickness of loess over range of parent materials, many poorly drained; range forested, beech-podocarp-hardwood forest, seral manuka, wet tussock uplands; lower areas farmed, some exotic forests; strong western floristic connections.

78 MAKAREWA

78.01 Southland Plains

Plains and downs below 300m a.s.l., extensive wetlands; mostly Quaternary sediments overlying Tertiary sediments; moist, windy; mainly leached soils from loess or alluvium on terrace and rolling land, fertile alluvial soils on river flats, many poorly drained, some sandy soils and limestone hill soils; swampy red tussock grasslands, some podocarp-hardwood forest pockets, manuka, salt marshes, sand dunes; mostly farmed, some exotic forests.

78.02 Waituna

Low relief, extensive wetlands, lagoons, harbours; Quaternary sediments underlain by extensive Tertiary lignite deposits; moist, cool temperate, exposed; poorly drained deep acid peats with very strongly leached to podzolised soils from loess and sands on surrounding undulating land; mostly peat swamps, bogs, manuka, flax, red tussock, stunted forest remnants, salt marshes, sand dunes; part drained and in pasture.

79 RAKIURA

79.01 Foveaux

Small islands, headlands in broad strait; ultrabasic, basic, intermediate intrusives; extremely oceanic, windy climate; mainly strongly leached acid, infertile, podzolised soils from range of parent materials; coastal scrub, low forest, some taller forest; numerous sea birds, sea mammals.

79.02 Anglem

Hill country to 980m a.s.l., glaciated cirques, diverse coastline; ultrabasic, basic, intermediate intrusives; oceanic, windy, wet climate; mainly acid, infertile soils showing altitudinal sequence from podzolised soils and podzols to blanket peats at higher altitudes, small areas of alluvial and sand soils; mostly forest, no beech, scrub, coastal tussockland; some clearing.

79.03 Freshwater

Band of low lying schist, crushed granite country; poorly drained areas, sandy ridges, dissected terraces; oceanic humid climate; mainly alluvial soils on floodplains and terraces, many with poor drainage, and sand soils ranging from raw sands to sand podzols, strongly leached and podzolised soils on rolling and hilly land; heath-like shrublands, manuka scrub, swamps, some tussockland, forest; some cleared.

79.04 Mt Allen

Hills of granite, gneiss, to 750m a.s.l.; soils range from acid, strongly leached and podzolised soils at lower altitudes to deep blanket peats at higher altitudes with minor areas of alluvial and sand soils and basin peats; oceanic, windy climate; forest, no beech, scrub some coastal tussockland; some areas burnt.

79.05 Solanders

Two isolated andesitic, steep sided islands, largest 340m a.s.l.; very exposed; salty peat soils; free daisy scrub and coastal grasslands; sea-lions, seals, sea birds.

79.06 Snares

Small isolated islands (largest 242-8 ha) and stacks at latitude 48°S, steep cliffs, few boulder beaches, sloping plateaux; mostly granite; cool, uniform, humid climate; mainly strongly to extremely acid peaty soils from blanket peat with some area of podzolised soils from granite and schist; unmodified simple vegetation, mostly *Olearia lyalli* forest, open tussockland on cliff tops; several endemic plant species; numerous breeding fur seals, other visiting marine mammals; approx. 6 million breeding sooty shearwaters; other breeding seabirds; 4 endemic bird species; endemic invertebrates; no introduced animals.