

THE SHORELINE VEGETATION OF LAKE ELLESMERE

CANTERBURY, NEW ZEALAND

BY

D.J. CLARK\*

(North Canterbury Catchment Board)

- AND -

T.R. PARTRIDGE

(Botany Division, D.S.I.R., Private Bag, Christchurch.)



A report prepared for the North Canterbury Catchment Board  
and Regional Water Board - March 1984

\* Present address: 28 Paremata Crescent, Paremata

## CONTENTS

	<u>Page No.</u>
SUMMARY	1
INTRODUCTION	3
METHODS	5
RESULTS	7
List of Vegetation Types	7
Vegetation Maps 1 - 4, 5A and 5B	after page 8
Legend to Vegetation Types	10
DISCUSSION	21
Summary of Vegetation Patterns	21
Causes of the Vegetation Patterns	26
Significant Species of the Shoreline	30
CONCLUSIONS AND RECOMMENDATIONS	33
REFERENCES	36
APPENDICES (I) List of Vascular Plant Species in the Survey Area	37
(II) Reports on the Vegetation of Harts Creek and Yarrs Flat Wildlife Reserves	52
(III) Brief Article on Rare Plants	70

SUMMARY

The vegetation of the shoreline of Lake Ellesmere was surveyed and the plant communities mapped. These include freshwater, halophytic and various types of farmland. Zonation is primarily related to elevation, from the mudflats below, to the farmland above. Secondary differences are related to sediment composition with at one extreme the muddy freshwater areas, and at the other, those which are dry, sandy and with halophytes. Farming practices have altered most of the shoreline vegetation, having been greatest in the upper zones. These practices include grazing, reclamation and ditching. A number of weedy species of importance have been identified. They include those which have spread as far as capable, such as salt barley grass, and those which may prove a problem in the future, such as grey willow.

Very little of the original native vegetation remains. Most of that which does is under threat from the same factors which have already caused the loss of extensive areas of wetland. Areas of greatest value have been identified and include Greenpark Sands and western Kaitorete Spit. Smaller areas and interesting plant species have also been identified for possible future protection.

## INTRODUCTION

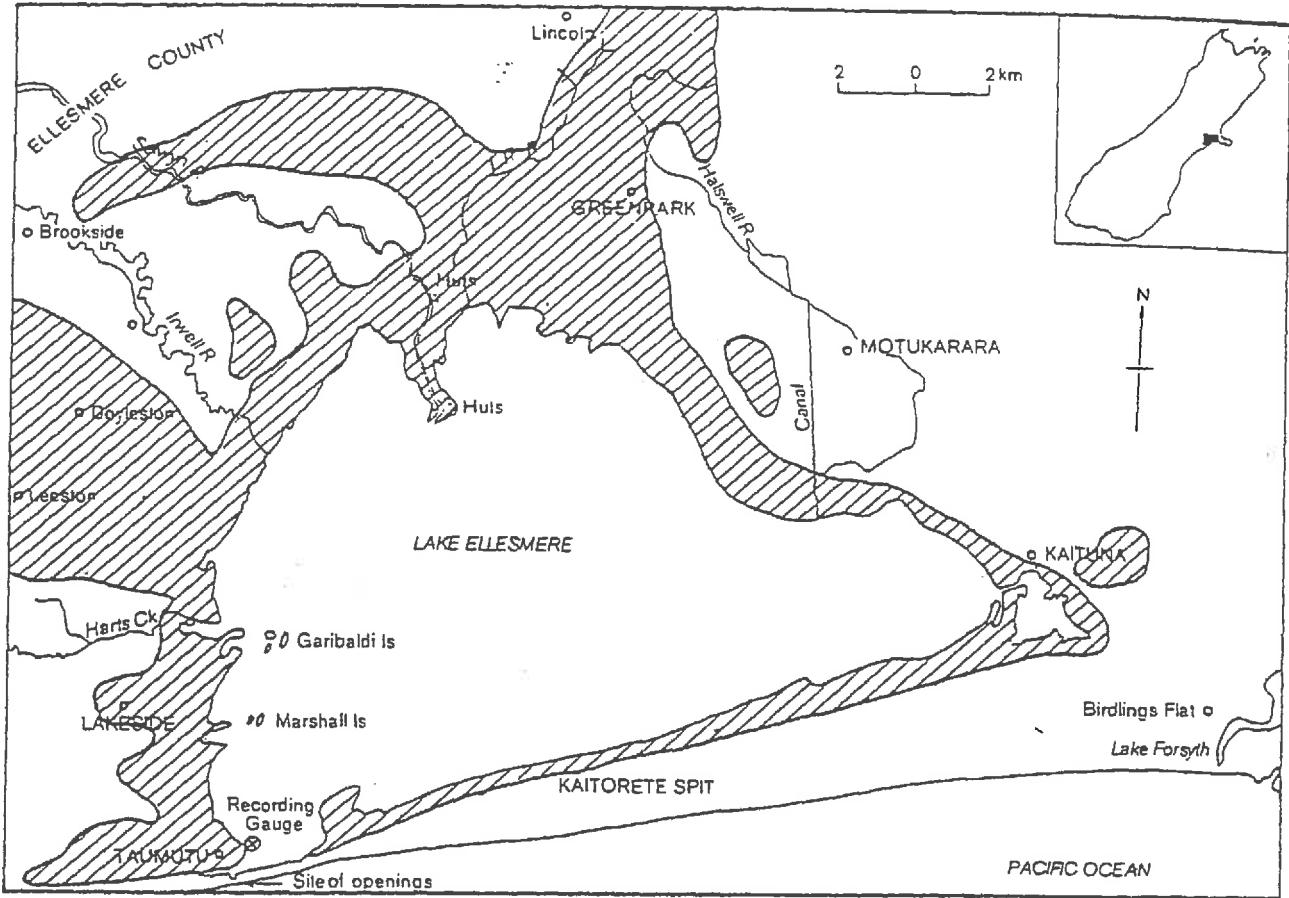
Lake Ellesmere is a large, shallow, brackish lagoon immediately south of Banks Peninsula, Canterbury. It is surrounded by the river gravel deposits of the Canterbury Plains and is separated from the sea by the long, gravel Kaitorete Spit which gradually narrows towards its western end. The lake is periodically opened to the sea by cutting a channel through the narrowest part of this Spit. Attempts are made to lower the lake level when it becomes marginally higher than 1.0 metres above mean sea level. This is mainly undertaken to clear the marginal land of water. At a level of 1.0 metres above m.s.l. the total length of lakeshore is over 90 km.

When European settlement began it is believed that extensive areas of swamp dominated by flax, raupo and Carex species were present north and west of the lake (Burrows, 1970). Since that time the area of wetland has been greatly reduced by burning and draining of swampland for conversion to farmland (Fig. 1). It has recently been suggested that at least 81% of the original area of wetlands has disappeared (Palmer, 1982).

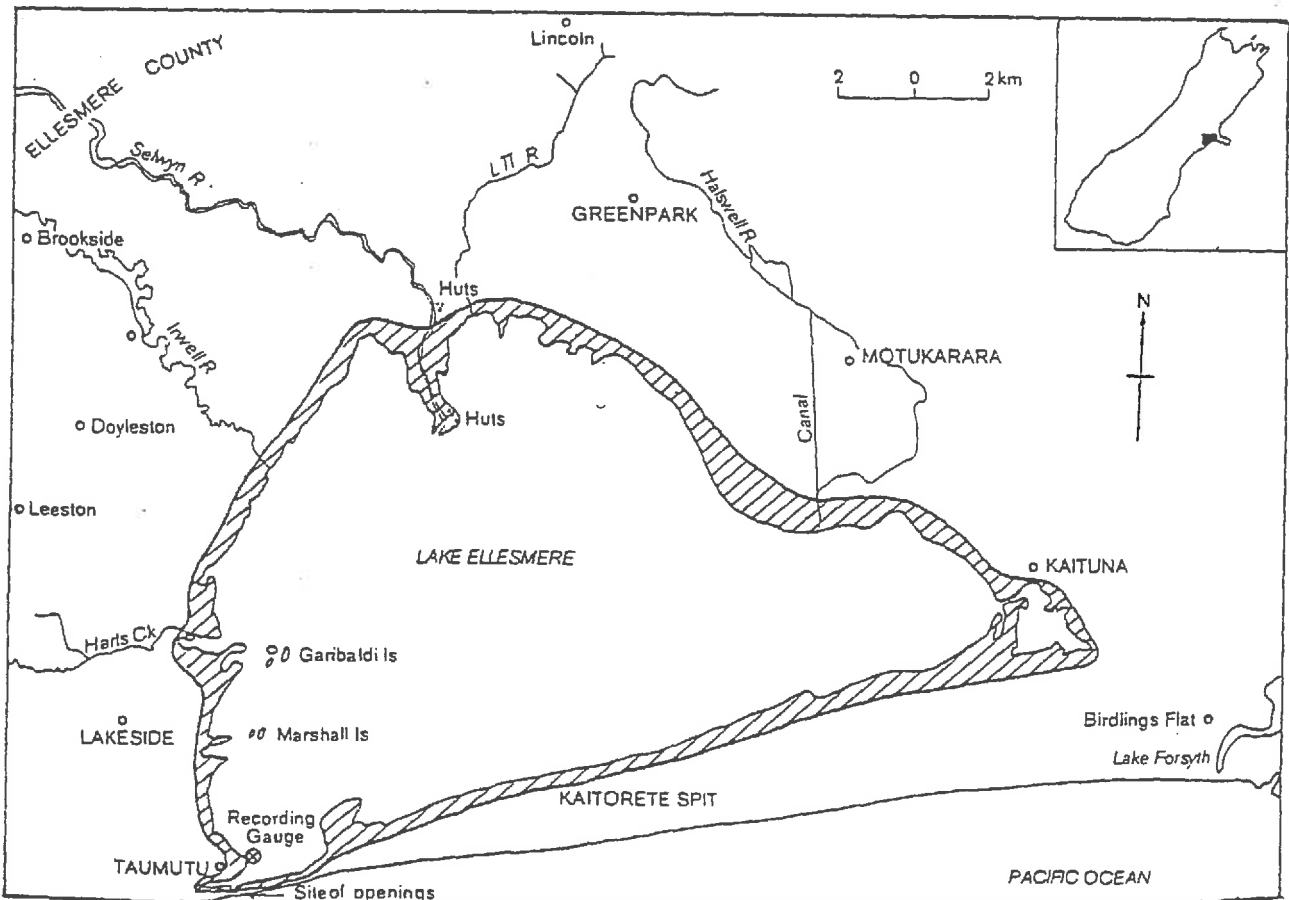
Little published information is available on the composition and distribution of the wetland vegetation around Lake Ellesmere. A study by Evans (1953) dealt briefly with the general vegetation pattern and then examined in more detail the zonation patterns in three study areas. Other published descriptions of the general vegetation pattern, sometimes with brief species lists, include Burrows (1969, 1970) and Mason (1968).

In recent years there have been conflicts concerning the best land use of the shoreline. To help determine this it was considered necessary to have a detailed description of the lake edge vegetation. As a result of this, the Resource Investigations Division of the North Canterbury Catchment Board instigated this survey. Its purpose is to document the vegetation of the shoreline of Lake Ellesmere. This will allow for more informed management decisions concerning the vegetation of the lakeshore.

Fig. 1 Past and Present Distribution of Wetland Vegetation



(a) Probable distribution of wetland vegetation in pre-European times (after Burrows, 1969)



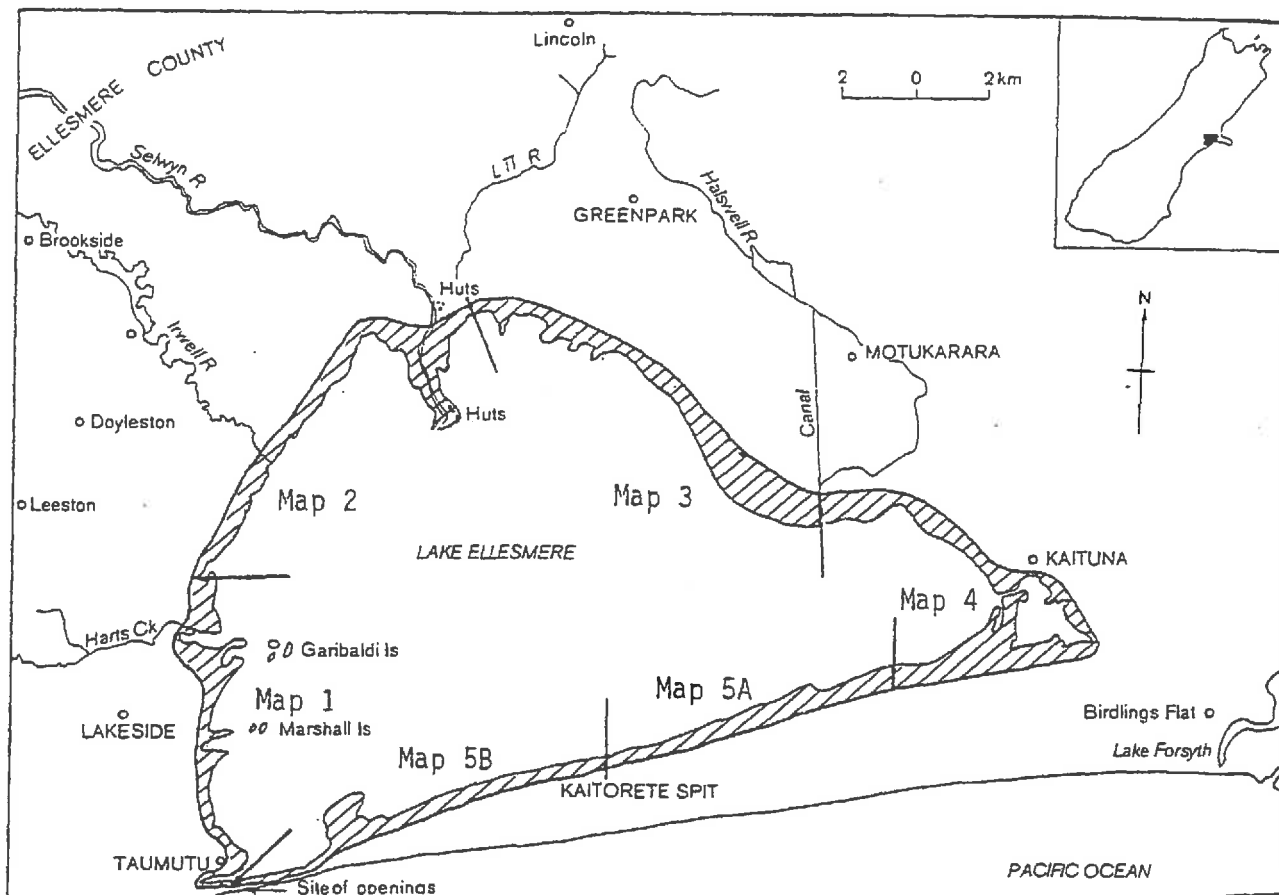
(b) Distribution of present wetland vegetation


## METHODS

In order to develop a classification system which adequately described the vegetation, a number of criteria were used. Most primary divisions of the vegetation types (plant communities) were made on summer growth form. These were usually subdivided to varying degrees using dominant species. A hierarchy of vegetation types was thus developed during the course of the survey. These types were all determined in the field by the same observer (D.J.C.) and were mapped directly onto black and white aerial photographs of the lakeshore, taken on 17 September 1975 (Department of Lands and Survey, SN2860). At that time the lake was open to the sea and at a level of 0.5 metres above mean sea level. The lakeshore was arbitrarily divided into five sections (Fig. 2) and all were mapped by field survey. The minimum mapping unit was approximately 1000 m<sup>2</sup>.

The area mapped extended from the lake edge (at low lake level) to an upper boundary between the 1.0 and 2.0 metre contours. This upper boundary usually marked a change from farmland/wetland vegetation to farm paddocks completely enclosed by fences. It should be emphasised that included were areas of farmland, raised stopbanks and sand dunes which cannot be classified as wetland. As all vegetation types on the shoreline have been mapped, it includes areas which are highly modified.

Fig. 2 Map Sections used in the Survey



- |   |             |
|---|-------------|
|  | MAPPED AREA |
| Map 1   | Taumutu     |
| Map 2   | Selwyn      |
| Map 3   | Greenpark   |
| Map 4   | Kaituna     |
| Maps 5A & 5B  | Kaitorete   |

## RESULTS

A total of fifty-four vegetation types have been identified and mapped. A compilation of the species found in these vegetation types is presented in Appendix 1.

The vegetation maps (Maps 1 - 4, 5A and 5B) are presented overleaf. Where a mosaic of more than one vegetation type is present in a mapping unit, a plus sign is used and the types are listed in decreasing importance in terms of area. For very complex mosaics only the three most important types are listed. For example an area mapped as 2Ba + 3Aca + 4Fa consists of a mosaic of: glasswort (Salicornia australis) and salt barley grass (Hordeum marinum) (2Ba), areas of sea rush (Juncus maritimus) over pasture grasses (3Aca), and other areas where marsh ribbonwood (Plagianthus divaricatus) is abundant (4Fa). In some cases boundaries between vegetation types may be well defined, while other types grade into each other. A boundary line drawn on the map may therefore indicate a gradual and not a sharp change in the vegetation. The vegetation types are listed and described below.

### List of Vegetation Types

1. Short plants only on flats of sand or mud: (<0.1 m tall)

1A Glasswort present

1Aa Glasswort and Puccinellia

1Ab Glasswort and Mimulus repens

1B Glasswort absent

1Ba Mimulus repens dominant

1Bb Lilaeopsis and Triglochin

2. Herbaceous species dominant (usually <0.75 m tall)

2A Grasses dominant

2Aa Agricultural crop

2Ab Dry mixed pasture

2Ac Wet mixed pasture

2Ad Creeping bent dominant pasture

2Ada Creeping bent essentially alone

2Adb Creeping bent with salt barley grass

2Adc Creeping bent with Selliera and Cotula



- 2Ae Tall fescue
- 2Af Silver tussock and Scirpus nodosus
- 2Ag Sand dune
  - 2Aga Marram grass
  - 2Agb Marram grass and pingao

- 2B Halophytic herbs dominant
  - 2Ba Glasswort and salt barley grass
  - 2Bb Selliera dominant

- 2C Rushes or sedges dominant
  - 2Ca Jointed rush dominant
  - 2Cb Schoenus with wet mixed pasture
  - 2Cc Carex sinclairii
  - 2Cd Carex coriacea

3. Herbaceous species dominant (usually >0.75 m tall)

- 3A Sea rush dominant
  - 3Aa Sea rush on mudflats
    - 3Aaa Sea rush with glasswort
    - 3Aab Sea rush without glasswort
  - 3Ab Sea rush with salt marsh
  - 3Ac Sea rush with pasture
    - 3Aca Sea rush with mixture of grass species
    - 3Acb Sea rush with creeping bent

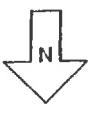
- 3B Leptocarpus
  - 3Ba Leptocarpus on mudflats
  - 3Bb Leptocarpus with creeping bent

- 3C Carex secta bog

- 3D Raupo
  - 3Da Raupo on mudflats
  - 3Db Raupo with creeping bent
  - 3Dc Raupo with monkey musk/peppermint bog

- 3E Flax
  - 3Ea Flax with grasses, rushes and rush-like plants
  - 3Eb Flax with Carex secta bog

MAP I  
Taumutu  
settlement -  
Drain Road



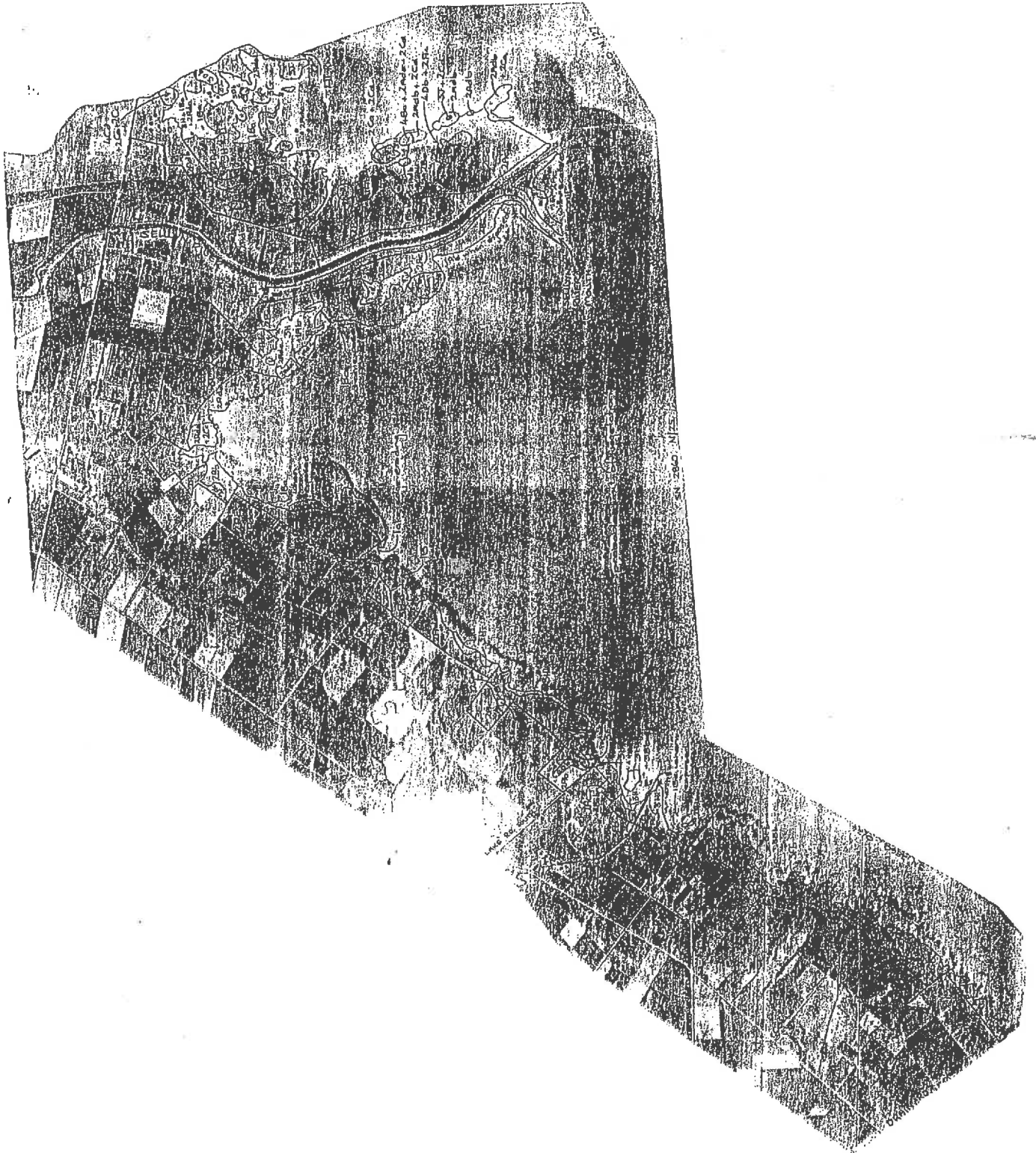
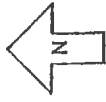
Scale: 1: 30 000



MAP 2

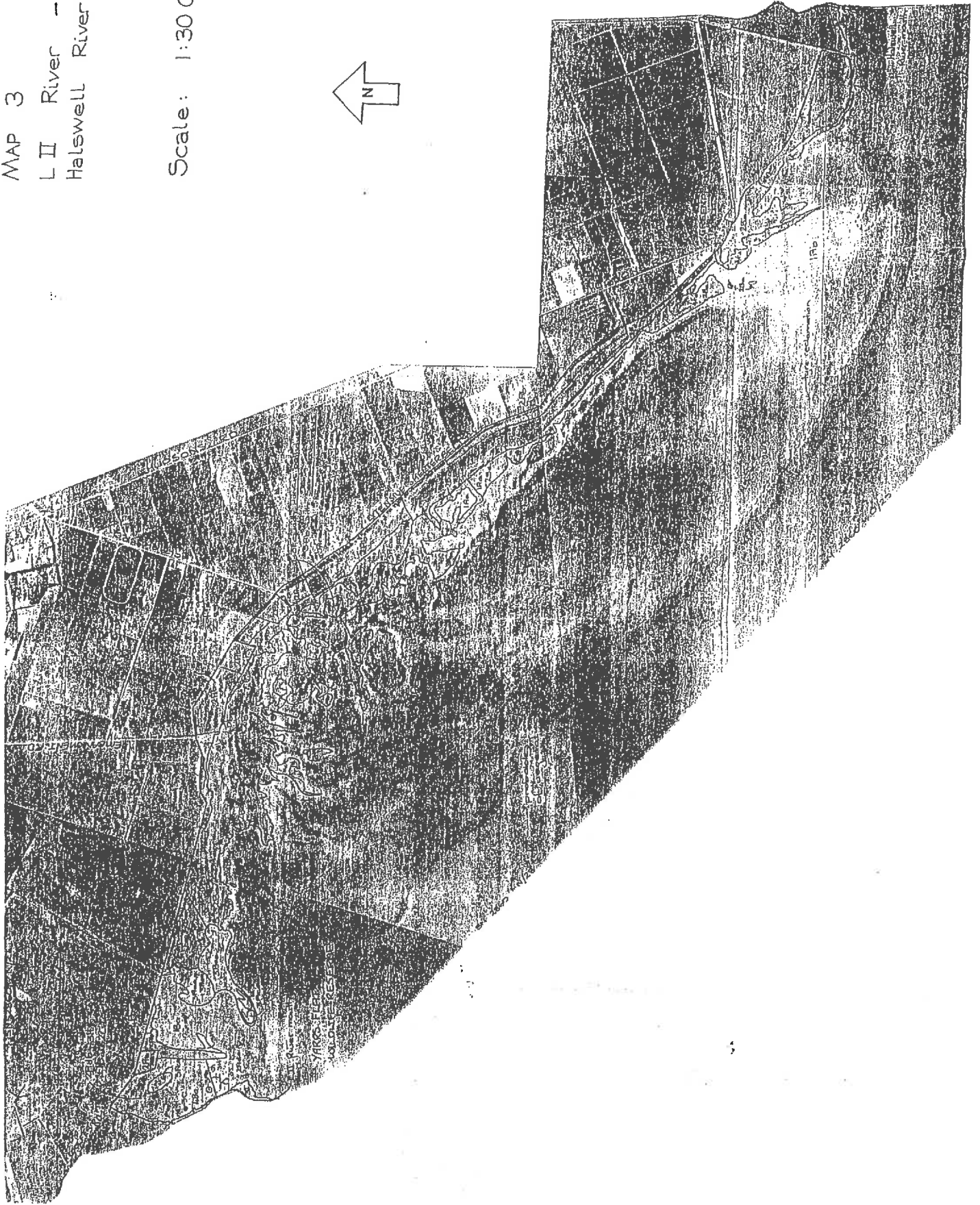
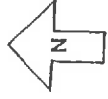
Drain Road -  
LII River

Scale: 1:30 000



MAP 3  
L II River -  
Halswell River

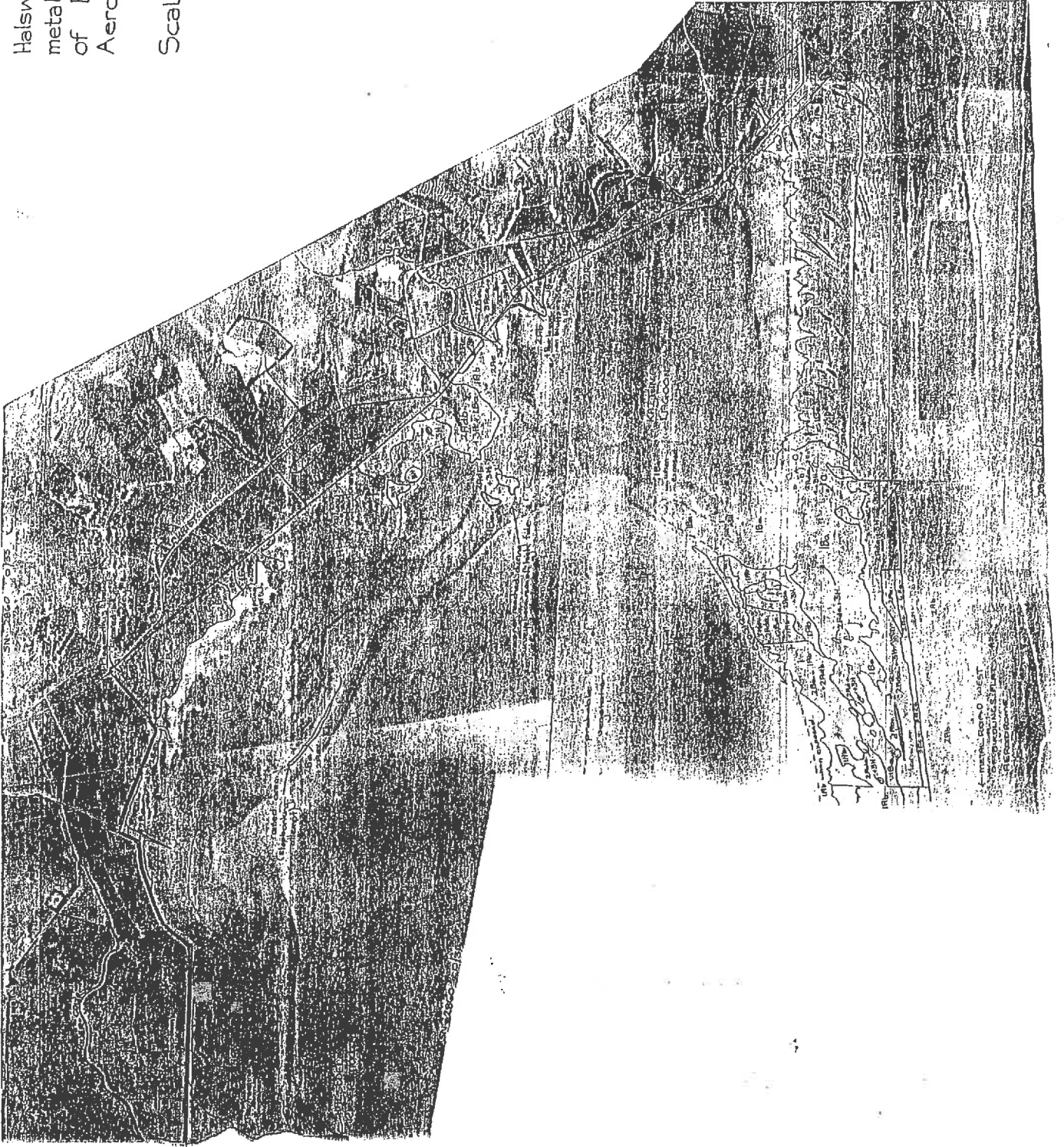
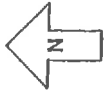
Scale: 1:30 000



MAP 4

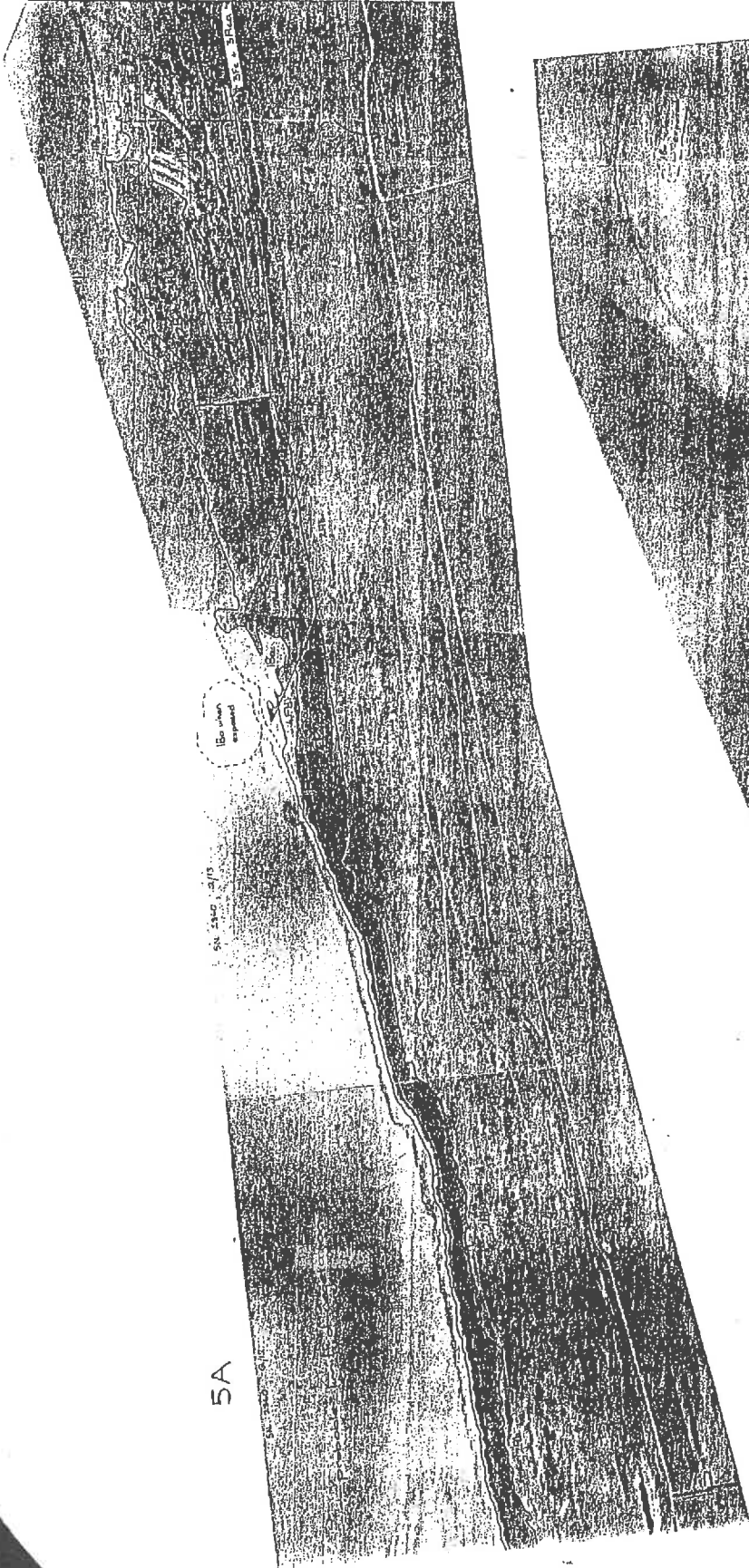
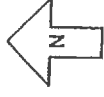
Halswell River -  
metal road west  
of Birdlings Flat  
Aerodrome

Scale: 1:30 000



MAPS 5A & 5B  
Metal road west  
of Birdings Flat  
Aerodrome - Lake  
opening

Scale: 1:30 000



3F Juncus gregiflorus

3Fa Dense J. gregiflorus

3Fb Open J. gregiflorus with creeping bent

3Fc Open J. gregiflorus with wet mixed pasture

3G Scirpus lacustris

3H Three-square

3I Scirpus caldwellii

3J Toetoe

4. Woody species abundant

4A Shelter

4B Crack willow dominant

4Ba Crack willow with herbaceous species beneath

4Bb Crack willow with grey willow and herbaceous species beneath

4C Grey willow dominant

4Ca Dense grey willow with Leptocarpus

4Cb Open grey willow with flax

4Cc Open grey willow with gorse

4Cd Open grey willow with crack willow and Carex secta, raupo and flax

4Ce Open grey willow with grasses, rushes and rush-like plants

4D Gorse

4Da Open gorse

4Db Dense gorse

4E Tree lupin

4F Marsh ribbonwood with sea rush

4Fa Marsh ribbonwood with sea rush and grasses

4Fb Marsh ribbonwood with sea rush on mudflats

4G Cutover pine plantation

LEGEND TO VEGETATION TYPES

1. Short plants only on flats of sand or mud: (<0.1 m tall)

Consists of low-lying land below the 1.0 metre contour but includes smaller, slightly higher areas subject to water ponding after high lake levels. The most extensive area of flats is the Greenpark Sands (Map 3).

1A Glasswort present

1Aa Glasswort and Puccinellia

On these sandy areas there is scattered glasswort with occasional Puccinellia stricta. This vegetation is present in sufficiently large areas to be mapped in only two locations, both on the Greenpark Sands.

1Ab Glasswort and Mimulus repens

Dominated by glasswort grading into one dominated by Mimulus repens, at lower elevation, it is the most abundant community of the lake flats below the 1.0 m contour and is characteristic of sandier, more saline sediments. The largest single area is on the Greenpark Sands where the upper margin of the flats is dominated by glasswort with occasional clumps of Puccinellia stricta. Towards the lake edge this vegetation is increasingly dominated by Mimulus repens. Mimulus is also dominant in hollows which are subject to water ponding. Common associated species in this type are Triglochin striatum and Cotula coronopifolia. Other, less common species include Samolus repens on raised areas up to one metre across, Scirpus cernuus, Lilaeopsis novae-zelandiae, Spergularia marginata and hastate orache (Atriplex prostrata).

1B Glasswort absent

1Ba Mimulus repens dominant

Dominated by Mimulus repens, this is found on silty, low salinity mudflats. Triglochin striatum is the most common associated species while Cotula coronopifolia and Lilaeopsis novae-zelandiae are sometimes abundant. Less common species include Scirpus cernuus and water milfoil (Myriophyllum propinquum). This vegetation is most common on the north-western shoreline (Maps 1 and 2) and at Kaituna Lagoon (Map 4). A narrow zone of three-square (Scirpus pungens) is often present on the upper, landward margin, but is too small to be mapped.



1Bb Lilaeopsis and Triglochin

Only in Harts Creek Wildlife Reserve (Map 1) was this community present. Consisting of only Lilaeopsis novae-zelandiae and Triglochin striatum, its peculiar feature is the absence of Mimulus repens.

2. Herbaceous species dominant (usually <0.75 m tall)

2A Grasses dominant

2Aa Agricultural crop

This includes cultivated land that was either planted with a field crop at the time of survey or left fallow. An example is the fields on the north-western lakeshore, south of Timber Yard Point (Map 1) which were planted in meadow barley (Hordeum secalinum) down to the 1.0 m contour. Another is a small area west of Taumutu settlement (Map 1) where dense fathen (Chenopodium album) had grown up as a weed on cultivated land.

2Ab Dry mixed pasture

This occurs on dry, freely draining land with stony, sandy soils. Sheep rather than cattle are usually grazed on this. Common grass species are hare's tail (Lagurus ovatus), Bromus mollis, silvery hair grass (Aira caryophyllea) and vulpia hair grass (Vulpia bromoides). Of the many other species present some of the more important are ripgut brome (Bromus diandrus), sheep's sorrel (Rumex acetosella), buck's-horn plantain (Plantago coronopus), haresfoot trefoil (Trifolium arvense), Calystegia soldanella, perennial ryegrass (Lolium perenne) and sweet vernal (Anthoxanthum odoratum). Occasional plants of silver tussock (Poa laevis) and Scirpus nodosus may also be present.

2Ac Wet mixed pasture

It occurs on poorly drained land usually grazed by cattle and dairy herds rather than sheep. Common grass species are perennial ryegrass, Yorkshire fog (Holcus lanatus), sweet vernal, crested dogstail (Cynosurus cristatus), creeping bent (Agrostis stolonifera), tall fescue (Festuca arundinacea), cocksfoot (Dactylis glomerata) and kneed foxtail (Alopecurus geniculatus). Also common are jointed rush (Juncus articulatus), Schoenus pauciflorus, strawberry (Trifolium fragiferum), red (T. pratense) and white (T. repens) clovers.

- 2Ad Creeping bent dominant pasture
- 2Ada Creeping bent essentially alone.  
This is a wet grassland dominated by creeping bent. In hollows, Cotula coronopifolia, Mimulus repens and Triglochin striatum are present. Cotula dioica and Selliera radicans are often present on the lakeward margin of this vegetation. Other species include Eleocharis acuta, tall fescue, three-square and Scirpus caldwellii. The most extensive areas of this occur on flat land of low salinity, just above the 1.0 m contour. Two examples are the eastern side of Selwyn Spit (Map 2) and the northern side of Kaitorete Spit near Kaituna Lagoon (Map 4).
- 2Adb Creeping bent with salt barley grass  
This differs from the preceding type only in that salt barley grass is usually present. Such vegetation is present in areas of slightly higher elevation and contains more salt tolerant species than 2Ada.
- 2Adc Creeping bent with Selliera and Cotula  
Here Cotula dioica and Selliera radicans are common in a wet grassland of creeping bent. Only along the north-western lakeshore was it present in areas sufficiently large to be mapped. Areas of this vegetation too small to be mapped may be present in type 2Ada.
- 2Ae Tall fescue  
Tall fescue dominates this wet grassland with creeping bent and sometimes couch (Agropyron repens) below. It is often found in areas of low salinity adjacent to the lake edge mudflats and is most plentiful around Kaituna Lagoon (Map 4).
- 2Af Silver tussock and Scirpus nodosus  
This is a depleted tussock grassland with silver tussock and Scirpus nodosus locally dominant, in combination with mixed dry pasture (as in type 2Ab). Also present are Carex flagellifera, Muehlenbeckia complexa, Carmichaelia appressa and Raoulia australis. Although in scattered locations on Kaitorete Spit, it only appears in the mapped area, on the western end of the Spit (Map 5B).

2Ag Sand dunes

2Aga Marram grass

Marram grass (Ammophila arenaria) occurs on the sand dunes near Taumutu (Map 1). Associated species are haretail, boxthorn (Lycium ferocissimum), Calystegia soldanella, Carex pumila and tree lupin (Lupinus aboreus). Scattered plants, or areas too small to be mapped, are present in dry pasture and along stopbanks in the Greenpark and Kaituna areas.

2Agb Marram grass and pingao

Similar to 2Aga, it differs only by the presence of pingao (Desmoschoenus spiralis). Within the survey area it is found only on the extreme western end of Kaitorete Spit, on a series of sand dunes between the lake and the sea. Pingao tends to be restricted to the seaward side of the dunes while marram grass is present on the lakeward side. As marram grass is absent eastwards along the Spit, this vegetation grades into one dominated by pingao only (Map 5B).

2B Halophytic herbs dominant

2Ba Glasswort and salt barley grass

A short vegetation dominated by glasswort and salt barley grass with buck's-horn plantain and hastate orache often present. Other species are Puccinellia stricta, sickle grass (Parapholis incurva) and barb grass (Hainardia cylindrica). It is a vegetation of sandy, saline areas slightly above the level of the lowest flats. The largest areas are those adjoining the Greenpark Sands (Map 3). At higher elevations, it often grades into a Juncus maritimus dominated community (vegetation type 3Aca or similar).

2Bb Selliera dominant

Selliera radicans is dominant and with Cotula dioica forms a dense, low growing carpet of herbs. Also present are Triglochin striatum, Eleocharis acuta, creeping bent, buck's-horn plantain and Lotus tenuis. Three-square may be abundant on the lakeward margin of this type while Mimulus repens and Lilaeopsis novae-zealandiae occur in hollows.

- 2C Rushes or sedges dominant
- 2Ca Jointed rush dominant
- This consists of either a bog of jointed rush or with this species locally dominant. The main associated species are usually monkey musk (Mimulus guttatus), Yorkshire fog, crested dogstail and kneed foxtail. Less common species are Eleocharis acuta, Microtis unifolia, Carex maorica, C. sinclairii, Juncus caespiticius, soft rush (Juncus effusus), toad rush (J. bufonius), peppermint (Mentha X piperita) and white clover. This type is most common along the north-western shoreline and on the Selwyn Spit (Maps 1 and 2). It is often the dominant vegetation of raised bogs.
- 2Cb Schoenus with wet mixed pasture
- Schoenus pauciflorus grows up to 0.75 m tall in wet pasture of Yorkshire fog, crested dogstail, creeping bent, kneed foxtail, sweet vernal and jointed rush. Only in one location on the north-western lakeshore was this vegetation present in an area of sufficient size to be mapped (Map 2).
- 2Cc Carex sinclairii
- Carex sinclairii grows up to 0.5 m tall with creeping bent below. Also common is Potentilla anserinoides. This type is present in a few locations on the north-western lakeshore.
- 2Cd Carex coriacea
- Carex coriacea dominates, usually with creeping bent below. Common are strawberry clover, Potentilla anserinoides and curled dock (Rumex crispus). Beneath the Carex coriacea, where boggy, are jointed rush, Juncus caespiticius, water forget-me-not (Myosotis caespitosa), water pepper (Polygonum hydropiper), lotus major (Lotus pedunculatus) and monkey musk. This type is present only on the Selwyn Spit (Map 2) and it had been heavily browsed by cattle at the time of survey.
3. Herbaceous species dominant (usually >0.75 m tall)
- 3A Sea rush dominant
- 3Aa Sea rush on mudflats
- 3Aaa Sea rush with glasswort
- Scattered plants of sea rush up to 1.0 m tall are found on flats of glasswort. Other species on the flats are Mimulus repens, Triglochin striatum and Cotula coronopifolia.

3Aab Sea rush without glasswort

Scattered plants of sea rush occur on mudflats but without glasswort. Other species on the mudflats are Mimulus repens, Triglochin striatum and Lilaeopsis novae-zelandiae.

3Ab Sea rush with salt marsh

In this case the 1.0 m tall sea rush has halophytic herbs such as salt barley grass, glasswort, buck's-horn plantain, creeping bent, Selliera radicans, Cotula dioica and C. coronopifolia beneath.

3Ac Sea rush with pasture

3Aca Sea rush occurs with a mixture of pasture grasses such as creeping bent, salt barley grass, sweet vernal and couch beneath. There may be occasional plants of marsh ribbonwood or Leptocarpus similis. Of the vegetation with sea rush dominant this is the most common, and is abundant in areas adjacent to the Greenpark Sands (Map 3).

3Acb Sea rush with creeping bent

Here sea rush has creeping bent (see type 2Ada) below.

3B Leptocarpus

3Ba Leptocarpus on mudflats

Leptocarpus similis grows up to 2.0 m tall on mudflats. It is present in only two locations on the north-western lakeshore (Map 1).

3Bb Leptocarpus with creeping bent

Like the previous type (3Ba) it is found only on the north-western lakeshore. It consists of Leptocarpus up to 2.0 m tall, but with a wet grassland of creeping bent beneath, this lower vegetation being type 2Ada.

3C Carex secta bog

These are small areas with Carex secta up to 2.0 m tall in a bog (see type 2Ca) with jointed rush and monkey musk. Although Carex secta is an associate species in other vegetation types (e.g. type 3Eb), it is dominant in a sufficiently large area to be mapped only on the Selwyn Spit (Map 2).

3D Raupo

3Da Raupo on mudflats

This has raupo (Typha orientalis) up to 3.0 m tall, growing on mudflats in areas of low salinity, such as in Harts Creek Wildlife Reserve (Map 1). There may be occasional trees of crack (Salix fragilis) or grey (S. cinerea) willow.

3Db Raupo with creeping bent

It differs from 3Da in being present at slightly higher elevations with creeping bent common. As with the previous type, occasional willow trees may be present.

3Dc Raupo with monkey musk/peppermint bog

Present in only one location on the north-western lakeshore (Map 1), it has raupo above a bog of monkey musk and peppermint.

3E Flax

3Ea Flax with grasses, rushes and rush-like plants

New Zealand flax (Phormium tenax) occurs up to 4.0 m tall over Juncus gregiflorus, J. distegus, creeping bent, Yorkshire fog and sweet vernal. It occurs in only two locations around the shoreline. On the north-western lakeshore (Map 2) it occurs with Leptocarpus similis, and near the end of Kaitorete Spit (Map 5B) with sea rush.

3Eb Flax with Carex secta bog

This has flax up to 4.0 metres tall in a bog (type 3C) with Carex secta jointed rush, monkey musk and grasses.

3F Juncus gregiflorus

3Fa Dense Juncus gregiflorus

A dense rushland of Juncus gregiflorus up to 2.0 m tall, with creeping bent beneath. It occurs in two locations on the north-western shoreline, near Harts Creek (Map 1), and the LII River (Map 3).

3Fb Open Juncus gregiflorus

The clumps of Juncus gregiflorus are scattered in a wet pasture of creeping bent (as in type 2Ada). Juncus distegus is often present and may be locally dominant.

3Fc Open Juncus gregiflorus with wet mixed pasture

An open rushland with scattered clumps of Juncus (usually J. gregiflorus) and with wet, mixed pasture of introduced grasses and clovers (as in type 2Ac). Juncus distegus is often present and may be locally dominant.

3G Scirpus lacustris

Small stands of Scirpus lacustris up to 2.0 m tall occur on mudflats of low salinity and most commonly near the mouth of the LII River (Map 2).

3H Three-square

Three-square occurs up to 1.0 m tall, both on the upper margin of mudflats and on low-lying land subject to inundation and water ponding. It prefers a mud or silt substrate and is most abundant around Kaituna Lagoon (Map 4) and as a narrower zone along the north-western lakeshore (Map 2). In sandy areas such as the Greenpark Sands (Map 3) it is absent, except along drainage channels where silt is deposited. Three-square is summer-green and dies down completely during the winter. It is for this reason that during winter months, areas mapped as type 3H have the appearance of either bare mudflats or wet grassland of creeping bent. Common associated species include Mimulus repens, Cotula coronopifolia, Lilaeopsis novae-zelandiae, Triglochin striatum, creeping bent and beard grass (Polypogon monspeliensis).

3I Scirpus caldwellii

Although not as abundant as the previous type, Scirpus caldwellii occurs in similar silty but less saline areas. Associated species are the same as for type 3H while there may be occasional plants of three-square. S. caldwellii is most common near the LII River mouth (Map 2) and around the northern shores of Kaituna Lagoon (Map 4).

3J Toetoe

Toetoe (Cortaderia richardii) grows up to 3.0 m tall above a bog with monkey musk or above a wet grassland of creeping bent, Yorkshire fog and white, red and strawberry clovers. Other species are water pepper, Lotus major and creeping buttercup (Ranunculus repens). It is present only on Selwyn Spit (Map 2) and had been heavily browsed by cattle at the time of survey.

4. Woody species abundant

4A Shelter

Shelter belts or stands of trees up to 20 metres tall. The most common species used are Pinus radiata and macrocarpa (Cupressus macrocarpa). Less common are Lombardy poplar (Populus nigra cv. 'Italica') and Eucalyptus sp.

4B Crack willow dominant

4Ba Crack willow with herbaceous species beneath  
Crack willow up to 10 m tall over bare ground, bogs, or grasses and rushes. The great diversity of species includes creeping bent, monkey musk, celery-leaved buttercup (Ranunculus sceleratus), peppermint, plicate sweet grass (Glyceria plicata), Yorkshire fog, crested dogstail, Carex secta and Juncus gregiflorus. It is usually found as a small stand or a narrow riparian strip along the edge of waterways.

4Bb Crack willow with grey willow and herbaceous species beneath  
This differs from the previous in that grey willow is present on both the margins of the stand of crack willow and in light gaps. It is usually characteristic of large stands of willows such as those found in Harts Creek Wildlife Reserve (Map 1).

4C Grey willow dominant

4Ca Dense grey willow with Leptocarpus  
Dense stands of grey willow up to 4.0 metres tall occur with Leptocarpus similis beneath. Other species often present are Juncus gregiflorus and Baumea rubiginosa. It is present only in, and adjacent to, Harts Creek Wildlife Reserve (Map 1).

4Cb Open grey willow with flax  
Grey willow up to 6.0 metres tall over New Zealand flax. Other species are Juncus gregiflorus, J. distegus, creeping bent, Yorkshire fog and sweet vernal.

4Cc Open grey willow with gorse  
It again consists of open grey willow up to 6.0 m tall but with gorse (Ulex europaeus) and pasture grasses and clovers (see type 4Db).

4Cd Open grey willow with crack willow and Carex secta, raupo and flax  
Scattered grey willow with occasional crack willow and a bog of Carex secta, raupo and New Zealand flax beneath. Only on the eastern side of Selwyn Spit (Map 2) was this type present in sufficiently large area to be mapped.

4Ce Open grey willow with grasses, rushes and rush-like plants  
Here scattered grey willow occurs in a wet grassland with Leptocarpus similis, Schoenus pauciflorus, Juncus gregiflorus and J. distegus. Common grass and clover species include sweet vernal, creeping bent, Yorkshire fog, crested dogstail and white, red and strawberry clovers.



4D Gorse

4Da Open gorse

Usually cutover gorse with grasses, clovers and rushes. Common species are sweet vernal, creeping bent, Yorkshire fog, crested dogstail, and white, red and strawberry clovers. Rushes include Juncus gregiflorus, J. distegus, jointed rush and soft rush. Species sometimes present include Schoenus pauciflorus, Leptocarpus similis and grey willow.

4Db Dense gorse

Dense stands of gorse up to 3.0 m tall with grasses and clovers beneath. Common species are Bromus mollis, Yorkshire fog, perennial ryegrass, salt barley grass and white, red and strawberry clovers.

4E Tree lupin

Tree lupin grows up to 3.0 m tall in a dry mixed pasture (as in type 2Ab). There are occasional plants of boxthorn up to 4.0 m tall, and gorse. Boxthorn may be locally dominant over the tree lupin. The only occurrence of this type is a large area centred around the Taumutu settlement (Map 1).

4F Marsh ribbonwood with sea rush

4Fa Marsh ribbonwood with sea rush and grasses

Marsh ribbonwood with Juncus maritimus over grasses and herbs. Creeping bent is the most common grass at low elevations near the lake, while further back salt barley grass, couch, Yorkshire fog and sweet vernal are more important. Common turf herbs are Selliera radicans and Cotula dioica, while Scirpus nodosus and Juncus distegus are taller species often present. Less common are Leptocarpus similis, Juncus pallidus and Carex flagellifera. This type is most abundant in sandy areas such as along the lakeward margin of the Kaitorete Spit (Map 5A and 5B).

4Fb Marsh ribbonwood with sea rush on mudflats

Marsh ribbonwood is dominant with sea rush, but over mudflats with Lilaeopsis novae-zelandiae, Triglochin striatum and Mimulus repens. Also present with the ribbonwood are Cotula coronopifolia, C. dioica and Selliera radicans. This type occurs only in one location on the Kaitorete Spit (Map 5A).

4G Cutover pine plantation

This is present only on Timber Yard Point (Map 1). It is a cutover plantation of Pinus radiata and consists of logging slash with some trees still remaining. The area has been invaded by gorse, blackberry (Rubus fruticosus), grasses and weeds.

DISCUSSION

Summary of the Vegetation Patterns

The lagoon at Taumutu has marram-covered sand dunes on the seaward side and dry, sandy farmland landward, except around the village itself where lupins dominate. In the still waters behind a promontory at the far end there is a small patch of raupo.

The point immediately north of the township is covered by lupin with some sea rush at lower elevation. In the large bay beyond, there is a change from sandy soils in the south to muddier ones northwards. The southern third is mostly a saline marsh of glasswort and sea barley grass grading into lupin on higher ground. The seaward edge is eroding. The central part has its lakeside edge dominated by three-square with a mixture of halophytes, pasture, rushes and sedges behind. In the northern third, three-square is again absent but there is a muddier vegetation with Mimulus repens, Lilaeopsis and Triglochin grading into a wet marsh/grassland mixture and either leptocarpus, rushes or wet pasture at higher elevation.

The two points to the north are again different, being sea rush dominated with herbs of mud flat or saline marsh between. At higher elevation the vegetation would have originally been a rushland of Juncus gregiflorus, but most has been cleared for agricultural crops and only one area remains. Extensive flats in the bay northwards are Mimulus, Lilaeopsis and Triglochin dominated. The southern end has sea rush and three-square, but northwards this changes into sea rush with pasture, and eventually a wetland mixture of raupo, jointed rush, monkey musk, and creeping bent with patches of gorse.

The point south of Timber Yard Point is an extremely complex mosaic of rushland, sedgeland and pasture, and contains numerous wetland species including a greater proportion of natives than elsewhere around the lake edge. The bay before Timber Yard Point has a large area of mudflat with either willow, rushland or agricultural land behind. Timber Yard Point in contrast has been extensively modified and has little wetland vegetation. A pine plantation at the landward end has been cut over and is now mostly gorse and blackberry amongst the wood remains. The rest is parkland with a conifer shelter belt down the centre. The largest of the Garibaldi Islands is conspicuous because of the dense, tall stand of crack willow over most of it.

North of this is the extensive wetland of Harts Creek Wildlife Reserve. This is a diverse wetland which is described in detail in Appendix 2. There are extensive mudflats with large patches of raupo and smaller areas of leptocarpus scattered on these. Crack and grey willow have spread over much of the wetlands and only deeper water ponds have remained bare. Remnants of the former vegetation include modified Juncus gregiflorus and wetlands of leptocarpus and Baumea, only recently invaded by grey willow.

Immediately beyond Harts Creek much of the wetland has been converted to farmland leaving a narrow band of leptocarpus with creeping bent and grey willow. North of Drain Road there is also marsh ribbonwood but no grey willow, in an area in which the native vegetation is in excellent condition, there being little sign of grazing. In the vicinity of Collets Road the shoreline vegetation is a narrow strip of short and tall rushes and related species in various stages of conversion to pasture. The main species of these are Juncus gregiflorus, Schoenus pauciflorus and leptocarpus. West of Lake Road South there are two small bays, the protection available within allowing the establishment of mudflat vegetation of three-square below the rushland and pasture.

Immediately north-east of Lake Road South however, the vegetation is vastly different and extremely diverse. Much of the area has been invaded by crack willow and has never been cultivated although it is intensively grazed. This means that apart from the areas of willow, the original vegetation pattern remains, even though many of the species have suffered from grazing and some more sensitive ones will have disappeared. This is especially so around the lower edge of the willows, adjacent to the three-square dominated mudflats, where a narrow but diverse zone of rushes and sedges exists. Behind the willows there are also some uncultivated but heavily grazed areas, many with flax, and others which have been invaded by gorse.

Further west a pasture of almost pure creeping bent indicates complete clearing of the native vegetation. Only small patches of three-square remain in protected bays. South-west of the end of Dickies Road rushes again appear, especially Juncus gregiflorus and leptocarpus, while on the area of land which extends into the lake they are more important. The lower part of this has creeping bent, but at higher elevations this species is joined by Carex sinclairii jointed rush, Juncus gregiflorus and many less common wetland species. In the protected bay between this point and the Selwyn River delta, there is sufficient protection for areas of mudflats to be colonised by Mimulus

and Triglochin. Above this the vegetation is mostly creeping bent, but there are some remnants of areas of halophytic herbs such as Selliera and Cotula dioica as well as Juncus gregiflorus and a patch of crack willow with Carex secta, on the Selwyn River side.

The western side of the Selwyn River delta is a mixture of pasture and halophytic herbs. Against the stopbank, pasture grasses dominate, but out from this they are replaced firstly by glasswort and salt barley grass, and further out still by the shorter halophytic herbs Selliera and Cotula dioica. Creeping bent and jointed rush are important in some raised areas. There are also two large lower-lying areas of sand flat with sparser glasswort and Mimulus vegetation along with areas of three-square.

The eastern side is similar in the upper zones with pasture and extensive areas of glasswort and salt barley grass as well as lower-lying glasswort and Mimulus patches. Around much of the raised lower edge however, the vegetation is quite different, being a complex mixture including a rushland and sedgeland of jointed rush and Carex coriacea, creeping bent, a patch of crack willow, toetoe, and a small area of gorse. In the protected bay, the glasswort is replaced by creeping bent and three-square. There are extensive mudflats of Mimulus, Lilaeopsis and Triglochin below. The western bank of the LII River on the opposite side of the mudflats is vastly different with extensive stands of Scirpus caldwellii with some marginal Scirpus lacustris. There is also an area of raupo with a few willows. Within this bay there are three areas where willows are important. The smallest is crack willow above Carex secta and Juncus gregiflorus. The others have grey willow with scattered crack willow above a raised bog with raupo, Carex secta and flax in one, and creeping bent, Carex sinclairii and jointed rush along with these in the other.

The Yarrs Flat Wildlife Reserve on the eastern side of the LII River has been described in detail in Appendix 2. It includes a stand of willows against the river bank with a highly modified pasture and mudflats behind. The pasture is mostly creeping bent while the mudflats are three-square or Mimulus and Triglochin. A raised promontory has a mixture of sea rush and glasswort with halophytic herbs, while beyond this there is a wide bay of mudflats, with Mimulus and Triglochin and some three-square around the edge. The effects of this bay extend far inland as a stand of increasing density of marsh ribbonwood and sea rush, first on mudflats and later with grasses beneath. The eastern side of the bay rises more gradually and therefore has mudflats of scattered sea rush with occasional raised areas of grasses and halophytic herbs below.

At higher elevations there is a marsh ribbonwood and sea rush mixture which grades into a ribbonwood dominated grassland further inland.

Beyond this is the extensive area of the Greenpark Sands. Apart from the extreme upper edge, they are essentially the same right down to beyond Greenpark Huts. The extensive areas of sand flats have scattered glasswort and Mimulus, with Triglochin plentiful. At their upper limit there is an abrupt change into a complete cover of glasswort and salt barley grass. The area inland of this usually has a zone of sea rush with creeping bent or other grasses, or occasionally glasswort beneath in hollows. Further above this there is usually dry pasture and a shelter belt. Near Jarvis Road there are sparse areas of scattered Puccinellia and Salicornia. At Greenpark Huts there are areas with marsh ribbonwood on the raised ground.

Around the corner from the Greenpark Huts there is an abrupt change as a consequence of stopbanking which results in the sandflats being eliminated. The vegetation here is glasswort and salt-barley grass with marsh ribbonwood and sea rush. This continues to the west bank of the Halswell River except for an area of mudflat adjacent to the channel. The east side of the river has extensive areas of glasswort and Mimulus on mudflats, except for some sea rush adjacent to the river. The glasswort and Mimulus dominate right round to Kaituna Lagoon. Above this are areas of glasswort and salt barley grass which vary from a narrow band below stopbanks to extensive stands. Near where the stopbanks reach the road, there are also areas of marsh ribbonwood although some of these were being cut at the time of the survey. Near Kaituna Lagoon there are areas of three-square on the mudflats and creeping bent on the raised areas. Behind the stopbanks the vegetation is dominated by sea rush and creeping bent.

The eastern side of Kaituna Lagoon is extremely complex. Inside the stopbanks there is a mixture of sea rush and pasture except for one area of mudflats with Mimulus, Triglochin and Cotula coronopifolia. Outside is essentially uncolonised mudflats except for small areas which have been colonised by glasswort and Mimulus and occasionally Scirpus caldwellii, and waste pasture of tall fescue and creeping bent at higher elevations. In the eastern corner of the lagoon the northern side is pasture of tall fescue, creeping bent and other species, except for some flats of glasswort and Mimulus. The southern side has mudflats of Mimulus and Triglochin below creeping bent pasture and three-square. In this there are elongated hollows of mudflats similar to those at lower elevation. The flats separating the lagoon from the rest of the lake are similar to those inside.

Kaitorete Spit immediately beyond Kaituna Lagoon has a raised strip outside a zone of mudflats and further raised areas adjacent to the Spit itself. Further down the Spit the area of mudflats abruptly disappears at a stopbank. Both raised areas have creeping bent with some salt barley grass and Selliera on the highest areas, with glasswort, Mimulus and occasional three-square on lower areas. The mudflats have Mimulus and Triglochin dominant. The edge of the Spit itself has dry pasture with zones of creeping bent and three-square between. Immediately adjacent to the dry pasture there are sometimes areas of sea rush, Juncus gregiflorus and marsh ribbonwood. As the Spit extends westwards, sea rush becomes more important, both on the raised area adjacent to the lake and on the Spit itself. Where these join, the zone beneath the dry pasture is a mosaic of sea rush, three-square, creeping bent and salt barley grass.

Westward, the second of the two fences diagonal to the shoreline marks important vegetation changes. The area between the two fences is similar to that eastwards but with less three-square and an increase in the importance of creeping bent. A small bay and an island of mudflats in the lake have Mimulus and Triglochin. A change in the vegetation pattern commences beyond the second fence and extends westward to where the Spit suddenly narrows. There is a narrow zone of mudflats with marsh ribbonwood and sea rush, and at higher elevations these species, but with grasses beneath. Above this again are raised areas of dry pasture although patches of sea rush occur in wet areas amongst this at the western end. The vegetation becomes more complex as the Spit narrows. The dry pasture here is less modified, containing silver tussock and Scirpus nodosus. A large area of exposed mudflats which extend into the lake has Mimulus and Triglochin, while closer to the shore Mimulus occurs with glasswort. Marsh ribbonwood is found as a narrow band along part of the edge, as are patches of sea rush and flax. Small islets on the western side of the mudflats have both sea rush with halophytes and areas of silver tussock and Scirpus nodosus.

The narrow spit down to the lake opening has dunes of coarse sand containing pingao seaward and marram behind. They continue eastward along the Kaitorete Spit itself, but with pingao dominant.

## Causes of the Vegetation Patterns

The large number of vegetation types and the many more combinations of these reflect the great differences in habitat around the shoreline. Most of this variation can be explained in terms of two natural environmental features: elevation in relation to inundation, and composition of the substrate. This can be overlaid by the effects of human disturbance which has produced a complex mosaic through the many forms it has taken. As with salt marshes it is convenient to divide the lakeshore vegetation into three elevational zones: lower, middle and upper (Partridge, 1981), although the middle zone may sometimes be obscure (Chapman, 1960).

The lower zone around Lake Ellesmere consists of the sand and mudflats. These are inundated for long periods when the lake is closed but may also receive long periods of exposure in summer or when the lake is open. Species in the lower zone must be tolerant of water-logging, and if small, submergence. Some however, although rooted in water, are tall enough to grow above its surface. Amongst these are raupo, sea rush, three-square, Scirpus lacustris and S. caldwellii. Shorter species however must be able to survive long periods of complete inundation. These include species such as Mimulus repens, Triglochin striatum, Lilaeopsis novae-zelandiae, Cotula coronopifolia and glasswort. The actual vegetation type present in the lower zone seems to be determined largely by soil composition. Sandy areas are subject to drying when exposed, such drying tending to increase the concentration of salt in the soil, thus favouring the halophytic species such as glasswort. Lower zone halophytes must also be tolerant of waterlogging however, and species such as salt barley grass are excluded. Of the taller species, sea rush and three-square are the most salt tolerant although both can survive well in fresh water. Three-square prefers muddy substrates or areas where water ponds, and tends not to occur in the sandiest areas. The less salt tolerant marsh ribbonwood is restricted to the upper edge of the mudflats. Least tolerant species occur on freshwater flats and on the muddiest soils where drying is rare and the small amount of salt is never concentrated. Of the shortest species Mimulus has low tolerance and Lilaeopsis and Glossostigma elatinoides even less. These last two species are found on the very muddy sediments in the sheltered Harts Creek area. Triglochin is tolerant of both salt and the reducing, waterlogged conditions often found beneath mudflats. It is widespread, from the sandy soils of Greenpark Sands to the muddy flats of Harts Creek. Of the taller species intolerant to salt, raupo, leptocarpus, Scirpus caldwellii and crack willow occur right out on the mudflats of the freshwater muddy areas only.



The middle zone is most obvious on the sandy saline areas. It is there characterised by an increased density of glasswort and the appearance of salt barley grass to form an almost complete cover. The second of these species probably avoids the winter inundation as a result of its annual life cycle, growing only in summer and producing seed quickly. These saline areas are even saltier than the mudflats below. Because of the longer periods of emergence and a lower water table, concentration of salt is greater, as can be seen in the absence of all but the most tolerant species. In extremely dry periods a crust of salt can sometimes be seen amongst the glasswort. Amongst this vegetation, in hollows where water ponds before drying out, salinity can reach the greatest extremes. The patches of glasswort and Puccinellia stricta on Greenpark Sands are examples of these. Where salinity is lower and the soil is wetter, the typical species of the middle zone are Selliera radicans and Cotula dioica. In even less saline areas, numerous species intolerant of salt such as leptocarpus, marsh ribbonwood, Carex flagellifera and many others, are the native components of the vegetation. Sea rush occurs in all but the most sandy areas but seems to prefer those which are saline. Within the middle zone on these low salinity soils however, creeping bent has replaced many of the smaller species. Selliera only persists in places where its greater salt tolerance gives it an advantage. Where the taller species have not been cleared, creeping bent is usually found between or climbing amongst these and where they have been cleared it tends to dominate.

The upper zone is where the vegetation of the lake edge meets that of the surrounding land. Except in the swamiest areas the latter has now the vegetation of farmland or waste areas. Furthermore many of the swamps have been invaded by either crack or grey willow and remnants of either raised bogs of Carex secta, swamps of leptocarpus or flax lands remain, often beneath these trees. It is therefore, adjacent land management practices which mostly determine this vegetation. The sandiest areas have been invaded by marram grass and lupin, there being only remnants of Scirpus nodosus, pingao and silver tussock left. Areas which were once farmed have been invaded by tall fescue and creeping bent. Most of the saline to slightly saline areas would have had marsh ribbonwood and sea rush in the raised parts. These species are fairly tolerant of farming without clearing, and still persist in such places as Kaitorete Spit and in parts of the Greenpark Sands. The rushes and sedges of freshwater swamps are more easily damaged and remnants of heavily grazed Carex sinclairii and square-stemmed sedge (Lepidosperma australe) are far more common than healthy plants.

Much of the wetland vegetation of the shoreline of Lake Ellesmere displays a high degree of seasonality, there being many summer-green species. For instance, areas close to the west bank of the LII River (mapped as 3i on Map 2) have the appearance in winter of a wet grassland of creeping bent, while in summer have a dense growth of 1.0 m tall Scirpus caldwellii. Other summer-green species worthy of note are raupo and three-square. In summer three-square can occupy extensive areas of mudflats which are almost devoid of vegetation during the winter months. With such features the shoreline has quite a different appearance at different times of the year. It is therefore important to consider these differences in the interpretation of the vegetation patterns.

The effects of farming around the lake edge are not restricted to the farming practices already indicated, but include the far greater changes caused as a result of reclamation through stopbanking and ditching. The greatest concentration of stopbanks is in the area from Greenpark Huts to Kaituna Lagoon, although many were built as embankments for roading and the former railway. The areas behind have been converted to pasture with varying success. This has often been dependent upon the ability to remove water from within the area behind the stopbank. The most commonly used scheme for this is single direction openings to the lake although there is also a pumping station to help drain land near the mouth of the Halswell River. In the case of shorter vegetation such as that dominated by glasswort, leaching of the salt is necessary before pasture can establish. Where rushes, sedges and marsh ribbonwood were present these have usually been cut. Provided water is not allowed to pond, the taller species have been permanently eliminated by grazing and replaced by pasture. Where not removed, ponded water has meant that grazing of the rushes and sedges and establishment of pasture, are less likely to take place. These areas revert to taller vegetation, usually of sea rush and three-square. The stopbanking within this area has resulted in land which has been both successfully and unsuccessfully reclaimed. If successful, the loss is of an area of wetland. Where unsuccessful, the loss is of the natural lake edge. Another form of reclamation has been the ditching and straightening of natural watercourses flowing into the lake. By keeping this water away from the land it would normally meander over and pond in, areas of former wetland have been made sufficiently dry for pasture to be established. The lowering of the water table has been of particular importance in the replacement of the original vegetation.

Erosion of the lakeshore is evident in many areas but is only of local importance. It is most apparent on exposed raised areas of short vegetation adjacent to the lake edge rather in areas where taller species dominate.

An example of an area of lakeshore where erosion is apparent, is the large bay north of Taumutu where the plant covering on the edge consists of creeping bent and halophytic turf herbs which are insufficient to protect the edge from wave action. Where three-square is present the rate of erosion is considerably slowed through the binding power of the rhizomes (Fig. 3). The establishment of three-square in areas immediately below the eroding edge also seems to be halting the process. A similar plant cover is present on large sections of shoreline on the eastern end of Kaitorete Spit. On small promontories and where the protection of three-square is absent, erosion is often taking place. The erosion of headlands is probably a natural phenomenon. It is however, unlikely to be a continual process, as the cutting back of the edge will eventually form a small bay in which mud and sandflat species can establish in the calmer conditions, initiating sedimentation.

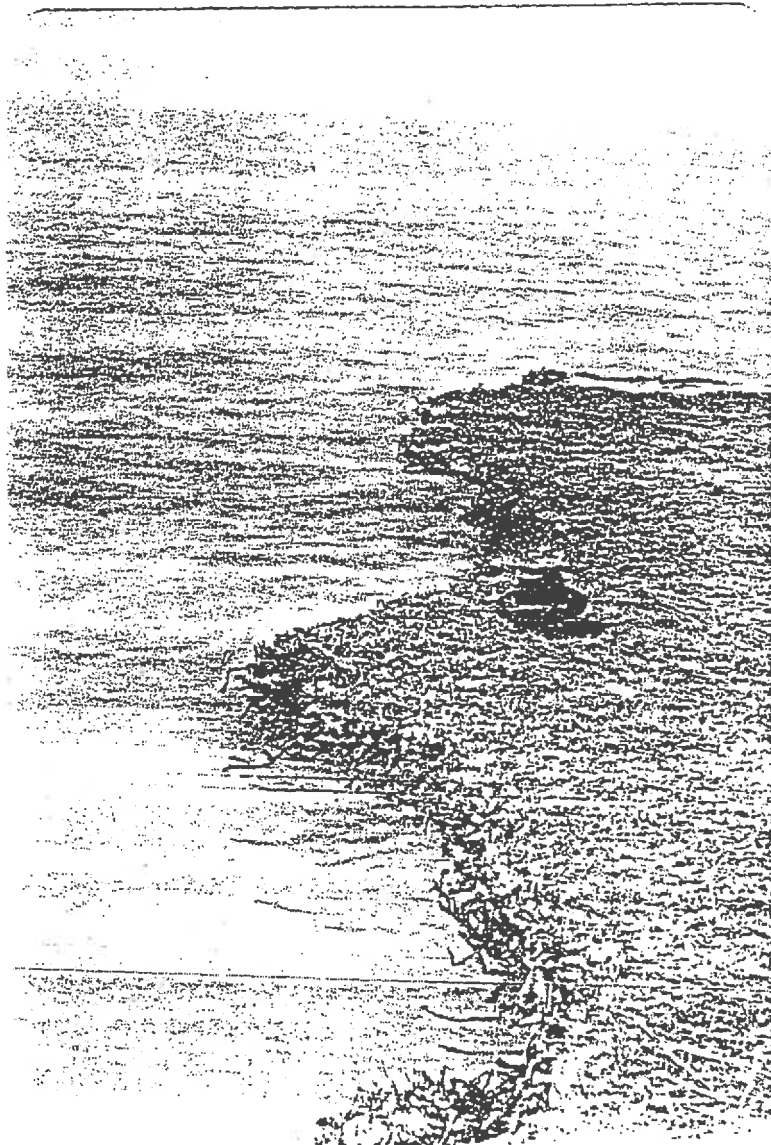


Fig. 3

Near Taumutu, September 1982.

Lake approximately 0.7 m above mean sea level. Photograph shows the importance of lake edge vegetation for erosion control. Mass of rhizomes of three-square probably helps to keep bank intact although some erosion is still occurring.

## Significant Species of the Shoreline

### Native Plants

Although a great number of native plant species have persisted around the shoreline (Appendix 1), many now have an extremely restricted distribution. These must be regarded as possible future losses from the area to join those others that have probably already disappeared. A brief article on the rare plants, previously published in the Canterbury Botanical Society Journal, appears as Appendix 3.

Baumea rubiginosa, not previously recorded from Lake Ellesmere and considered rare in Canterbury (Moore and Edgar, 1970) has been found at a number of locations on the north-western lakeshore. It occurs in greatest quantity in Harts Creek Wildlife Reserve, where it is growing with leptocarpus and being invaded by grey willow. It is in danger of being completely shaded out by the latter. Baumea has also been found in small, boggy areas, close to the lake south of Timber Yard Point where it is easily overlooked because of heavy grazing and a superficial resemblance in its vegetative state to species of Juncus. Continued grazing in these areas will inevitably lead to an even greater decline in its distribution.

The square-stemmed sedge (Lepidosperma australe) is present in wet pasture and boggy places in only a few locations north and south of Timber Yard Point. It is invariably heavily grazed when found and was probably once far more widespread.

The native nettle Urtica linearifolia is often found along the north-western shoreline. It is usually found growing over trunks of Carex secta or sometimes scrambling amongst leptocarpus under willows.

Other unusual plants sometimes found in boggy places along the north-western shoreline include bladderwort Utricularia monanthos, a native sundew Drosera binata and a rare native orchid Spiranthes sinensis.

Two clumps of Cyperus ustulatus have been found growing on the banks of the Irwell River, near its mouth, north-east of Hanmer Road. This large sedge had not previously been recorded at Lake Ellesmere and is rare in Canterbury. It reaches its eastern, southern limit for New Zealand, just south of Lake Ellesmere, at the mouth of the Rakaia River.

Immediately north-east of the end of Lake Road South is the largest area of flax (Phormium tenax) remaining at Lake Ellesmere. Parts of this area are still subject to burning for conversion to farmland. The only other area of flax around the lake edge is a smaller remnant near the end of Kaitorete Spit.

Small stands of the tall sedge, Scirpus lacustris are present around the mouth of the LII River and smaller remnants are present both near the mouths of the Selwyn and Kaituna Rivers, and on the lake edge two miles north-west of the Taumutu settlement.

Along the seaward side of Kaitorete Spit and occurring in the mapped area at its western end, is the native sand binding plant pingao (Desmoschoenus spiralis). It is becoming increasingly uncommon along the N.Z. coastline because of disturbance and subsequent invasion by marram grass. Although dominant on sand dunes further east along the Spit, on the extreme western end near the lake opening site pingao is present with marram grass and is probably undergoing a slow decline.

Present in the survey area on the western end of Kaitorete Spit and widespread on the remainder of the Spit is a native broom, Carmichaelia appressa. This species is found only on Kaitorete Spit. Although not within the scope of this survey, it should be noted that many other species present on the Spit have disappeared from sand dune areas elsewhere in New Zealand (Molloy, 1971).

#### Introduced Plants

The original plant communities on the shoreline of Lake Ellesmere have been extensively modified by the invasion of introduced plant species. Some of these species appear to have reached the extent of their spread while others will probably continue to invade existing plant communities.

The character of much of the vegetation of the lakeshore flats has been changed by the widespread invasion of salt barley grass into glasswort dominated vegetation in areas subject to infrequent inundation. As this species is an annual, its rate of spread would have been rapid and it now appears to occupy all areas available to it.

Also widespread but in areas subject to more frequent inundation, is creeping bent which forms extensive areas of wet grassland around the lakeshore. This species is most abundant where the original vegetation of halophytic turf

species, rushes or sedges has been modified or completely removed by farming and grazing. Although spreading by vegetative means its growth rate is so rapid (Partridge, 1981) that colonisation of the available habitats would have taken place within a very short time.

Many wetland areas around the shoreline of Lake Ellesmere have been invaded by species of willow and many more areas are suitable for colonisation. In the recent past, crack willow was the main species used in plantings near the lake edge and most older stands contain this species. Along the north-western shoreline invasion of marginal wetland habitats by grey willow is common. Usually spreading from mixed stands of crack and grey willow and often into areas containing predominantly native plant communities, these woody species eventually shade out the former vegetation.

## CONCLUSIONS AND RECOMMENDATIONS

Only remnants of once extensive and diverse wetlands remain around the margin of Lake Ellesmere. With the exception of some lower elevation sand and mudflat communities, all show extensive modification through farming and reclamation and the introduction of adventive species. Native plants only persist where it has proved impossible or uneconomic to completely convert the land to pasture. High seasonal salinity has protected some of the areas of halophytes and these have fared better than the fresh water wetlands. The introduction of salt tolerant weeds such as salt barley grass and buck's-horn plantain have however altered the nature of these. At present the wetlands are managed primarily for grazing or as wildlife habitats in the case of the two wildlife reserves. No part of Lake Ellesmere is presently managed primarily to ensure the preservation of wetland or halophytic plant communities. Any further agricultural development around the shoreline will reduce the wetland area and its diversity.

A number of areas are, despite modification to varying degrees, considered worthy of note in respect to preservation of the vegetation.

The extensive sand flat communities of the Greenpark Sands are of particular note. The middle and upper zones have been modified by salt barley grass and agriculture, but most native species still persist. The lower sand flats however are of particular value because of their size, and essentially undisturbed combination of halophyte and fresh water species. The threats to this may come from possible reclamation, or damage to the vegetation by the extension of the area near Greenpark Huts used for land yachting.

The western end of Kaitorete Spit has an almost continuous margin where the wetland vegetation has not been cleared. This includes a zone of sea rush and marsh ribbonwood which are otherwise fragmentary in their distribution around the margin of the rest of the lake. Above this is dry pasture containing some native species, and at lower elevation, mudflats. The greatest threat to this area would come from clearing of the sea rush for grazing and the consequent invasion of species such as creeping bent.

A number of botanically interesting areas as well as those which have been highly modified, occur on the north-western margin of the lake. The point south of Timber Yard Point has a great diversity of rushes, sedges and other low-growing native wetland species. Parts of this area however have been burnt

in an attempt to eliminate the taller growing plants (Fig. 4). The Harts Creek Wildlife Reserve has interesting stands of raupo and leptocarpus, but these are under threat from invasion by willows further inland. The area of leptocarpus in which Baumea is found has already been invaded by grey willow and the native species are disappearing. North of Drain Road there is a dense stand of leptocarpus and marsh ribbonwood in a narrow strip which is almost ungrazed. North of Lake Road South there are wetlands of many diverse species including flax, which have so far been protected from farming by stands of willows. The success of clearing over much of the rest of this shoreline indicates the urgency needed to protect those areas which remain.

The west bank of the LII River is an area in which many native species persist. This includes large stands of Scirpus caldwelii and also raupo and Scirpus lacustris. Grazing by cattle is the greatest threat to this, especially in times of low lake levels.



Fig. 4 South of Timber Yard Point. Photograph shows a burn to remove taller swamp plants from grazed area. The species particularly chosen for burning was N.Z. flax. Also burnt in the vicinity were raupo, leptocarpus and Baumea rubiginosa.



Other areas of the lake margin are of less to no botanical value. Many of these, such as stands of willow, have other wildlife importance and it is often the native component which contributes to this. The loss of native plant communities has taken place on an extremely large scale. Withholding protective status from the most important of those which remain cannot be justified.

The areas of greatest value and some indication of their importance are as follows:

1. Greenpark Sands - national importance. An example of an extremely rare vegetation type in New Zealand; the saline lagoon margin on sandy soil.
2. Inner side of Kaitorete Spit - regional importance. A large area of low salinity native lagoon edge vegetation which is more continuous than elsewhere.
3. Area North of Lake Road South - regional importance. Undisturbed although a rather narrow area of native freshwater vegetation.
4. West Bank of LII River - regional importance. Extensive stands of native freshwater vegetation including the taller raupo and Scirpus lacustris.
5. Point South of Timber Yard Point - local importance. An area of low-growing mostly native rushes, sedges and smaller species which has however been extensively burnt.
6. Harts Creek Wildlife Reserve and Yarrrs Flat Wildlife Reserve - these have already reserved areas of botanical interest (see Appendices).

## REFERENCES

- BURROWS, C.J., 1969: A handbook of background material to the ecology of the Lake Ellesmere area. Unpublished. Botany Department, University of Canterbury.
- BURROWS, C.J., 1970: Flora and Vegetation of the Shores of Lake Ellesmere. Canterbury Botanical Society Journal 3.
- CHAPMAN, V.J., 1960: Salt marshes and salt deserts of the world. Leonard Hill, London and New York.
- EVANS, L.T., 1953: The ecology of the halophytic vegetation at Lake Ellesmere, New Zealand. Journal of Ecology 41: 106 - 22.
- MASON, R., 1968: The vegetation of the coast: salt marshes and brackish lagoons: in "The Natural History of Canterbury", Editor G.A. Knox.
- MOLLOY, B.P.J., 1971: Possibilities and problems for nature conservation in a closely settled area. Proc. N.Z. Ecol. Soc. 18: 25 - 37.
- MOORE, L.B. & EDGAR, E., 1970: Flora of New Zealand, Volume II. Government Printer, Wellington.
- PALMER, J.D., 1982: Ellesmere: A Critical Area. Coastal resource investigation. Department of Lands and Survey, Christchurch.
- PARTRIDGE, T.R., 1981: The Halophytic Vegetation of Otago. Ph.D Thesis, University of Otago, Dunedin.

APPENDIX I: LIST OF VASCULAR PLANT SPECIES IN THE SURVEY AREA

A list of 290 species is presented overleaf. It includes 106 species of native plants and 171 introduced species. One hundred and ninety three species are found in wetland habitats.

Symbols use are: \* introduced species; + species found in wetland habitats; - cultivated species. Except where authorities are cited, nomenclature follows:

Allan, H.H., 1961: Flora of New Zealand. Volume I. Wellington, Government Printer.

Healy, A.J.; Edgar, Elizabeth, 1980: Flora of New Zealand. Volume III. Wellington. Government Printer.

Moore, Lucy B.; Edgar, Elizabeth, 1970: Flora of New Zealand. Volume II. Wellington. Government Printer.

New Zealand Weed and Pest Control Society, 1969: Standard common names for weeds in New Zealand. Wellington, Editorial Services.

Voucher specimens for the majority of the species on the list may be found in a reference collection held by the North Canterbury Catchment Board. The authors would like to acknowledge the work done by Mr Ken Baxter (N.C.C.B.) in the compilation of this reference collection and also the help received from the staff of the Botany Division, D.S.I.R.

Species

Common Name

Distribution/Habitat in Survey Area

* <i>Acaena agnipila</i> Gand.		dry pasture
* <i>A. novae-zelandiae</i>	piripiri	stopbanks, waste places
* <i>Achillea millefolium</i>	• yarrow	pasture, waste places
* <i>Agropyron repens</i> +	couch	common in wet pasture, waste places
* <i>Agrostis stolonifera</i> +	creeping bent	widespread in wet pasture, salt marsh
* <i>A. tenuis</i>	browntop	pasture
* <i>Aira caryophylla</i>	silvery hair grass	widespread in dry pasture
* <i>Alisma lanceolatum</i> With. +		drains, waterways
* <i>Alopecurus geniculatus</i> +	kneed foxtail	widespread in wet pasture, bogs
* <i>Amaranthus deflexus</i>	prostrate amaranth	dry waste places
* <i>Ammophila arenaria</i>	marram grass	dry places, sand dunes
* <i>Anagallis arvensis</i> +	scarlet pimpernel	arable and waste land
* <i>Anthoxanthum odoratum</i> +	sweet vernal	common in wet pasture, bogs
* <i>Apium filiforme</i> +		swamps, rushland
* <i>Arrhenatherum elatius</i>	tall oat grass	pasture, waste places
* <i>Atriplex prostrata</i> DC. +	hastate orache	common in salt marsh
* <i>Azolla rubra</i> +		widespread in drains, ponds
* <i>Baumea rubiginosa</i> +		rare in swamps, bogs
* <i>Bellis perennis</i> +	daisy	pasture, waste places
* <i>Blechnum cf capense</i> +		swamp, boggy places
* <i>Bromus diandrus</i> +	rippgut brome	pasture, waste places
* <i>B. mollis</i> +		dry pasture, waste places
* <i>B. unioloides</i> H.B.K. +	prairie grass	pasture, waste places
* <i>Bupleurum tenuissimum</i> +	slender hare's ear	rare in salt marsh

<u>Species</u>	<u>Common Name</u>	<u>Distribution/Habitat in Survey Area</u>
<i>Callitriche stagnalis</i> +	starwort	bogs in water
* <i>Calystegia silvatica</i> (Kit.) Griseb. +	greater bindweed	waste places, under willows
<i>C. soldanella</i>	shore bindweed	dry pasture, stopbanks, sand dunes
* <i>Capsella bursa-pastoris</i> +	shepherds purse	pasture, arable land
* <i>Cardamine hirsuta</i>	bitter cress	waste places
* <i>Carduus tenuiflorus</i>	winged thistle	dry pasture, waste places
<i>Carex buchananii</i> +		wet pasture
<i>C. coriacea</i> +		wet pasture, bogs
<i>C. diandra</i> +		swamps
<i>C. flagellifera</i> +		wet pasture
<i>C. flaviformis</i> +		wet pasture, bogs
<i>C. gaudichaudiana</i> +		wet pasture, bogs
<i>C. geminata</i> +		rare - drain banks
<i>C. maorica</i> +		bogs
<i>C. pumila</i>	sand sedge	sand dunes
<i>C. secta</i> +	niggerhead	swamps
<i>C. sinclairii</i> +		common in wet pasture, bogs
<i>C. virgata</i> +		bogs
<i>Carmichaelia appressa</i>		dry pasture - Kaitorete Spit only
* <i>Casuarina</i> sp. -		Timber Yard Point only
<i>Celmisia gracilentia</i> +		uncommon - in bogs
* <i>Centaurium erythraea</i> +	centaury	wet pasture, bogs
<i>Centella uniflora</i> +		bogs

Species

Common Name

Distribution/Habitat in Survey Area

* <i>Cerastium fontanum</i> Baumg. ssp. <i>triviale</i> (Link) Jalas +	mouse-ear chickweed	pasture, arable land, waste places
* <i>C. glomeratum</i> +	annual mouse-ear chickweed	pasture, arable land, waste places
* <i>Chenopodium album</i> +	fathen	stopbanks, waste places
* <i>C. murale</i>	nettle-leaved fathern	waste places
* <i>Cirsium arvense</i> +	Californian thistle	pasture, waste places
* <i>C. vulgare</i> +	Scotch thistle	pasture, waste places
* <i>Conium maculatum</i> +	hemlock	waste places
* <i>Conyza floribunda</i> Kunth = <i>Erigeron floribundus</i>	broad-leaved fleabane	rare in pasture, waste places
<i>Coprosma propinqua</i> +		rare - under willows
<i>C. robusta</i> +	karamu	rare - under willows
<i>Cordylone australis</i> +	cabbage tree	rare - swampy places
* <i>Coronopus squamatus</i> (Forskål) Asch. +	wart cress	damp waste places
<i>Cortaderia richardii</i> +	toetoe	rare - in bogs
* <i>Cotula australis</i>		dry waste places
<i>C. coronopifolia</i> +	batchelor's button	sand and mudflats
<i>C. dioica</i> ssp. <i>dioica</i> +		salt marsh
* <i>Crataegus monogyna</i> +	hawthorn	wet places - under willows
* <i>Crepis capillaris</i> +	hawksbeard	pasture
* <i>Cupressus macrocarpa</i> -	macrocarpa	common - shelter on farmland
* <i>Cuscuta epithymum</i> +	clover dodder	parasitic on <i>Lotus pedunculatus</i>

SpeciesCommon NameDistribution/Habitat in Survey Area

* <i>Cynosurus cristatus</i> +	crested dogstail	widespread in wet pasture, boggy places
* <i>C. echinatus</i> +	rough dogstail	rare in drier waste places
<i>Cyperus ustulatus</i> +		rare - bank of Irwell River
* <i>Cytisus scoparius</i> (= <i>Sarothamnus</i> )	broom	dry waste places
* <i>Dactylis glomerata</i> +	cocksfoot	wet pasture
* <i>Daucus carota</i> +	wild carrot	common - waste places
<i>Desmoschoenus spiralis</i>	pingao	sand dunes
* <i>Dianthus armeria</i>	Deptford pink	dry waste places
* <i>Digitalis purpurea</i> +	foxglove	uncommon - stopbanks, waste places
<i>Discaria toumatou</i>	matagouri	dry pasture
<i>Drosera binata</i> +	sundew	rare in boggy ground
* <i>Dryopteris filix-mas</i> +	male fern	uncommon - wet places under willows
* <i>Echium vulgare</i>	viper's bugloss	dry waste places
<i>Eleocharis acuta</i> +		swamps, bogs, wet pasture
* <i>Elodea canadensis</i> +	Canadian pondweed	common in drains, ponds
<i>Elymus rectisetus</i> (Nees) Löve et Connor ( <i>Agropyron scabrum</i> N.Z. authors)	blue wheat grass	dry pasture with <i>Poa laevis</i>
* <i>Epilobium adenocaulon</i> Hauss. (= <i>E. ciliatum</i> ) +		swamp, bogs
<i>E. billardierianum</i> ssp. <i>billardierianum</i> +		swamp, bogs
<i>E. chionanthum</i> +		swamp, bogs
<i>E. pallidiflorum</i> +		bogs, drains

SpeciesCommon NameDistribution/Habitat in Survey Area

* <i>Erodium cicutarium</i> +	storksbill	pasture, waste places
* <i>E. moschatum</i> +	musky storksbill	arable land, pasture
<i>Eryngium vesiculosum</i>	sea holly	rare - gravelly stopbanks
* <i>Eschscholtzia californica</i>		gravelly waste place
* <i>Eucalyptus</i> sp. -		shelter
* <i>Festuca arundinacea</i> +	tall fescue	common - wet pasture
* <i>Festuca rubra</i> ssp. <i>commutata</i> +	Chewings fescue	wet pasture
* <i>Foeniculum vulgare</i> +	fennel	uncommon - waste places
* <i>Fumaria muralis</i>	scrambling fumitory	waste places
* <i>Galium aparine</i> +	cleavers	waste places
<i>G. tenuicaule</i>		swamp - scrambling over <i>Carex secta</i> , <i>Leptocarpus</i>
* <i>Geranium dissectum</i> +	cut-leaved geranium	wet waste places
* <i>Glaucium flavum</i>	horned poppy	uncommon - stony lakeshore
<i>Glossostigma elatinoides</i> +		uncommon - mudflats
* <i>Glyceria plicata</i> +	floating sweet grass	swamps, drains
<i>Gnaphalium involucreatum</i>		wet places under willows
* <i>G. luteo-album</i>	Jersey cudweed	sand dunes
<i>G. sphaericum</i> Willd.		dry waste places
* <i>Hainardia cylindrica</i> (Willd.) Greuter (= <i>Monerma</i> ) +	barb grass	common - salt marsh
* <i>Holcus lanatus</i> +	Yorkshire fog	widespread - wet pasture, bogs



usually finding it growing over the trunks of the niggerhead, Carex secta (as described by Miss Mason) or sometimes creeping amongst clumps of Leptocarpus similis under willows.

Map references for some localities where rare or uncommon sedges have been found are listed below. Perhaps if members of the society are ever in the areas concerned they would like to keep a watchful eye on these plants.

All map references NZMS 1.

*Baumea rubiginosa*:

Harts Creek Wildlife Reserve	S93 745252
Small point south of Timber Yard Point	S93 766234
Bog south of Timber Yard Point	S93 765230
Boggy area two miles N.W. of Taumutu	S93 757196

*Cyperus ustulatus*:

Road end north of Hanmer Road. South bank of drain beside road - 50 metres from lake edge	S93 779295
---	------------

*Scirpus lacustris*:

LII River mouth	S83 840336
Selwyn Spit	S83 835315 and 820317
Lake edge 2 miles N.W. of Taumutu	S93 760196

*Lepidosperma australe*:

Small point south of Timber Yard Point	S93 766234
N.W. Lakeshore - approximately midway between Timber Yard Point and Selwyn Spit	S93 777293

Species

Common Name

Distribution/Habitat in Survey Area

* <i>Hordeum leporinum</i> Link +		
* <i>H. marinum</i> +	salt barley grass	stopbanks, waste places
* <i>H. murinum</i> +	barley grass	widespread - salt marsh waste places
* <i>H. secalinum</i> Schreb. -	meadow barley	planted for stock feed
<i>Hydrocotyle americana</i> +	waxweed	wet pasture, boggy places
<i>H. hydrophila</i> +		wet pasture, boggy places
<i>H. novae-zelandiae</i> +		wet pasture, boggy places
* <i>H. cf sulcata</i> +		wet pasture, boggy places
* <i>Hypochoeris glabra</i>		dry pasture
* <i>H. radicata</i> +	smooth catsear	waste places, wet pasture
<i>Hypolepis tenuifolia</i> +	catsear	uncommon - wet places under willows
* <i>Ilex aquifolium</i> +	holly	rare - wet pasture
* <i>Iris pseudacorus</i> +	yellow flat	rare - wet places under willows
* <i>Juncus articulatus</i> +	jointed rush	widespread - bogs, wet pasture
<i>J. australis</i> +		uncommon - pasture
* <i>J. bufonius</i> +	toad rush	common - bogs, upper mudflats
<i>J. caespiticius</i> +		common - bogs
<i>J. distegus</i> +		common - wet pasture
* <i>J. effusus</i> +	soft rush	wet pasture - boggy places
* <i>J. filicaulis</i> +		wet pasture
<i>J. gregiflorus</i> +		common - wet pasture
<i>J. maritimus</i> var. <i>australiensis</i> +	sea rush	common - wet pasture, salt marsh
<i>J. pallidus</i> +		uncommon - wet pasture
<i>J. planifolius</i> +		bogs

Species

Common Name

Distribution/Habitat in Survey Area

* <i>Lachnagrostis</i> sp. +		wet pasture
* <i>Lactuca serriola</i>	prickly lettuce	stopbank
* <i>Lagurus ovatus</i>	hareetail	common - dry pasture
* <i>Lathyrus latifolius</i>	everlasting pea	grassy, waste places
<i>Lemna minor</i> +	duckweed	widespread in drains, ponds
* <i>Leontodon autumnalis</i> +	autumn hawkbit	waste places and pastures
* <i>Lepidium desvauxii</i> Thell.		dry waste places
* <i>L. pseudo-tasmanicum</i> Thell.		dry, waste places and stopbanks
<i>Lepidosperma australe</i> +	square-stemmed sedge	uncommon - wet pasture
<i>Lepilaena biloculatus</i> +		drains, waterways
<i>Leptocarpus similis</i> +	leptocarpus	wet pasture, mudflats
<i>Leptospermum scoparium</i> +	manuka	rare - wet pasture
<i>Lilaeopsis novae-zelandiae</i> +		common - damp rushland, mudflats
<i>Limosella lineata</i> +		uncommon - mudflats
* <i>Linum marginale</i> (= <i>L. bienne</i> ) +	Australian flax	waste places, pasture
* <i>Lolium multiflorum</i>	Italian ryegrass	uncommon - waste places
* <i>L. perenne</i> +	perennial ryegrass	common - pasture
* <i>Lotus pedunculatus</i> +	lotus major	wet pasture, bogs, rushland
* <i>L. tenuis</i> +		pasture, herbfield
* <i>Lupinus arboreus</i>	tree lupin	dry pasture, sand dunes
* <i>Lycium ferocissimum</i>	boxthorn	dry pasture, sand dunes
* <i>Lythrum hyssopifolia</i> +	loosestrife	wet hollows on open ground

Species

Common Name

Distribution/Habitat in Survey Area

* <i>Nasturtium microphyllum</i> +	watercress	common - swamp, drains
<i>Olearia virgata</i> var. <i>lineata</i> -		
* <i>Oxalis articulata</i>		shelter
* <i>O. exilis</i>		dry pasture
		dry pasture
* <i>Parapholis incurva</i> +	sicklegrass	common - salt marsh
* <i>Parentucellia viscosa</i> +	tarweed	common - boggy ground
* <i>Pastinaca sativa</i>	wild parnsip	waste places
* <i>Petroselinum crispum</i>	wild parsley	wet waste places
* <i>Phalaris aquatica</i> (= <i>P. tuberosa</i> ) +		wet waste places
* <i>Phleum pratense</i> +	timothy	..et pasture, waste places
<i>Phormium tenax</i> +	New Zealand flax	uncommon, wet pasture, boggy ground
* <i>Picris echioides</i>	oxtongue	• waste places
* <i>Pinus radiata</i> -		widespread - shelter
<i>Plagianthus betulinus</i>	ribbonwood	stopbank (1 plant only)
<i>P. divaricatus</i> +	marsh ribbonwood	widespread - wet pasture, rushland, salt marsh
* <i>Plantago coronopus</i> +	buck's-horn plantain	pasture, salt marsh
* <i>P. lanceolata</i> +	narrow-leaved plantain	wet pasture, waste places
* <i>P. major</i> +	broad-leaved plantain	wet pasture, waste places
* <i>Poa annua</i> +		pasture, arable land
<i>P. laevis</i>	silver tussock	dry pasture
* <i>P. pratensis</i> +		wet pasture
* <i>P. trivialis</i>		wet pasture

Distribution/Habitat in Survey Area

Common Name

Species

* <i>Polygonum aviculare</i> +	wireweed	common - waste places
* <i>P. hydropiper</i> +	water pepper	swamp, boggy ground
* <i>P. persicaria</i> +	willow weed	swamp, drains, boggy ground
* <i>Polygonum monspeliensis</i> +	beard grass	wet pasture, upper mudflats
<i>Polystichum vestitum</i> +	prickly shield fern	uncommon - wet places under willows
* <i>Populus nigra</i> cv. 'Italica' -	Lombardy poplar	shelter
<i>Potamogeton cheeseemanii</i> +	pondweed	drains, ponds
<i>P. pectinatus</i> +	pondweed	drains, ponds
<i>Potentilla anserinoides</i> +	silverweed	wet pasture
* <i>Prunella vulgaris</i> +	selfheal	wet pasture, bogs
* <i>Prunus cerasifera</i>	cherry plum	stopbank (1 plant only)
<i>Pteridium aquilinum</i> var. <i>esculentum</i> +	bracken	rare - dry pasture, swamps
<i>Puccinellia stricta</i> +	salt grass	salt marsh, sand flats
* <i>Pyrus communis</i> L.	pear	stopbank (1 plant only)
* <i>Quercus</i> sp. -		rare
* <i>Ranunculus</i> subgenus <i>Batrachium</i> (unidentified) ( <i>R. fluitans</i> auct. N.Z.) +	water buttercup	drains, ponds
* <i>R. repens</i> +	creeping buttercup	wet pasture, bogs
* <i>R. sceleratus</i> +	celery-leaved buttercup	bogs, shallow water
<i>Raoulia australis</i>	scabweed	dry pasture (Kaitorete Spit)
* <i>Reseda luteola</i>	wild mignonette	dry pasture

Species

Common Name

Distribution/Habitat in Survey Area

- \* *Rorippa sylvestris*
- \* *Rosa rubiginosa* +
- \* *Rubus fruticosus* agg. +
- \* *Rumex acetosella* +
- \* *R. conglomeratus* +
- \* *R. crispus* +
- \* *R. obtusifolius* +
- Ruppia megacarpa* +
- R. polycarpa* +
- \* *Sagina procumbens*
- Salicornia australis* +
- \* *Salix alba* ssp. *vitellina* (L.)  
Arcang. +
- \* *S. babylonica* -
- \* *S. cinerea* +
- \* *S. fragilis* +
- \* *S. matsudana* Koidz. 'Tortuosa' -
- \* *Sambucus nigra* +
- Samolus repens* +
- Schoenus pauciflorus* +
- Scirpus caldwellii* +
- S. cernuus* +
- S. lacustris* +

- creeping yellow cress
- sweet brier
- blackberry
- sheep's sorrel
- clustered dock
- curled dock
- broad-leaved dock
- horse's mane weed
- horse's mane weed

- uncommon - swamp
- stopbanks
- wet waste places
- pasture, waste places
- wet pasture, waste places
- wet pasture, bogs
- wet pasture, waste places
- brackish water, drains
- brackish water, drains

- pearlwort
- glasswort

- boggy pasture
- idespread - salt marsh

- golden willow
- weeping willow
- grey willow

- uncommon - near waterways and other willows
- Timber Yard Point only
- common - near waterways, wet pasture, upper mudflats

- crack willow
- tortured willow
- elder

- common - near waterways, wet pasture
- Timber Yard Point only
- mudflats, salt marsh

- bog-rush

- wet pasture, boggy ground
- common - bogs, lake margins in mud
- mudflats, salt marsh
- uncommon - lake margins in mud

Species

Common Name

Distribution/Habitat in Survey Area

S. nodosus +		dry pasture
S. pungens +	three-square	widespread, wet pasture, mudflats
* S. setaceous		mudflats, salt marsh
* Sedum acre	stonecrop	dry waste places
* S. album	white stonecrop	dry waste places
Selliera radicans +		widespread - salt marsh, wet pasture
Senecio biserratus		waste places
S. glomeratus		stopbanks, waste places
S. minimus		waste land
* Silene gallica	catchfly	dry waste places
* Sinapsis alba +	white mustard	waste places, escape from cultivation
* Sisymbrium officinale +	hedge mustard	waste places, cultivated land
* Solanum dulcamara +	bittersweet	damp or shaded waste places
* S. laciniatum +		uncommon - wet waste places
* S. nigrum +	black nightshade	common - waste places
* Sonchus oleraceus	sow thistle	waste places
* S. asper	prickly sow thistle	waste places
Spergularia media +	sea spurrey	sand flats, salt marsh
* S. marina (L.) Griseb. +	sea spurrey	sand flats, salt marsh
* S. rubra +	sand spurrey	sand flats, salt marsh
Spiranthes sinensis +		rare - boggy ground
* Stellaria graminea +	stitchwort	boggy ground
* S. media +	chickweed	pasture, arable land
* Stipa variabilis	needle grass	dry pasture

<u>Species</u>	<u>Common Name</u>	<u>Distribution/Habitat in Survey Area</u>
* <i>Tamarix chinensis</i> Lour. -		uncommon - shelter
* <i>Taraxacum officinale</i> +	dandelion	bogs, pasture, waste places
<i>Tillaea moschata</i>		stony waste places
<i>T. sieberiana</i>		stony waste places
* <i>Trifolium arvense</i>	haresfoot trefoil	dry pasture
* <i>T. dubium</i>	suckling clover	dry pasture
* <i>T. fragiferum</i> +	strawberry clover	bogs, pasture, waste places
* <i>T. glomeratum</i>	clustered clover	waste places, dry pasture
* <i>T. pratense</i> +	red clover	wet pasture, bogs
* <i>T. repens</i>	white clover	wet pasture, bogs
* <i>T. subterraneum</i>	subterranean clover	dry waste places
<i>Triglochin striatum</i> +		widespread - mud and sand flats,
<i>Typha orientalis</i> +	raupo	salt marsh
		swamps, bogs and upper mudflats
* <i>Ulex europaeus</i> +	gorse	pasture, waste land
* <i>Urtica urens</i> +	nettle	arable land, stock camps
<i>U. linearifolia</i> +		uncommon - swampy places
<i>Utricularia monanthos</i> +	bladderwort	bogs, swamps
* <i>Verbascum thapsus</i>	woolly mullein	dry pasture and waste places
* <i>V. virgatum</i>	moth mullein	dry waste places
* <i>Veronica anagallis-aquatica</i> +	water speedwell	swamp, drains
* <i>V. persica</i> +	scrambling speedwell	arable land
* <i>Vicia sativa</i>	vetch	grassy waste places



<u>Species</u>	<u>Common Name</u>	<u>Distribution/Habitat in Survey Area</u>
* <i>Vittadinia triloba</i>	purple fuzzweed	dry places, stopbank
* <i>Vulpia bromoides</i>	vulpia hair grass	dry pasture
<i>Wahlenbergia marginata</i>		dry pasture with <i>Poa laevis</i>
<i>Zannichellia palustris</i> +		brackish water

APPENDIX II: THE VEGETATION OF HARTS CREEK AND YARRS FLAT WILDLIFE RESERVES,  
REPORTS TO THE WILDLIFE SERVICE, SEPTEMBER 1982, BY  
T.R. PARTRIDGE

1. HARTS CREEK WILDLIFE RESERVE

SUMMARY:

Harts Creek Wildlife Reserve has diverse wetland vegetation types including those which have been modified by man (e.g. pasture) and those which have not (e.g. raupo swamp). The spread of willows (crack and grey) has already resulted in the loss of much of the native vegetation and will continue to replace much of that remaining unless checked, although this is only feasible along the lakeside margin.

INTRODUCTION:

The reserve is on the south-west shores of Lake Ellesmere to the north of Timber Yard Point. The northern part is essentially willow-dominated down to the mudflats and raupo stands, while the southern end has predominantly modified rushland which has been converted into poor quality pasture. A large pond and the stream feeding it almost cuts the reserve into these two sections and there is a smaller pond in the north corner.

VEGETATION DESCRIPTION:

Twelve vegetation types were recognised, these being indicated using letters as shown on the vegetation map on page vii. Descriptions follow:

A. Raupo Swamp:

Virtually pure stands of raupo (Typha orientalis) occur in patches in area subject to frequent flooding, especially along the lake margin.

B. Tall Crack Willow - Dry Beneath:

The tallest stands are of crack willow (Salix fragilis) and occur on raised areas which are drier than those on which the shorter willows are found. Beneath, it is either bare or there are swards of creeping bent (Agrost stolonifera) with occasional Iris pseudacorus.

C. Tall Crack Willow - Ponds Beneath:

In the northern part of the reserve there is a great deal of variation in the elevation of the ground. The raised areas are dominated by crack willow with occasionally grey willow (Salix cinerea), while the lower areas are full of water with jointed rush (Juncus articulatus) dominant around the margin.

D. Grey willow with Leptocarpus and Baumea:

This is a mixture of young grey willow up to 4 m tall on wet peaty soil, with the tall rush-like species Leptocarpus similis and Baumea rubiginosa abundant beneath up to 1.5 m in height. Creeping bent is common on the ground. The area occupied by this grades from less grey willow and plentiful leptocarpus and Baumea in the south, to grey willow dominant, less leptocarpus, virtually no Baumea with creeping bent where light penetrates to the floor, in the north.

E. Mosaic of Crack and Grey Willows:

There are areas dominated by either crack willow, grey willow, leptocarpus or creeping bent. The willows tend to occur on the inland areas and the other closer to the mudflats although some crack willows are found on mounds out amongst the mudflats themselves.

F. Mudflats:

The mudflats have Mimulus repens, Triglochin striatum and Cotula coronopifolia which die down during the winter to appear around the time the lake level drops in spring.

G. Rushes:

Although Juncus gregiflorus is common in the cultivated land (H), there are two areas in which it is particularly dense. The species around the base of the plants are, however, pasture species.

H. Pasture with Rushes:

This is grazed pasture containing mostly species of swampy grassland (jointed rush, creeping bent) and occasionally taller plants of the rushes Juncus gregiflorus and soft rush (Juncus effusus). Nearer the road leading to Timber Yard Point the pasture is in better condition with clovers and pasture grasses such as ryegrass (Lolium perenne) and cocksfoot (Dactylis glomerata) more abundant.

I. Leptocarpus on Mud:

In amongst the mudflats of F, there are clumps of leptocarpus, with one large patch close to the lake as shown on the map.

J. Pines:

A small grove of Pinus radiata appears to have been planted around a former building.

K. Pasture and Gorse:

This is ungrazed pasture, drier than that in H, with large areas of gorse (Ulex europaeus). Some short manuka (Leptospermum scoparium) occurs in places.

L. Open Water:

Submerged and aquatic species are rare in both the large pond and in the smaller one to the north. Duckweed (Lemna minor) can be found floating in shaded areas around the margins and there is some Callitriche stagnalis.

DISCUSSION:

Harts Creek Wildlife Reserve has a considerable diversity of wetland vegetation. It includes sparsely colonised mudflats, dense stands of raupo, ponds, rushes, swamps of rush-like species, and willows. Some of these vegetation types consist primarily of native species, but most, and especially those dominated by willows, are mostly adventive. The problem for the future is how to maintain this diversity especially considering the ability of the willows to spread and replace the smaller species. The potential of this is

well demonstrated by the occurrence of young grey willows in the mudflats. The problem with this particularly vigorous species is best observed within vegetation type D. At the southern end of this area the grey willow has established more slowly and although plentiful, has not developed a canopy covering the leptocarpus and Baumea beneath. Northwards the grey willow becomes taller and more dense. First the Baumea and then the leptocarpus disappear to be replaced by a bare understory. Where there are openings, these species have not recolonised, but have been replaced by creeping bent and blackberry (Rubus fruticosus agg.). It can be expected that this process will result in the eventual replacement of the remaining Baumea and leptocarpus in the southern section. Control of the grey willow would not be easy as it is already well-established and may be difficult to remove. The areas adjacent to the mudflats however, have much less of this species at present and its lakeward spread should be halted. With crack willow there is little sign of spread, with most plants appearing long established. In fact there is little evidence as to the species present before these invaded as few natives remain beneath.

At the southern end of the reserve nearest Timber Yard Point, the stands of native rushes are under some pressure from grazing. There are in the reserve, good healthy stands of Juncus gregiflorus (G), but where cattle have grazed these, the depleted stands of pasture (H) result. Further grazing will reduce the remaining rushes even further, resulting in a boggy pasture of weeds tolerant of grazing and tramping, and especially the introduced jointed rush. At the least, the remaining areas of dense rushes need to be protected from possible grazing and thus any further degradation. The small peninsula south of Timber Yard Point has on it wetland vegetation with a great diversity of native species indicating the interesting and valuable kinds of wetlands lost when cattle are grazed in such areas.

Harts Creek complements the other wildlife reserve around the margins of Lake Ellesmere, that at Yarrs Flat. The salinity of the lake edge soils varies considerably from place to place, with Yarrs Flat being the more saline of the two. There, halophytes such as glasswort (Salicornia australis), Samolus repens, Selliera radicans, buck's-horn plantain (Plantago coronopus) and sea rush (Juncus maritimus) are abundant. At Harts Creek, however, there are only fresh water species with raupo, which is intolerant of salt, occurring around the lower edge, a contrast to the rushes and small herbs at Yarrs Flat.

The present vegetation of Harts Creek reflects the changes which are taking place around the margin of Lake Ellesmere. The native species which remain are

being replaced by either vigorous introduced species such as willow or through the effects of agriculture and grazing. In the reserve there are remnants of the native wetland species and in time many of these may disappear. Only the almost impenetrable raupo remains essentially unaffected. There is, however, an opportunity to protect the lakeward margin by halting the spread of willow and keeping grazing animals out of this area.

## SPECIES LIST

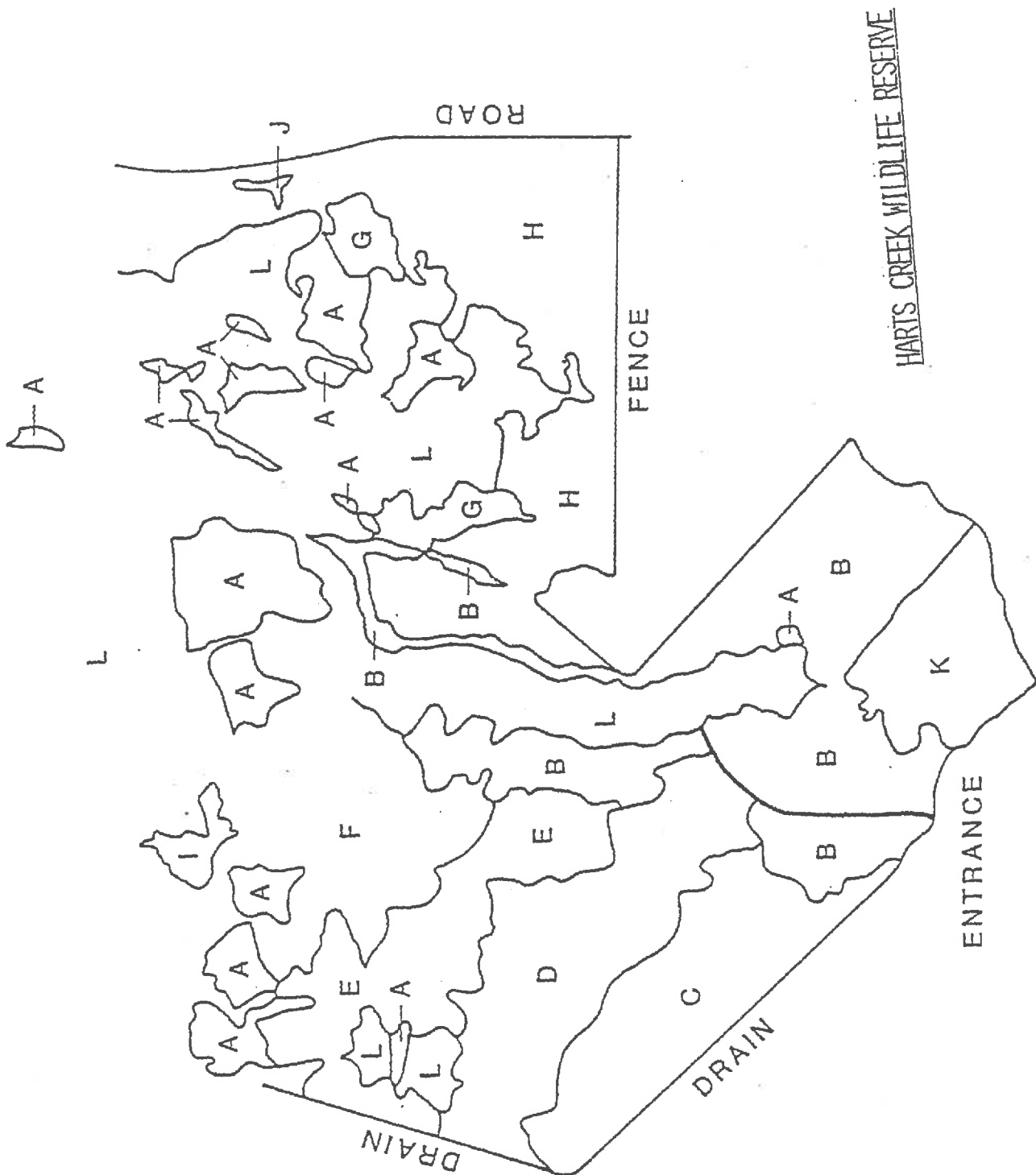
<i>Achillea millefolium</i>	yarrow
<i>Agrostis stolonifera</i>	creeping bent
<i>Anthoxanthum odoratum</i>	sweet vernal
<i>Atriplex prostrata</i> *	hastate orache
<i>Azolla rubra</i> *	
<i>Baumea rubiginosa</i> *	
<i>Bellis perennis</i>	daisy
<i>Blechnum cf capense</i> *	
<i>Bromus mollis</i>	soft brome
<i>B. unioloides</i> (= <i>B. catharticus</i> )	
<i>Callitriche stagnalis</i> *	
<i>Cardamine hirsuta</i>	bitter cress
<i>Carex gaudichaudiana</i> *	
<i>C. secta</i> *	niggerhead
<i>C. virgata</i> *	
<i>Cerastium fontanum</i>	mouse-eared chickweed
<i>Cirsium arvense</i>	Californian thistle
<i>C. vulgare</i>	Scotch thistle
<i>Conium maculatum</i>	hemlock
<i>Coprosma propinqua</i> *	
<i>C. robusta</i> *	
<i>Cordyline australis</i> *	cabbage tree
<i>Cotula coronopifolia</i> *	bachelors button
<i>Crataegus monogyna</i>	hawthorn
<i>Crepis capillaris</i>	hawksbeard
<i>Cynosurus cristatus</i>	crested dogstail
<i>Dactylis glomerata</i>	cocksfoot
<i>Daucus carota</i>	wild carrot
<i>Dryopteris filix-mas</i>	
<i>Erodium moschatum</i>	
<i>Festuca arundinacea</i>	tall fescue

<i>Galium aparine</i>	cleavers
<i>G. tenuicaule</i> *	
<i>Holcus lanatus</i>	yorkshire fog
<i>Hydrocotyle americana</i> *	
<i>Hypochoeris radicata</i>	catsear
<i>Ilex aquifolium</i>	holly
<i>Iris pseudacorus</i>	yellow flag
<i>Juncus articulatus</i>	jointed rush
<i>J. bufonius</i>	toad-flax
<i>J. effusus</i>	soft rush
<i>J. gregiflorus</i> *	
<i>J. pallidus</i> *	
<i>Lemna minor</i> *	duckweed
<i>Leptocarpus similis</i> *	
<i>Leptospermum scoparium</i> *	manuka
<i>Lolium perenne</i>	ryegrass
<i>Lotus pedunculatus</i>	lotus major
<i>Matricaria matricarioides</i>	rayless chamomile
<i>Mentha x piperita</i>	peppermint
<i>Mimulus guttatus</i>	monkey musk
<i>Myriophyllum propinquum</i> *	
<i>Phormium tenax</i> *	N.Z. flax
<i>Pinus radiata</i>	Monterey pine
<i>Pittosporum tenuifolium</i> *	
<i>Plantago lanceolata</i>	narrow-leaved plantain
<i>P. major</i>	broad-leaved plantain
<i>Poa annua</i>	
<i>Polygonum hydropiper</i>	
<i>Potentilla anserinifolia</i> *	
<i>Ranunculus repens</i>	creeping buttercup
<i>R. sceleratus</i>	celery-leaved buttercup
<i>Rubus fruticosus</i> agg.	blackberry



<i>Rumex crispus</i>	curled dock
<i>R. obtusifolius</i>	broad-leaved dock
<i>Salix alba</i> ssp. <i>vitellina</i>	golden willow
<i>S. cinerea</i>	grey willow
<i>S. fragilis</i>	crack willow
<i>Sarothamnus scoparius</i>	broom
<i>Schoenus pauciflorus</i> *	
<i>Scirpus pungens</i> *	
<i>Senecio minimus</i> *	
<i>Sonchus oleraceus</i>	sowthistle
<i>Stellaria media</i>	chickweed
<i>Sisymbrium officinale</i>	hedge mustard
<i>Taraxacum officinale</i>	dandelion
<i>Trifolium dubium</i>	yellow trefoil
<i>T. repens</i>	white clover
<i>Triglochin striatum</i> *	
<i>Typha orientalis</i> *	raupo
<i>Ulex europaeus</i>	gorse
<i>Urtica linearifolia</i> *	
<i>Vicia sativa</i>	vetch
<i>Vulpia</i> sp.	hair grass

\* indicates native species



## 2. YARRS FLAT WILDLIFE RESERVE

### SUMMARY

The vegetation of Yarrs Flat Wildlife Reserve is made up of a complex pattern of saline and fresh water communities modified to varying extents by agriculture. Those parts nearest the LII River tend to be fresh water, while eastward the vegetation grades into the sandy saline types which continue to the Greenpark Sands. The wide area of mudflats of Yarrs Bay essentially divides the area into these two parts. The parts at present grazed by cattle have little botanical value except for two small raised bogs which they tend to avoid. The areas of interesting halophyte vegetation however are only lightly grazed by sheep and thus show little damage. They should remain so provided cattle are confined to their present location.

### INTRODUCTION

Yarrs Flat Wildlife Reserve is on the north-eastern side of Lake Ellesmere and extends eastward from the LII (Liffey) River. The western section is complex containing raised and low areas of land, some of which have been modified by farming and cattle grazing while others are less modified having been grazed by only sheep. The large area of mudflats of Yarrs Bay divide the reserve in two, the eastern section being more evenly sloped and lightly grazed by sheep. A deep ditch cuts through the reserve just eastward of Yarrs Bay, making access from one side of the reserve to the other almost impossible, and this further emphasises the two different parts. As the exact location of the lakeward edge of the reserve was difficult to determine, this report is open-ended along that edge.

### VEGETATION DESCRIPTION

The letters refer to the vegetation map on page xv.

#### A. Improved Pasture on Dry Soils:

In the field at the end of Wolfes Road is an area of elevated land which is far drier than the rest of this part of the reserve. The pasture grasses such as crested dogstail (Cynosurus cristatus), sweet vernal (Anthoxanthum odoratum) and chewings fescue (Festuca rubra spp. commutata) are indicative of this type of pasture as is the small clover, haresfoot trefoil (Trifolium dubium).

B. Improved Pasture on Wet Soils:

Most of the area grazed by cattle has a mixture of grasses and weeds which tolerate both grazing and heavy trampling. The grasses include cocksfoot (Dactylis glomerata), creeping bent (Agrostis stolonifera) and kneed foxtail (Alopecurus geniculatus), while common weeds include toadrush (Juncus bufonius), jointed rush (Juncus articulatus) and monkey musk (Mimulus guttatus).

C. Pasture of Creeping Bent:

The least elevated of the pasture types is almost pure creeping bent. This area is subject to flooding when the lake levels are high.

D. Pasture with Sea Rush and Marsh Ribbonwood:

This is a mixture of the taller halophytes, sea rush (Juncus maritimus var. australiensis) and marsh ribbonwood (Plagianthus divaricatus) and somewhat salt tolerant pasture grasses such as salt barley grass (Hordeum marinum), couch (Agropyron repens) and creeping bent (Agrostis stolonifera). The density of the tall plants can vary from open with plentiful pasture between, to almost impenetrable with very little between.

E. Mosaic of Sea Rush and Smaller Halophytes:

On the long finger of raised land there are patches of sea rush with larger areas of smaller halophytes such as glasswort (Salicornia australis), Puccinellia stricta, Selliera radicans, buck's-horn plantain (Plantago coronopus) and creeping bent. These species are more salt tolerant than the grasses of D.

F. Sea Rush on Mudflats:

Clumps of sea rush occur on mudflats colonised by species different from those of the above pasture and saline areas. These are semi-aquatics such as Mimulus repens and Triglochin striatum, or in some cases the ground may be bare. Occasionally there are raised areas with species of D and E such as salt barley grass, creeping bent or Selliera radicans.

G. Glasswort and Salt Barley Grass:

Towards the east the soil salinity increases resulting in the absence of the less tolerant species. Furthermore it becomes sandier so that the species of the muddier areas such as sea rush, marsh ribbonwood and three-square (Scirpus pungens) are also absent. The two species which remain are the annual salt barley grass and the very tolerant glasswort, which together form a fairly dense sward on the sandy saline soils.

H. Rushes of Juncus gregiflorus:

Adjacent to the willows of J are two areas of dense Juncus gregiflorus rushes which have been grazed around the outer margin. This has resulted in a ring of dead plants surrounding those in the centre which have been less grazed.

I. Carex secta:

The northern-most larger area of Carex secta is a stand which has been grazed around the margin by cattle, while the extremely soft mud in the centre appears to have deterred animal entry, resulting in the survival of the stand. The two smaller areas are raised bogs which move when stood on. The Carex secta on these are healthy and are surrounded by a number of smaller-bog plants of which monkey musk (Mimulus guttatus) and jointed rush are the most common.

J. Crack Willow:

Along the edge of the LII River is a stand of tall crack willow (Salix fragilis), the plants decreasing in height and health towards the river mouth.

K. Plantation:

A small plantation has been planted around the pond in the centre of the largest cultivated area. The lower branches of the trees have been chewed back except where cattle cannot reach over the water.

L. Three-square:

Areas of dense three-square are found along the eastern side of the raised area of vegetation type E. It occurs on saturated mud below the smaller

This complex vegetation pattern has been further modified by differences in the grazing regime. However, cattle, which cause the most damage, have been confined to the cultivated wetter areas of B and C, while the drier areas have been grazed by sheep, or, if by cattle, then so lightly as to not be obvious. The soil surface is also broken up by cattle and the smaller species replaced by those tolerant of such damage as creeping bent and jointed rush. The muddier areas are more susceptible to this sort of damage and cattle should be kept out of such vegetation types as D, F, L, and M. Grazing of sheep should have no further effect on the areas where they are present. The introduced buck's-horn plantain (Plantago coronopus), a halophyte of slightly disturbed saline sites, is already well established as is salt barley grass which is capable of invading even where there is no disturbance.

At Yarrs Flat there are not the problems with willows that are found elsewhere around the lake margin as at, for instance, Harts Creek Wildlife Reserve. Crack willow is confined to the river margin and although the field adjacent appears a suitable habitat, there are no signs of it invading, the presence of grazing cattle perhaps stopping it. Grey willow (Salix cinerea) is absent, and at any sign of its entry into the reserve should be removed immediately. Willows will not invade any of the saline areas.

In further comparison with Harts Creek it should be emphasised that although parts of Yarrs Flat are highly modified, there is overall far more vegetation consisting of essentially native species remaining. Saline soils, the absence of willows, less cultivation and lighter grazing have all preserved this larger proportion of the native flora and vegetation.

The vegetation of Yarrs Flat Wildlife Reserve appears at present to be a stable mixture of native and introduced fresh water and saline communities. It should remain so provided the present farming practices are not extended, especially the areas of cattle grazing. The one possible exception would be the two small but interesting raised bogs along the river margin, which, although showing no signs of being grazed, may at some future time be under threat from this and suffer as has the other area of Carex secta already. The high proportion of native vegetation on the saline and muddy soils over much of the reserve make it one of the more interesting botanical areas around the edge of Lake Ellesmere.

SPECIES LIST

<i>Agrostis stolonifera</i> *	creeping bent
<i>Agropyron repens</i> *	couch
<i>Alopecurus geniculatus</i> *	kneed foxtail
<i>Anthoxanthum odoratum</i> *	sweet vernal
<i>Apium filiforme</i>	
<i>Atriplex prostrata</i>	hastate orache
<i>Azolla rubra</i>	
<i>Bromus mollis</i> *	soft brome
<i>Callitriche stagnalis</i>	
<i>Carex flagellifera</i>	
<i>C. secta</i>	niggerhead
<i>C. virgata</i>	
<i>Cerastium fontanum</i> *	mouse-eared chickweed
<i>Cirsium vulgare</i> *	thistle
<i>Cotula coronopifolia</i>	
<i>C. dioica</i>	
<i>Crassula moschata</i> (= <i>Tillaea</i> )	
<i>Crepis capillaris</i> *	hawksbeard
<i>Cynosurus cristatus</i> *	crested dogstail
<i>Dactylis glomerata</i> *	cocksfoot
<i>Festuca rubra</i> ssp. <i>commutata</i> *	chewings fescue
<i>Galium aparine</i> *	cleavers
<i>G. tenuicaule</i>	
<i>Glyceria plicata</i>	plicate sweet-grass
<i>Holcus lanatus</i> *	yorkshire fog
<i>Hordeum marinum</i> *	salt barley grass
<i>H. murinum</i> *	barley grass
<i>Hypochoeris radicata</i> *	catsear
<i>Juncus articulatus</i> *	jointed rush
<i>J. bufonius</i> *	toad rush
<i>J. effusus</i> *	soft rush

<i>J. gregiflorus</i>	
<i>J. maritimus</i> var. <i>australiensis</i>	sea rush
<i>Lemna minor</i>	duckweed
<i>Leontodon autumnalis</i> *	autumn hawkbit
<i>Lilaeopsis novae-zelandiae</i>	
<i>Limosela lineata</i>	
<i>Lolium perenne</i> *	perennial ryegrass
<i>Mimulus guttatus</i> *	monkey musk
<i>M. repens</i>	
<i>Myriophyllum propinquum</i>	water milfoil
<i>Phleum pratense</i> *	timothy
<i>Plagianthus divaricatus</i>	marsh ribbonwood
<i>Plantago coronopus</i> *	buck's-horn plantain
<i>P. major</i> *	broad-leafed plantain
<i>Poa annua</i> *	
<i>P. trivialis</i> *	
<i>Polygonum aviculare</i> *	wire-weed
<i>Potentilla anserinoides</i>	
<i>Puccinellia stricta</i>	
<i>Ranunculus repens</i> *	creeping buttercup
<i>Rosa rubiginosa</i> *	sweet brier
<i>Rumex obtusifolius</i> *	curled dock
<i>Salicornia australis</i>	glasswort
<i>Salix fragilis</i> *	crack willow
<i>Samolus repens</i>	
<i>Scirpus caldwellii</i>	
<i>S. lacustris</i>	
<i>S. pungens</i>	three-square
<i>Selliera radicans</i>	
<i>Solanum nigrum</i> *	black nightshade
<i>Stellaria media</i> *	chickweed
<i>Taraxacum officinale</i> *	dandelion



Trifolium dubium \*

haresfoot trefoil

T. fragiferum \*

strawberry clover

T. repens \*

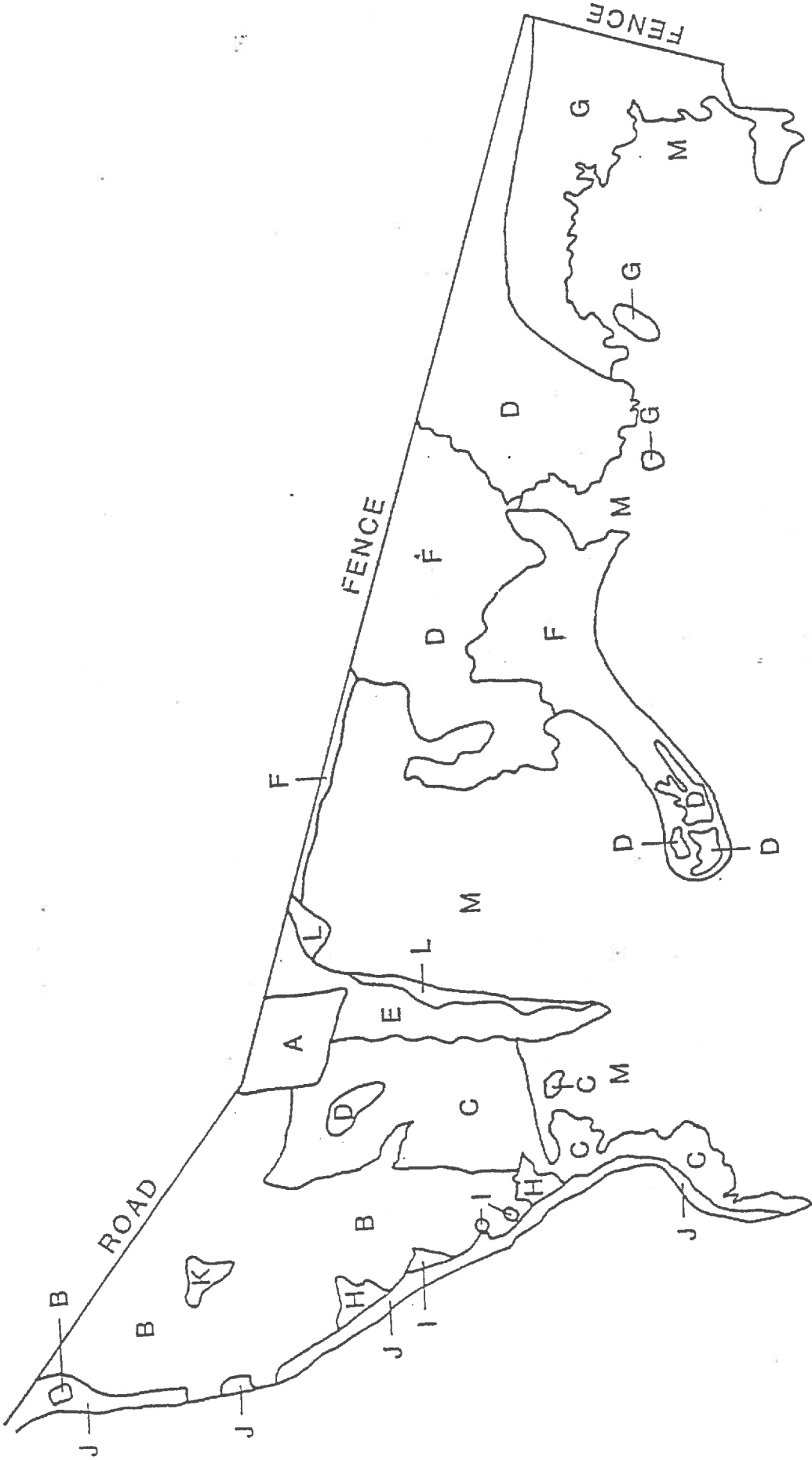
white clover

Triglochin striatum

Ulex europaeus \*

gorse

YARRS FLAT WILDLIFE RESERVE



SOME LAKE ELLESMERE WETLAND PLANTS BY DENNIS J. CLARK

During survey work for a vegetation map and plant species list of the wetland areas around the margin of Lake Ellesmere, a number of interesting finds have been made. To date these have mainly been on the less saline north-western lakeshore. I would like to single out five species for special mention, the first four all belonging to the sedge family (Cyperaceae).

Baumea rubiginosa, previously not recorded from Lake Ellesmere and considered rare in Canterbury, has been found at a number of locations on the north-western lakeshore. It is present in Harts Creek Wildlife Reserve where it is growing with Leptocarpus similis and young Salix cinerea (grey willow) and is in danger of being completely shaded out by the latter. B. rubiginosa has also been found in small, boggy areas, close to the lake south of Timber Yard Point where it is easily overlooked because of heavy grazing and a superficial resemblance in its vegetative state to species of Juncus.

Two clumps of Cyperus ustulatus have been found growing on the bank of an open drain beside an access road north-east of Timber Yard Point. This sedge has previously been recorded from the other side of the lake (Tai Tapu, Motukarara and Kaituna) and near the mouth of the Rakaia River.

Another plant considered rare in Canterbury is the tall sedge Scirpus lacustris. Small stands are present around the mouth of the LII River and rather tatty remnants are present near the mouth of the Selwyn River and on the lake edge two miles north-west of the Taumutu settlement.

The uncommon Lepidosperma australe with its four-sided clumps is present with Schoenus pauciflorus in damp and boggy places in a few locations north and south of Timber Yard Point. It is invariably heavily grazed where found.

Finally, I would like to mention that a statement by Miss Ruth Mason in Vol. 4 of this journal to the effect that Urtica linearifolia is not so uncommon in Canterbury as some authors have suggested, has been well borne out by my wanderings around the lake edge. I have quite often come across this nettle,

