THE

MACKENZIE BASIN

A REGIONAL STUDY IN THE

SOUTH ISLAND HIGH COUNTRY
"O ye that enter the portals of the Mackenzie to found homes, take the word of a child of the misty gorges and plant forest trees for your lives. So shall your mountain facings and river flats be preserved to your children's children and for evermore."

Michael John Burke.

Monument at Burke's Pass.
ACKNOWLEDGEMENTS

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INTRODUCTION

During recent years the high country of the South Island has attracted a good deal of attention from farm economists, soil conservationists, geographers and also politicians. With the present need for increased national production the problem of keeping the high country in productive occupation is the subject of justifiable concern. The purpose of this regional study is to describe one of the most distinctive areas in the high country, and to discuss the problems which have caused the recent Royal Commission on the Sheep-farming Industry in New Zealand to investigate the general economic position of the runholders.

Besides being a well-defined physiographic unit, the Mackenzie basin or, as it is better known to the local people, the Mackenzie Country has a distinctive character of its own. On entering Burkes Pass even the most casual observer cannot fail to notice how different the landscape within the basin appears compared with that outside. This large, gravel-filled intermontane depression with its vast expanse of dun coloured tussock and its clear, dry climate seems to have a special flavour which distinguishes it from any other part of either Canterbury or Otago."

 Probably the most striking feature of the basin is its
monotonous uniformity of both physical conditions and human activities. The extensive sheep-farming economy has imposed a distinctive pattern of land use over the whole area. Not only does the landscape have a similar appearance everywhere but, because of their common interests, the people all tend to live alike and think alike.

Before 1939 the basin was solely a sheep-grazing area but, with the recent developments connected with the storage of water in the lakes for the generation of hydro-electricity, the Mackenzie Country has assumed a new importance. With the dam-building schemes at Tekapo and Pukaki an entirely new element has been introduced into the landscape - the large Public Works Camp. These camps, however, are, for the most part, temporary features and the sheep-station remains the typical unit of settlement. For this reason the major part of this study is devoted to a description of the landscape as it has developed under the extensive sheep-farming economy and a discussion of the problems resulting from the exploitation of the natural vegetation.

When the early settlers first took up their runs they had the opportunity of making the Mackenzie basin one of the best merino grazing areas in New Zealand. In most cases that opportunity was lost, due partly to ignorance of proper grazing methods under sub-humid conditions and partly to short-sighted
practices caused by temporary economic difficulties. Overburning and over-stocking extracted an early toll from the vegetation cover which, in spite of numerous attempts can never be fully repaid.

By deliberately introducing rabbits into the area the early runholders made their third and possibly their greatest mistake. These rabbits were allowed to multiply unchecked for nearly twenty years before it was realised what a menace they were likely to become. By that time it was too late. Today, the rabbit is generally considered to be the chief cause of the disturbing decline in the sheep carrying capacity of the Mackenzie Country.

Altogether, unwise burning, overstocking and rabbits have caused such a deterioration in the tussock cover that Cumberland's description of some parts of the basin as "deserts in the making" is quite appropriate. Admittedly conditions are not as bad as in the "man-made deserts" of Central Otago but a serious problem at present confronts the Mackenzie runholders.

THE MACKENZIE BASIN

LOCATION MAP

[Map of the Mackenzie Basin showing major cities and rivers]
CHAPTER I
PHYSICAL

PHYSIOGRAPHY.

The Mackenzie Country is one of those intermontane basins which owe their formation to downwarping of portions of the earth's crust during the later phases of mountain building. As a result of late Tertiary orogenic activity several such basins occur in the alpine region of the South Island of New Zealand but the Mackenzie Country is the largest of them. It is approximately 50 miles long and 25 miles wide at its maximum width while the floor of the basin, which covers an area of roughly 800 square miles, consists of gently sloping plains which merge into rolling morainic uplands towards the north-west. On the west it is bounded by the ranges of the Southern Alps just where they reach their greatest height, while on the east the basin is cut off from the rest of Canterbury by the Two Thumb Range in the north, and by the Rollesby, Dalgety and Grampians Ranges further south. These eastern ranges, often rising to over 5,000 feet, form an almost continuous barrier, broken only by the low saddles of Burkes Pass, Mackenzie Pass and the Hakataramea Pass. At its southern end, in the province of Otago, the basin is
hemmed in by more mountains, the Lindis Pass into Central Otago and the Otematata Saddle into the Waitaki Valley being the only outlets.

Soon after the formation of the intermont it experienced severe glaciation. In his estimate as to the extent of glaciation von Haast made one major postulation which has since been refuted by Speight, the only modern geologist to study the area in any detail. Haast concluded that the entire Mackenzie plain was once a sea of ice, the present glaciers of the Mt. Cook region being mere remnants of the Great Waitaki Glacier which filled the basin to a depth of 5000 feet flowing through the Waitaki valley and spilling over the Hakataramea, Mackenzie and Burkes Passes. Speight, however, was unable to find any conclusive evidence in these localities to prove the theory. In his opinion the ice sheet did not extend much further than the present area of the morainic deposits. There can be no doubt, however, that, "in the not very remote past three tongues of ice penetrated southward through the deep valleys of the Godley, the Tasman, and the Dobson and tributary valleys". As this ice moved over the country it acted as a flexible rasp removing all major irregularities and producing characteristic flowing outlines such as can be seen on the country between Tekapo and Braemar Station and also along the eastern side of Lake Tekapo. The spurs along the sides of the
valleys, especially in the Tasman, were trimmed into line by these slow moving rivers of ice which coalesced to form a continuous sheet of ice and glacial detritus. Large deposits of moraine were dumped on the floor of the basin completely masking its substructure along the western margin. These deposits are greatest at the lower end of Lake Pukaki between Simons Pass and the recently constructed dam but large accumulations also occur to the west of the Tekapo - Pukaki road at places where the ice came over the ridges from the direction of the Tasman Valley e.g. near Balmoral and Irishman's Creek stations. Similar deposits are found around the lower ends of Lake Tekapo and Lake Chau. This moraine is composed of angular blocks and boulders of greywacke of all shapes and sizes. In some places a finer grained material, containing scratched stones, is found underneath the coarser rubble. This probably represents the material which was dragged along under the ice.

Morainic deposits are also largely responsible for the formation of the lakes Tekapo, Pukaki and Chau. The glaciers exerted a certain amount of scouring action on the floors of the valleys so that hollows were formed and this, together with the ponding action of the morainic bars, resulted in the damming back of the water from the glacial rivers. The lakes were formerly of much greater extent as can be seen from old lake
Plate 1.  An air view of the Mackenzie basin, taken from the south-east corner, looking through the Waitaki gorge.  The alluvium filled depression is enclosed by ranges of greywacke highlands and, in places, isolated blocks project from the basin floor.
beaches and deposits of lake silt above the present lake levels. They are still fairly deep, however, so that, under normal circumstances, there is no likelihood of their being drained in the near geologic future.

It is not certain how long it is since the ice came down the valleys to the points previously mentioned but, in all probability, it was not more than 50,000 years ago that the retreat began in earnest. There are indications that, when the recession began, it proceeded fairly rapidly but not regularly, for old moraines in various places along the floors of the valleys indicate halts in the recession long enough for considerable deposits to be made at the temporary terminals of the glaciers. At the present time the glaciers have retreated right into the heart of the alpine ranges.

One of the most noticeable features of the Mackenzie basin is the enormous amount of recent gravel which hides the sub-surface of the plains. This was produced more especially during the time of the ice advance, when large rivers issued from the terminal faces of the glaciers, carrying with them the debris brought down from the highlands and scattering it over the country as they changed their courses. In time the material was rounded and reduced in size so that it became like an ordinary river gravel. The finer material from the rivers, reinforced by rock flour ground from the solid
bed of the glaciers, was spread over the plains to form a thin coating of soil. Where the proportion of rock flour and windblown silts is high the soils are deep and fertile.

The gravel plains have been terraced by the Tekapo, Pukaki and Ohau rivers and at their junction in the south-east of the basin where they form the Waitaki, the river is entrenched about 30 feet below the general level of the plains.

Piercing the alluvial mantle of the plains, in several places, are isolated greywacke blocks, such as the Mary Range and Grays Hills, which are presumed to be fault-block relics. They occupy about 40 square miles in all.

Mt. John, another isolated hill at Tekapo, has a smooth, rounded slope on the north-west but on the side facing the lake the slope is quite abrupt. For this reason it is generally considered to be a huge roche moutonnee.

The highlands which form the rim of the basin are all composed of either greywacke or argillite. Only exceptionally, as on the Sealy Range and on Mt. Wakefield, are they formed of schist like the neighbouring ranges of Central Otago. The ranges of the eastern rim are lower than those in the west and have a much less rugged appearance. Apart from the Two Thumb Range, they show no obvious signs of glaciation and resemble the dissected fault blocks of Otago and South Canterbury rather than the heavily glaciated highlands of the
western rim.

The snow-capped ranges along the western margin of the basin are the highest in the South Island alpine axis. Ten of the peaks in the vicinity of Mt. Cook, including such well-known ones as Tasman, Sefton and La Perouse, are over 10,000 feet while Cook, itself (12,349 feet) is renowned as the highest mountain in New Zealand.

Remnants of the huge glaciers which gouged deep valleys in the greywacke highlands clog the lower reaches of the valleys with their immense accumulations of coarse moraine. Along the steep sides of the valley walls enormous scree slopes provide an additional supply of angular rock waste.

For the student of geomorphology interested in alpine glaciation the Mt. Cook area is a paradise. Literally hundreds of text-book examples of glaciated peaks, arêtes, cirques, hanging valleys and related phenomena can be found on any of the main ranges because it is so easily accessible. The magnificent alpine scenery which was early appreciated, has attracted a thriving tourist trade to the "Hermitage".
Plate 2. A closer view of the south-eastern corner of the basin, illustrating the fan-like drainage pattern. This photo shows the junction of the Ohau, Pukaki and Tekapo rivers where they join to form the Waitaki. Wide, stoney beds, with braided streams, are typical of rivers in the basin.
CLIMATE:

Lack of sufficient recording stations and the consequent lack of climatic data make it difficult to give anything of the climate other than a general account of the Mackenzie Country. There are only two recording stations within the whole of the area which send in regular reports to the Meteorological Office. One of these is Takapo House at Tekapo and the other is the Hermitage near Mt. Cook. At these stations only temperature, rainfall, wind direction and sunshine hours are recorded and strict accuracy does not appear to be considered necessary. (Formerly the sunshine hours for Tekapo were notoriously exaggerated in order to boost the place as a pleasure resort.) However, the observations may be taken as broadly representative of climatic conditions in the Central and western parts of the basin. Unfortunately, along the eastern margin of the basin there is no official recording station. The only records kept are those of the monthly rainfall at the Grampians station. Several run-holders use aneroid barometers and thermometers for their personal satisfaction but keep no records. Until more stations are set up to take accurate observations any analysis of the climate will, of necessity,
have to be rather superficial.

TEMPERATURES:

Due to its shape and position the Mackenzie basin experiences effects of continentality similar to those of Central Otago. During the summer months the temperature often exceeds 80°F during the day, skies are clear and the number of sunshine hours is high. The humidity is low giving a dry heat for which the country is renowned.

In the winter the temperature usually drops below freezing point at night resulting in heavy frosts. Winter conditions set in early and frosts may occur even during the summer. At Tekapo the annual number of ground frosts for eight years ranged from 178 to 246. The lowest temperature yet recorded at Tekapo was -10.5°F on the grass (i.e. 42.5°F of ground frost.) In July, 1938, which was particularly cold, there were 12 days when the air temperature remained below freezing point all day, 6 of these days occurring on end.

In spite of these cold temperatures skies usually remain fairly clear and sunshine hours remain relatively high. Tekapo has an average of over 2300 hours for the year but the number is lower at Pukaki where winter fogs hang over the lake.
RAINFALL:

Over the greater part of the basin there is a general deficiency of rainfall which becomes more marked along the eastern margin due to a pronounced rain shadow effect.

<table>
<thead>
<tr>
<th>Location</th>
<th>Rainfall (in)</th>
<th>Rain Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hermitage</td>
<td>161.41</td>
<td>140</td>
</tr>
<tr>
<td>Braemar</td>
<td>35.68</td>
<td>93</td>
</tr>
<tr>
<td>Tekapo</td>
<td>22.53</td>
<td>79</td>
</tr>
<tr>
<td>Grampians</td>
<td>19.45</td>
<td>No record</td>
</tr>
</tbody>
</table>

Most of the rainfall comes in the form of nor’-west showers which rapidly lose intensity from west to east. In the driest part of the basin, the south-east, the average annual rainfall is estimated to be about 15 inches.

Figures show that, over a period of several years, rainfall is fairly evenly distributed throughout the year. At Tekapo the average rainfall for each month is approximately 2 inches and the number of rain days averages about 6 each month. A corresponding evenness in distribution is shown in the figures for Braemar station. The precipitation efficiency, however, varies with the seasons. In
summer, when the evaporation rate is very high, the efficiency is greatly reduced.

In winter much of the precipitation is in the form of snow which thaws in the spring, producing a seasonal flush in all of the rivers. When the thaw begins the ground becomes very spongy and transport difficulties often occur.

Snow-storms may occur at any time of the year, causing heavy stock losses unless the runholder is able to reach them with stored feed. Most of the heavy falls come during the winter and early spring but snow has been known to fall on Christmas day at the Grampians station in a locality where the snow risk is usually not very great. The greatest snow-storm within living memory occurred in the winter of 1895 and is still talked of today. Early snows began in April and on June 24th the great snow began. Fall after fall occurred in July and continued on into the first week of September by which time there was an accumulation of nearly eleven weeks snow. It is estimated that approximately 750,000 sheep perished in the high country and in some places whole flocks were wiped out. On Balmoral, Glenmore and Braemar, out of the 45,000 sheep turned out in May only 14,000 were shorn in the following summer. The cold was intense. Woodwork snapped, concrete foundations
cracked and even the hardy native manuka was killed. For several months the back-country was isolated while snow ploughs attempted to clear the roads.

Heavy falls also occurred in 1903 and 1906 but since that time there have been no really disastrous winters. Nevertheless the runholder has to be prepared for such contingencies.

Occasionally, during a mild winter very little snow falls and little moisture is stored up in the highland basins which form natural reservoirs for the mountain streams. At such times the streams may run almost dry in the summer and the need for water becomes acute.

During the summer months "cloud-bursts" and thunderstorms sometimes occur, causing flooding which washes out the roads and disrupts communications for several days.

WINDS:

Winds play a vital part in giving the Mackenzie basin its distinctive climate. The "nor'-wester", which is the prevailing wind, not only brings most of the precipitation, but is also largely responsible for the high evaporation rate which gives the basin its sub-humid climate. When the "nor'-wester" strikes the basin temperatures soar and, be-
cause of the low humidity, the heat becomes oppresssive. Clouds form over the western ranges and showers sweep down the gorges across the western margin of the plains. Unfortunately the efficiency of this rainfall is greatly reduced by the high evaporation rate, especially during the summer months.

Climatically, the basin appears to be divided into two broad zones.

1. The Western half which receives rainfall with the "nor'-wester".

2. The Eastern half, where the "nor'-wester" is a gusty wind drying up the ground which already receives an inadequate rainfall.

The boundary of these two zones co-incides roughly with a line joining the outlets of the lakes Tekapo, Pukaki and Ohau. This line also divides the alpine ranges and morainic downlands of the west from the alluvial plains and low ranges of the eastern part of the basin. To the west of the line the rainfall everywhere exceeds 20", reaching 160" at the Hermitage while to the east the rainfall in an average year is about 20" but in dry years drops as low as 12" in the south-east. Most of the rain in this area comes from the south or the east. Although
rainfall deficiency is common in the east there is not the same snow risk as is found in the north or west.

THE PRIMITIVE VEGETATION.

Although the Maoris frequented the Mackenzie basin on hunting trips it is probable that when the first white settlers arrived the vegetation was still in its natural state. Shells of great totara logs have been found on Mt. Cook station, suggesting that there was once a much more luxuriant vegetation but it is most unlikely that the Maoris had anything to do with its destruction because nowhere else in South Canterbury did they remove any of the bush cover.

When von Haast visited the area in March 1862 the floor of the basin presented a great tawny expanse of low tussock grassland merging into snowgrass and sub-alpine vegetation at higher altitudes. Among the tussock, and especially along the banks of the rivers, were dense thickets of matagouri (Discaria toomatou) and spear-grass (Aciphylla squarrosa). In the valleys of the Tasman and Godley rivers where the rainfall increases the matagouri, or Wild Irishman
**Fig. 1.** A general view looking south across the Tekapo flats. Over this wide, monotonous expanse of country only a light tussock cover exists.

**Fig. 2.** Small matagouri (*Discaria tomentosa*) growing among the tussocks at Irishman Creek station. Much of the original cover along the western margin of the basin probably appeared similar to this.
as the settlers called it, grew to an unusually large size. Haast, in his notes, observes that, in the neighbourhood of the Godley river "groves of large specimens of Discaria toumatou were growing. Some of them which I measured were 16 to 18 feet high and over 2 feet in diameter at the base". In the Tasman he says "we arrived at such an impenetrable thicket of Wild Irishman and spaniards that, after more than an hour, we had at last to give up the attempt with our clothes torn and our hands and faces covered with blood".

Although throughout most of Canterbury beech forest grew on the slopes of the ranges between roughly 1,000 feet and 3,500 feet there was a general lack of trees in the Mackenzie basin due to the sub-humid climate. Only in the higher rainfall areas of the Tasman, Dobson and Hopkins valleys were there patches of beech. Commenting on a trip to the Murchison valley von Haast observed that "although Lake Tekapo is only 2,437 feet above sea-level no beech forest is found growing anywhere near it or along the banks of the rivers by which it is fed, but on the shores of Lake Fukaki (1,717 feet) and along the valley of the Tasman river almost up to the terminal moraine of the Tasman glacier small groves of Nothofagus cliffortiodes, the 'white birch'.

1. "Geology of Canterbury and Westland" von Haast. p. 25
2. "Geology of Canterbury and Westland" von Haast. p. 29
Fig. 3. A thicket of "Wild Irishman" about 6 feet high growing on the shores of Lake Tekapo. Metagouri this tall is uncommon today, most of it having been destroyed by fire.

Fig. 4. A fine specimen of a spaniard (Aciphylla spp.) growing at Burke's Pass. Spaniards were a curse to stock in the early days but they are rarely found today except in the western ranges.
of the settlers, are found in many localities". He says, "they began some twenty feet above the valley and terminated about 600 feet higher. With them not only a number of the shrubs and trees usually found only in lower regions such as several species of Panax (now Nothopanax), Coprosma, Griselinia and many others were growing most luxuriantly but close to them stood true sub-alpine forms of Olearia, Senecio, Cassinia and Veronica, growing mostly in well shaped semi-globular masses". Between these shrubs grew snowgrass, celmisias and Mt. Cook lilies while "everywhere huge plants of Aciphylla squarrosa and Aciphylla colensoi the Spaniards of the settlers, their flowering stems often ten feet high, were growing where they found favourable ground.

Although the luxuriant alpine and sub-alpine vegetation of the western ranges is the most interesting from the botanist's point of view it is the tussock association which covered by far the greatest portion of the basin that is of most importance both to the runholder and the geographer, for it is the tussock country which has undergone the greatest change since the basin was first settled. On the plains and the lower slopes of ranges the dominant grass was the hard tussock (Festuca novae zelandiae). The palatable blue tussock (Poa colensoi) was also quite common but the
Fig. 5. One of the few large patches of beech forest (*Nothofagus cliffortioides*) growing in the basin, located in the Hopkins valley at the head of Lake Ohau.

Fig. 6. Sub alpine vegetation growing on moraine in the Mt. Cook area. The leafy plants in the foreground are *clemisia* or "cotton plants". The shrubs are mainly *cassinia* and *dracophyllum*. 
silver tussock (Poa caespitosa) grew only in moist, sheltered positions. Among the tussocks blue grass (Agropyron scabrum) and plume grass (Deyeuxia Crinata), both eagerly sought after by sheep, grew in much greater abundance than they do today. In the absence of grazing animals a number of small herbaceous plants also grew under the shelter of the close tussock cover.

The boundary between the low tussock grassland and the tall tussock grassland varied in altitude according to the amount of rainfall and aspect but, in general, the vegetation on the higher slopes of the western ranges between 3,000 feet and 5,000 feet was dominated by snowgrass (Danhonia flavescens) which grew to about three feet in height so that little could compete with it except the tall spaniard (Aciphylla colensoi) and herbs such as the celmisias.

Unfortunately, although the constituent plants of the tussock grasslands are fairly well-known, the density of the original cover has never been accurately determined. Even as early as 1862 when von Haast visited the Mackenzie basin most of the tussock had been burned at least once in an attempt to get rid of the matagouri and spaniards and promote fresh growth for the sheep to feed on. There can be no doubt, however, that the carpet of vegetation was much thicker than it is today and it is the depletion of the original cover with
Fig. 7. A light cover of snowgrass (Danothonia flavaeformis) growing at 6,000 ft. on Mistake Peak, overlooking Lake Tekapo.

Fig. 8. Celmisia growing among the tussocks at 5000 ft on Mistake Peak.
the subsequent decline in its sheep-carrying capacity which forms a major aspect of any study of the Mackenzie Country.

SOILS.

Because depletion of the vegetation cover and soil erosion are two of the most serious problems facing runholders in the Mackenzie Country, a study of the various types of soil to determine their relative susceptibility to these two menaces is of prime importance. No detailed work has been done on the soils of the area but a useful survey carried out in connection with soil erosion has been made by H.S. Gibbs and J.D. Raeside whose work is published in the D.S.I.R. bulletin 92 "Soil Erosion in the High Country of the South Island". To date this is the only article published on the subject and constant recourse has to be made to it.

In general, the soils of the basin are derived from greywacke gravels and alluvium and show a monotonous uniformity. They are, for the most part, shallow and stony but "small areas of deeper silt loams and sandy loams have been formed in the lee of the ranges within the basin and at the foot of the mountains bounding the eastern or leeward margin of the plains". On
SOIL MAP

SOIL
Tasman 1
Alexandra 2
Omarama 3
Kaikoura 4
Haast 6
Alpine 0

Scale
1 2 3 4 5 6 7 8 12 Miles

Authority: Gibbs & Raeside
the Grampians station and in the lee of the Mary Range these windblown silt deposits have been cultivated successfully but careful management is necessary to prevent wind erosion.

According to the D.S.I.R. Bulletin, six different soil types are present in the Mackenzie basin.

1. THE TASMAN SOILS:
These soils are found on the lower terraces of the wide floors of the principal rivers and are derived from recent alluvial deposits. For the most part they are shallow and stony but the swamps at the head of Lakes Tekapo, Pukaki and Ohau have deeper, heavier soils which support a good cover of vegetation suitable for grazing cattle. Soil erosion is negligible.

2. THE ALEXANDRA SOILS:
These soils have developed under a semi-arid climate where the rainfall is less than 17 inches. They are found only in the drier south-eastern part of the basin near Haldon and Black Forest stations and are particularly susceptible to soil erosion.

3. THE OMARAMA SOILS:
The soils of the Omarama series cover most of the Mackenzie plains, reaching an altitude of 4,000 feet on some sunny slopes, especially on the dry western faces
of the Two Thumb Range and the Grampians. These soils represent a transition between the Omarama soils developed in drier localities and the Kaikoura soils found at higher levels. They are more resistant to erosion than the Alexandra soils but they have all been moderately eroded.

4. **THE KAIKOURA SOILS:**

On the ranges bounding the dry intermontane basin the Kaikoura soils occur above the Omarama soils at altitudes between 3,000 and 4,000 feet. The extent of soil erosion depends largely on slope and aspect.

5. **HAAST SOILS:**

Where the rainfall exceeds 75" and temperatures are lower the Kaikoura soils give place to the Haast series e.g. around the Hermitage and in the Tasman and Murchison river valleys. Soils are generally poor and are not heavily grazed.

6. **ALPINE SOILS:**

The Alpine soils are found on the higher slopes above 5,500 feet. They are not a true series but delineate the area which was practically bare at the time of first settlement. The surface consists of bare rock, scree slopes and ice. Only a few alpine plants exist.
Plate 3. The straight, U-shaped valley of the Dobson river at the head of Lake Ohau, a beautiful example of alpine glaciation. Sheep and cattle graze on the tussock grasslands right up to the head of the valley and large herds of deer roam through the beech forests in the upper reaches.
CHAPTER II

THE OCCUPATION AND SETTLEMENT OF THE MACKENZIE BASIN

THE MAORIS.

Prior to European occupancy the Mackenzie country was used by the Maoris as a hunting ground during the summer and autumn months. The lakes and creeks contained plenty of eels, the swamps and riverbeds swarmed with ducks and pukekos, the scrub covered flats were full of wekas and the beech-clad gorges were the home of kakas and pigeons.

The Maoris made their hunting expeditions into the Mackenzie country either by way of the Waitaki valley or through the passes which were all known to them. The chief object of these trips was to lay in stores of eels and woodhens which were cleaned, dried in the sun, or smoked, then conveyed "down-country" for winter use.

Apparently the Maoris always chose warm, sheltered sites for the white settlers who followed later often found traces of Maori camps close to the sites on which they themselves had chosen to build their homesteads. Greenstone implements have been found at Haldon station and, at Simons Hill, the
remains of "umus" or Maori ovens can still be seen.

The number of Maoris who visited the Mackenzie basin was probably never large and with the coming of the settlers their expeditions were soon curtailed. The last regular expedition took place in 1889.

Although the Maori was as regular visitor to the Mackenzie country he did little to alter the appearance of it. When the first Europeans arrived they probably saw the country in its native state for the Maori was essentially a hunter and a conservative one at that.

THE EUROPEAN DISCOVERY AND SETTLEMENT OF THE MACKENZIE COUNTRY.

The European discovery of the Mackenzie country is associated with the story of Mackenzie, the sheepstealer, and his famous dog. This story has become almost legendary and the only concrete evidence of what actually happened is contained in a letter written on March 6th, 1855 to Messrs R. and G. Rhodes of the Levels station by J.H.C. Sidebottom, manager of their western run. He recounts that a Maori shepherd called Seventeen came in to report the "reiving" of the greater part of his flock by the Scotsman, Mackenzie. Sidebottom and Seventeen with another Maori named Taiko set out to track the thief. They followed the sheep trail until, on the evening of the third day, they came to "a pass in the Snowy Mountains leading to the
West Coast". This was the pass between the Rollesby and Dalgety ranges, known to the Macris as Manahouna and now called Mackenzie Pass. Here Mackenzie was captured with the stolen flock. It is generally supposed that, on previous occasions, he had driven sheep through the pass, across the basin which now bears his name and into Otago by the Lindis or Waitaki routes where he could dispose of them in safety. On seeing this marvellous expanse of good sheep grazing country, Sidebottom applied for the leasehold of virtually all of the basin which could be seen from Mackenzie Pass. His claim, however, was not registered and so passed unnoticed by the general public for close on twelve months. It was not until May 10th, 1856 that the following notice appeared in a newspaper.

"Discovery of Additional Sheep Country"

"At the time of Mackenzie's capture there was a report current that an extensive plain existed beyond the gorge in the Snowy Mountains, through which Mackenzie was travelling when taken by Mr Sidebottom. We understand that further search has confirmed the truth of this report and that a plain of immense extent has been discovered capable of pasturing sheep. We hope to be able to give further particulars in a short time".

This news focused the attention of South Canterbury People on the area and various parties of one or two men slipped
away secretly in the year 1856 to explore the possibilities of the country. The first to leave must have been William McHutchison and his nephew, Frank Sinclair, who selected 20,000 to 30,000 acres of land on the shores of Lake Pukaki and took up their run, the first in the Mackenzie country, in May, 1856. In the following year John Hay and his wife went through Burke’s Pass to take up their run at Tekapo and in their wake followed a stream of land-hungry settlers. In 1858 and 1859 the influx was at its height, by 1860 it had begun to ebb and by 1868 it had ceased almost completely.

During the early rush all the land in the eastern and central parts of the basin was occupied and the "misty gorges" of the west were avoided, but during the early sixties Lilybank, Mistake, Mt. Cook, Birch Hill and Glen Lyon stations were all taken up and no more land was left for newcomers.

It is interesting to note that Otago had no hand in the original settlement of the Mackenzie country. This is probably due partly to the relative difficulty of entering the basin from the south compared with the north and partly to the absence of gold in any payable quantity. All the runholders came from the north, some from Mid-Canterbury and some from Christchurch but most came from Nelson. It was from Nelson also that many of the sheep and horses came.

The men who originally acquired the Mackenzie country
runs from the Crown were not high-country sheepmen and, with few exceptions, they had had little or no experience with sheep. The majority were English Public School men, some of whom had never seen the runs taken up for them by their friends.

**PIONEER FARMING.**

"The early sheepmen did not find the tussock grassland easy to occupy and manage. The vegetation cover was by no means pure tussock but in the association was much of the thorny 'matagouri' or 'wild Irishman' and species of spear-grass that often made travel with flocks extremely difficult or even impossible. So the early runholders adopted the simple device of burning their way into the country and these earliest fires laid the foundation of profound changes in the character of the cover. Noting that after a burn a growth of more succulent green herbage appeared, the runholders adopted seasonal burning as a routine procedure in the grazing of the tussock country. In the long run this has proved to be a mistaken procedure".¹

These early runholders knew so little about native feeding conditions that they really thought that their country was understocked unless the coarse tussock was being "topped" by

¹. Address to A.N.Z.A.A.S., Hobart, 1949. G. Jobberns
the sheep. They were ignorant of the fact that it is the
fine feed which shelters between the tussocks that determines
the carrying capacity.

Up to the early sixties there were no shepherds in the
true sense of the word. The mustering and sheepwork, such
as it was, was carried out by bullock drivers and run-away
sailors. Lambing was allowed at all times of the year, scab
was rampant, and it was thought a fine thing to dodge dipping
regulations. There were no fences and, in many cases, the
absence of rivers and creeks entailed patrolling by men on
foot. Some squatters attempted the Australian system of yard-
ing the flocks at night and shepherding them through the day
but it was not a success.

Unfortunately for the country the oldtime squatters
understood their bullock teams and riding horses better and
took more pride in them than they did in running or understand-
ing their merino flocks. During the sixties, however, the
vanguard of the invasion of Highland and Lowland Scottish
shepherds arrived and proved a heaven-sent blessing to the
struggling run-holders. These trained sheepmen held sway
until about 1895 when the "colonial" began to come into his
own. They cleared the country of scab, introduced system
into the management of flocks and regulated lambing to the only
reasonable time, the late Spring. Gradually they began to
awaken the conscience of the runholders as to the dangers of
overstocking and the necessity of wintering sheep on the safest country. The result, of course, was that the runholder left the management of the station to his head shepherd and, in many cases, this canny Scotsman finally acquired the run himself.

Overburning and overstocking were not the only evils introduced by the early runholders. Within a few years of the settlement of the Mackenzie country twelve rabbits were brought by Mr A.C. Begg from his Clinton station in Southland as game to entertain friends. These rabbits were liberated on islands in the Ohau river and left to multiply. When a flood swept some of them down to Haldon station they were welcomed by the runholders who put an advertisement in the Timaru "Herald" offering a £10 reward for information leading to the conviction of anyone interfering with these rabbits.

When, in 1882, a Rabbit Nuisance Act was passed empowering inspectors to compel a landowner to destroy rabbits on his property the squatters were most indignant. Even with the sad example of Southland before them they considered the act "a useless piece of machinery". In their opinion they could keep the rabbits down with a few days sport each winter. By 1887, however, it was obvious that, unless something was done soon, the whole of South Canterbury would be over-run with rabbits. As a last resort the government put up an 80 mile wire-netting fence across the southern boundary of
Canterbury. This fence ran from the Waitaki river opposite Kurow, up the Hakataramea Valley, across Grays Hills to the Tekapo river, and thence from the head of Lake Pukaki for 20 miles up the Tasman Valley. Unfortunately nature was on the side of the rabbits. Floods washed holes under the fence and boulders tore holes in it allowing the rabbits to stream through from Otago. The warm facets of the Haldon, Grampians, Grays Hills and Whalesback stations on the drier eastern side of the basin were ideal breeding grounds for them so that, within ten years Haldon had reversed its protection reward to a bonus for rabbit skins.

Numerous suggestions have been brought forward to remove the rabbits: shooting, trapping, stoats, weasels and ferrets and poison have all been tried but, so far, no method has been completely successful.

Another feature of the early days which had a detrimental effect on the general condition of many of the runs was the rapid changes in ownership. The Burnett family is the only one which has remained in continuous occupation of a run. Several men bought runs, overstocked them and, on producing a favourable balance sheet, were able to demand a high goodwill. Naturally, the newcomer who paid dearly for his run had to continue overstocking to make a profit and the carrying capacity of the land suffered accordingly.
Most of the runs were leased from the Crown and periodically they came up for re-lease. In 1911, when the lease on several of the runs expired an attempt was made at subdivision. Eighteen runs were subdivided into 27 pastoral runs and 7 small grazing runs, the latter situated more or less on main roads at Sawdon, Tekapo, Glenmore, Simons Pass and Glentanner. When the thirteen of the 27 runs were offered for auction applications were made by people in all walks of life seeking to make money from land deals.

After the First World War a further subdivision of some of the large runs was made but, in most cases, experience has proved that this was a mistaken policy. During the last decade some of these small runs adjacent to each other have been combined to make one economic unit.

For several reasons the development of settlement in the Mackenzie basin does not fall into well defined historical periods. Unlike Central Otago there was no gold mining era simply because gold was never found in payable quantities. Andrew Burnett had a ring made out of gold found on Black Forest station but the presence of gold anywhere else in the basin has not been discovered and is not considered likely.

Unlike the rest of Canterbury there was no "bonanza" wheat farming period during the seventies. Besides the fact that the climate was too severe to grow wheat successfully
the squatter generally avoided cropping the land. The "cockatoo" farmer never invaded the Mackenzie country.

Nor did the introduction of refrigeration in the eighties have any pronounced effect on the farming practices of the runholders. Mainly because of the severe climate and the harsh grazing conditions the mutton and wool cross bred sheep, so common on the Canterbury Plains from the eighties onwards, did not thrive and the raising of merino sheep for wool remained the sole occupation of the "up-country" farmer.

During this century half-bred sheep have been introduced on some stations but, because they are not heavy feeders and will survive under harsher conditions, the fine woolled merino remains the predominant strain. The growing of crops for winter feed has also been introduced but the extent of cropping varies considerably from place to place according to the policy of the runholder and the amount of arable land available. Even today, the economy of the Mackenzie run is essentially the same as it was fifty or sixty years ago. Fine wool is, and apparently always will be the staple crop of the country.
CHAPTER III
THE PRESENT PATTERN OF FARMING SUBDIVISION.

POPULATION DISTRIBUTION.

Because the sub-humid tussock grasslands of the Mackenzie basin have been devoted almost solely to extensive sheep grazing, the population density has remained very low. Prior to the recent establishment of large Public Works Camps at Tekapo and Pukaki, there was nothing resembling a town anywhere in the basin. These camps, however, are only temporary features and the sheep station is still the typical unit of settlement. There are only 4 pastoral runs in the Mackenzie Country, and some of these are managed in conjunction with each other by the one owner. On an average station the number of people is about 6 or 7, so that the population density is considerably less than 1 person per square mile.

The road pattern (see Communications map.) shows three main areas of settlement:
1. Along the eastern margin of the basin on the Haldon Road.
2. Along the central belt on the Tekapo-Pukaki Road.
3. Along the western margin on both sides of the three main valleys containing the lakes Tekapo, Pukaki and Ohau.
**Fig. 9.** The homestead on Irishman Creek station. Houses are typically large but not all are so modern.

**Fig. 10.** A typical unpainted corrugated iron woolshed with stock pens adjacent. The shelter belt behind the shed consists of *Pinus ponderosa.*
A TYPICAL SHEEP STATION.

Runs vary in size from approximately 10,000 to 100,000 acres according to the suitability of the land for sheep grazing, but the site, the ensemble of farm buildings, and the organization of each station are broadly similar.

Homesteads are usually located at a break in the slope at the foot of the ranges where there is a reliable water supply. The homestead, itself, is in most cases a large wooden house surrounded by a shelter of pines, and often larches, poplars or willows. The house may be the home of the owner and his family or, in his absence, it may be occupied by the manager. Within a short distance from the homestead are the sheepyards, which consist of wooden railed holding pens, usually infested with barley grass, and a long, deep dipping trough. Nearby, is the woolshed, a large building constructed of timber and corrugated iron, capable of housing several hundred sheep overnight, if necessary. The station hands’ quarters, which are usually situated somewhere between the homestead and the sheepyards, consist of a large bunkhouse for the shearers and two or three small huts occupied by the permanent hands. The tractor shed, implement shed, and garage are generally grouped together in a convenient situation. A distinctive feature of a high country run are the rows of dog kennels under the shelter of trees around the out-buildings.

Most stations have a fairly tidy but somewhat bare appearance. Because of the dry climate and the pure air, corrugated iron does not have to be painted to prevent rusting. The result is that
most buildings remain a dull grey colour. Severe climate and shallow soils tend to hinder the cultivation of gardens. Only hardy shrubs and flowers will thrive, and the growing season for vegetables is short. However, on some stations where there are rich silt loams, the enthusiastic gardener is able to beautify the homestead considerably and also provide a good supply of summer vegetables.

Lack of hedges is a noticeable feature in the Mackenzie Country. Because of the cold winters and dry summers, gorse, a typical "down-country" hedge plant, does not thrive. Where it grows the sheep and rabbits keep it trimmed down almost to ground level. In most places the hedge is replaced by the wire fence. Small plantations of pines or larches are the only shelter from the keen winds which sweep across the basin in winter. The pine most commonly planted is not Pinus radiata but Pinus ponderosa which stands up to the harsh climatic conditions much better. These dark green patches of trees, which stand out against the monotonous expanse of brown tussock, are most welcome to the traveller's eye.

Near the sheepyards is a large "holding paddock" where sheep are held from the time they are mustered until they are turned out again on to the grazing blocks. Where the soils are favourable, a few smaller paddocks near the homestead are kept for cultivation, but in some cases paddocks may be a mile or two away where the soils are better. The rest of the run is divided into huge grazing blocks of several thousand acres by wire fences or natural boundaries. As far as possible, the "summer country",

Fig. 11. Stockyards infested with barley grass, the seed heads of which cling to the sheep's wool and irritate the skin. *Pinus ponderosa* shelter belts are a common feature.

Fig. 12. Part of a flock of pure-bred Merino rams. The Merino breed is almost universal.
i.e. the higher slopes and shadier facings, is separated from
the "winter country", i.e. the lower, warmer slopes. A good
run is one which has a well balanced proportion of each type of
country. Where there is not enough "winter country", the snow
risk is greater and more winter feeding is necessary.

CROP AND LIVESTOCK ASSOCIATIONS.

The Mackenzie Country has always specialized in fine-woolled
sheep. Under the severe climatic conditions and the limitations
of the tussock grassland for grazing, the Merino has proved the
most suitable breed. On an average sheep-station the number of
sheep is about 4,000. Sheep are bred primarily for replacements.
Old cull sheep and store lambs are sold annually to "down-country"
farmers at the Tekapo sale in March, but very few lambs or ewes
are ever sold fat off the station. The report of the Royal
Commission on the Sheepfarming Industry in New Zealand notes that
"the fall in the value of fine wool during the depression saw some
change to halfbreds in order to quit culled-for-age ewes to the
Plains farmers for crossing with Southdowns. The change has,
however, brought trouble to the high country, as less than 2
halfbreds can be maintained where 3 Merinos grazed comfortably,
and also because the halfbred is much less hardy in bleak winters.
The effect has been overstocking and later, when pasture depletion
became evident, a reduction in the number of ewes run. The
higher prices ruling for fine wools may hasten a return to the
Merino."

On most runs there are some areas of swamp on which a few
Fig. 13. A good crop of baled hay at Ben Chau station. Hay is the main crop grown in the basin.

Fig. 14. Oats at Irishman Creek station. The stocks have all been blown down by a violent "nor'wester".
head of Hereford-Blackpoll Cattle are run. The heaviest concentration of cattle is found on the swamps at the head of Lake Pukaki and Lake Ohau. On Glen Lyon station at the head of Lake Ohau, 800 head of cattle are run as well as approximately 7,000 sheep.

Compared with the amount of land used for grazing, the amount devoted to agriculture is very small indeed. This is due to three main reasons — poor soils, severe climate and past policy of the run-holders. For the most part, the soils of the floor of the basin are shallow and stoney, but pockets of deep, fertile silts are found in the lee of the ranges and along the eastern side of the basin. In these areas, excellent crop yields may be obtained in a favourable season, but the likelihood of heavy winter snows and long summer droughts imposes a large element of risk. Conditions for harvesting in late summer are usually ideal, but, in a dry season, the crops may not be worth while harvesting. The main crops grown are hay, oats and lucerne, which are used for winter feed, but, if the yields and prices for the season warrant it, clover and rye-grass seed may be harvested as well. Turnips are also grown for winter feed.

A good deal depends on the individual runholder, as to how much ground is devoted to agriculture, and the amount varies considerably from station to station. The Grampians "farm" is approximately 2,000 acres in size, whereas the Godley Peaks station has no cultivated land at all. Some runholders consider that too much work is required for agriculture compared with the results shown: the expense involved is not worth the risk. These men prefer either to buy their winter feed or else to winter some
Fig. 15. A crop of turnips choked by fat hen (Chenopodium album) which thrives in the dry weather.

Fig. 16. A crop of turnips grown on a small irrigated area at Holbrook station. Growth is much more luxuriant and weeds are less of a problem.
of their sheep "down-country".

FARMING PRACTICES.

Little labour is required on a high country run but the type of work done requires resourcefulness and physical fitness. The major part of the work consists of mustering the sheep for shearing, dipping and weaning. Musterers is an arduous task, calling for considerable skill and patience. When mustering far away blocks the station hand may start out with his hack and dogs and a day's supply of food at 3 or 4 o'clock in the morning. In summer and autumn, when the sheep are on the "tops" he may have to climb up to 6,000 or 7,000 feet, and scramble along rocky ridges for several miles, but the task does not seem to worry him unduly. Musterers usually work in twos or threes, so that good team work is essential. For this, much depends on the efficiency of the dogs. A good sheep dog is the musterer's most valuable possession.

Dipping and weaning operations are also carried out by the permanent hands, but shearing is done by gangs of expert shearers, usually supplied by contract. Some of the shearers come over from Australia for the season, which begins as a rule in November and finishes in February. Although it is usually considered that machine shearing leaves insufficient wool on the sheep to protect them in the event of a sudden spell of bad weather, several stations employ machines on the assumption that an extra half-inch of wool is not going to make much difference to the number of sheep lost. Besides, machines are much quicker and machine
Fig. 17. Snow-raking the modern way at Irishman Creek station.

Fig. 18. Snow-raking by the old method.
shearers are more easily obtained. In the northern portion of the basin, however, where the snow risk is high, most runholders shear their sheep with blades. As soon as the sheep are shorn the fleeces are classed and pressed into bales in the woolshed; then, at a later date, the bales are removed to Fairlie by lorries and thence to Timaru.

After the shearing season follows any haymaking or harvesting which the runholder intends to do. Quite often two neighbouring stations pool their labour for these activities, moving from one place to another as soon as work on one station is completed.

During a severe winter the station hands may have to go snowraking. This unwelcome task, which consists of making tracks for sheep caught in deep snow drifts, may continue for several weeks, during which time the sheep have to be fed with hay and chaff. The ewes are kept on the safer, warmer country where they can be more easily attended during the lambing season in the late spring. After lambing, shearing is the next operation, and so the annual routine starts again.

**THE HIGHLANDER.**

The high country sheepman is essentially a rugged individualist who resents official interference of any kind (unless it be to reduce his rent, his taxes or his rates). The ideal of "laisser faire" colours his economic beliefs. He deplores the drift of young country people to the towns and criticizes the recently developed secondary industries in the cities as parasites on the farming community.
The high country farmer is also a practical man. Because he is so far isolated from the services of the town, he must be a "Jack of all trades". Should any station machinery break down, he can generally be relied upon to fix it or improvise with some contrivance until it can be fixed. Machinery seems to have a fascination for him, and this great interest is manifested in the engineering workshops at Irishman Creek. Music, art and literature usually have little interest for him, and he is much more at home discussing sheep work or current topics, such as wool prices, politics or rabbit boards.

TRANSPORT AND COMMUNICATIONS.

Isolation is a characteristic of the Mackenzie Country runs, especially those not on the Tekapo-Pukaki Road. Petrol is obtainable at Tekapo and Pukaki, but there is no general store in the whole of the Mackenzie basin. The nearest store is at Burke's Pass, approximately 13 miles from Tekapo. Fairlie, the nearest town, is 27 miles from Tekapo, while Timaru, the commercial centre for the basin, is 66 miles from Tekapo. Glen Lyon station, at the head of Lake Chau, is over 100 miles away from Timaru.

Strangely enough, although the natural drainage of the basin is through the Waitaki Gorge, in the south-east corner there is very little traffic from the Mackenzie country down the Waitaki Valley. The economic outlet for the basin is through Burke's Pass in the north-east. All the wool from the station is disposed of at the Timaru wool sale, and all supplies are obtained either from Fairlie or Timaru. Oamaru does not tap any of the
Fig. 19. Winter conditions on the floor of the basin. Falls of snow are experienced every winter but they are not always as heavy as this one.

Fig. 20. The main highway between Tekapo and Pukaki blocked by winter snow.
trade north of the Ohau river.

Roads are the only means of transport in the Mackenzie basin. Although an extension of the railway to Tekapo was once mooted, the railhead has remained at Fairlie, which is the transport centre for the Mackenzie Country. Fairlie motor transport companies cart the wool, sheep and lambs from the basin and bring in the winter feed, farm machinery, fertilizer, coal and provisions.

The main highway to Tekapo and Pukaki is generally good in summer, but winter snows sometimes delay transport until snow ploughs are able to clear the road. Spring thaws often make the road treacherous for heavy traffic. Once the thin frozen crust of the gravel surface is penetrated, trucks and buses quickly become bogged and have to be hauled out with crawler tractors. During summer floods, the absence of suitable bridges on the Pukaki-Mt. Cook road occasionally isolates the Hermitage for a day or two, but the State Highways Board is attempting to construct an all-weather road so that tourists will be able to travel when they desire.

The other five roads in the Mackenzie basin are also liable to summer flooding and snow blockages in winter, but the Mackenzie County Council's road graders and snow ploughs render useful service in clearing the roads as quickly as possible. The least accessible stations are rarely isolated for more than a week.

Along the Tekapo-Pukaki-Hermitage road, the Mt. Cook and Southern Lakes Tourist Company runs a passenger and mail service every second day, but along the other roads the mail is delivered
only once a week or not at all. From some stations, the people have to make a journey of several miles over rough gravel roads to Tekapo or Pukaki to collect their mail or to meet the Mt. Cook bus. Both Haldon station in the south east corner of the basin and Mt. Cook station in the west are over 20 miles away from the main highway.

Because of the long distance from station to town, and also from station to station, the telephone is an indispensable means of communication. Each station has a telephone, and some runholders have installed private lines connecting their out-stations to the homestead. In cases of emergency, an aeroplane can be called from Timaru to transport injured persons or to bring in spare parts of machinery. Emergency landing grounds have been established at the Hermitage and at Irishman Creek, but there are also several other places where a Tiger Moth aeroplane can land and take off. One Timaru pilot often lands at Glen Lyon station on the flats at the head of Lake Ohau to bring in odd requirements and occasionally the station has used a 'plane to locate isolated mobs of sheep.

ELECTRIC POWER.

Sparse settlement has hindered the extension of electric power in the Mackenzie basin. At present, the power lines extend only as far as Tekapo. A small plant at Pukaki supplies the Public Works Camp with its requirements, but the sheep stations have to provide their own power. This is done by several different means. Some stations have small hydro-electric
schemes, while others use a system of batteries which they charge with the aid of a water wheel or a small internal combustion engine. The hydro-electric schemes at Braemar, Irishman Creek and Glen Lyon stations are among the biggest private plants in New Zealand.

Power from the plants is used for lighting, domestic electrical appliances, refrigerators and also for shearing machines on some stations.

Even after the installation of the generating station at Tekapo within the next year, it seems unlikely that isolated stations will be linked up with the state hydro-electric supply, because the cost of erecting power lines over miles of sparsely populated country is so high.
Plate 4. The Tasman river, occupying a broad glaciated valley, winds its way from the Tasman Glacier to Lake Pukaki over this wide, flat bed of alluvium. With a rise in the storage level of Lake Pukaki some of the swamp to the left of the river may be inundated, putting former cattle grazing land out of production. The station in the right foreground is Braemar. The amount of land under crop production is greater than is found on most stations, but the general layout with pine shelter belts, and poplars and willows growing in the creek beds near the homestead, are typical.

In the background are the heavily glaciated highlands of the Southern Alps. The three highest peaks shown are, from left to right, Sefton 10,359', La Perouse 10,101' and Cook 12,349'.
CHAPTER IV

PROBLEMS OF LAND USE IN THE MACKENZIE BASIN

For many years past the difficulties of farming in the high country of the South Island have warranted investigation and, with the recent publishing of the report of the Royal Commission on the Sheep-Farming Industry in New Zealand, it is hoped that the government will give the matter the attention it deserves. As high country men the runholders of the Mackenzie basin are acutely conscious of the problem of declining production but recent wartime economic conditions have not been conducive to improvement. High post-war prices for fine wool have assisted financial recovery but unless this prosperity can be maintained the problems of farming in the area are likely to increase even further.

The generally unfavourable economic position of the Mackenzie country sheepfarmer arises from the risks and problems associated with a one crop (fine wool) economy based on a declining resource, the native vegetation cover. In his dependence on one crop the farmer is at the mercy of both the climate and the fluctuating market. During a severe winter he may lose the greater proportion of his stock while during a slump in prices his income may be
drastically reduced. Acting on the Royal Commission's advice, the Government may be able to alleviate the economic position of the runholders by reducing the burden of rent and taxation but unfortunately, it cannot eliminate the risks inherent in high country farming.

Besides the risks involved in concentration on the production of fine wool there are the problems resulting from the dependence of the sheepfarmer on the native vegetation cover to provide feed for extensive grazing. The most disturbing feature in the farming economy of the high country during this century has been the gradual decline in the sheep carrying capacity of the tussock grasslands. Statistics show that, with few exceptions, stations in the Mackenzie Country are carrying considerably fewer sheep than in 1895, or even in 1936. This is due primarily to the deterioration and depletion of the original tussock association, followed in some places by severe soil erosion. Conditions are not as bad as in parts of Central and North Otago where the vegetation cover has been depleted to such an extent that "man-made deserts" have developed but, unless the present rate of deterioration is checked, it is conceivable that the more arid parts of the Mackenzie basin may also be turned into deserts within another century's occupancy. Cumberland has described these areas as "deserts

1 See Appendix.
2 "Soil Erosion in New Zealand", p. 81.
Fig. 21.

A good average stand of tussock with seed heads prominent.

Fig. 22.

Tussock with the soil between punctured by sheep trampling, loosened by frost lift, and blown away by strong nor'-west winds.

Fig. 23.

A patch of depleted tussock with little but desert poa and scab-weed growing on the bare soil between the widely spaced tussocks.

Fig. 24.

Soil erosion. The topsoil has been removed and stoney subsoil is exposed. At this stage revegetation is a particularly difficult problem.
THE EXTENT OF TUSSOCK DEPLETION AND SOIL EROSION*

Except for the swamps no part of the basin has escaped tussock depletion. Some parts, however, are worse than others. The problem is most serious in the south-eastern corner of the basin where the rainfall drops below 20 inches. On the dry, north-facing slopes of the Benmore Range and on the Tekapo river flats near Haldon station the tussocks, which are only three or four inches high, are often several feet apart. Sorrel (*Rumex acetosa*), woolly mullein (*Verbacum thapsus*), thistles (*Cirsium arvense*, *C. lanceolatum*, *Carduus tenuiflorus*) and catsear (*Hypochaeris radicata*) are now the principal members of the vegetation cover while in some places little but scabweed (*Raoulia* spp.) and desert Poa (*P. maniototo*) is found growing among the stones on the bare soil.

The Alexandra and Omarama soils which cover most of the flat and undulating slopes of the basin are particularly susceptible to soil erosion. D.S.I.R. Bulletin 92\(^1\) claims that "on the Mackenzie Plains all stages of erosion are shown on these soils. Where tussocks are healthy and spaced

*Although much of D.S.I.R. Bulletin 92 has been condemned by the Royal Commission as inaccurate and misleading, I consider that in regard to the Mackenzie basin, its statements and maps referring to soil erosion are generally correct.

\(^1\) "Soil Erosion in the High Country of the South Island." p.37.
Fig. 25. Wind erosion near the foot of Lake Ohau. Wind blown sand from a hollow in the glacial moraine is transgressing on tussock country. The plants growing in the right middle distance are thistles.

Fig. 26. Young tussock regenerating on a cushion of scabweed. A healthy sign.
up to twelve inches apart little erosion is taking place, even though the space between the tussock is bare. But when the vegetation is so depleted that tussocks are more than three feet apart, wind erosion takes place. Baring is rapid and is only stopped by a patch of denser or more healthy tussocks, or a change of slope. The areas are stripped of all topsoil, and only subsoil is left. They are roughly oval in shape and all sizes from a few yards to a quarter of a mile in length. A typical area more than 100 acres in extent occurs near the south-eastern corner of Lake Tekapo and another about a mile west of Mount John."

Over most of the basin floor and the lower slopes of the enclosing ranges there is still a fair vegetation cover. The proportion of nutritive plants, however, has decreased greatly in favour of unpalatable weeds and poorer types of exotic grasses. In more favourable areas silver tussock, blue tussock, plume grass and bluegrass are still common but, for the most part, their place has been taken by sorrel, catsear, hairgrass, yarrow, twitch, sweet vernal, Chewings fescue and numerous weeds including bidi-bidi and horehound.

Along the western margin of the basin where the precipitation is greatly increased the mat of vegetation is still fairly dense but dwarf heath (Leucoosporon fraseri), a formerly unimportant native plant, and browntop (Agrostis
tenue) are increasing at the expense of the tussock association. Cocksfoot (*Dactylis glomerata*) and yorkshire fog (*Holcus lanatus*) grow in some of the damper localities but do not spread to any extent.

While admitting that tussock depletion has reduced the sheep carrying capacity of the land, several runholders in the basin claim that weed infestation is likely to reduce the stock numbers more quickly than soil erosion. Fortunately gorse does not thrive in the Mackenzie country but in the drier areas the spread of briar has become a serious problem. No animals will eat the plant or its seeds and each bush has to be treated with sodium chlorate to eradicate it. Under the circumstances it is almost impossible to keep the briar in check.

**CAUSES OF TUSSOCK DEPLETION AND SOIL EROSION.**

There can be little doubt that the present depleted condition of the tussock cover in the Mackenzie basin is due primarily to previous unwise burning, overstocking, and rabbit infestation. Although burning has played a much less important part during the last thirty years, the big "burns" carried out during the last century to clear the land of matagouri and spaniards and to provide fresh sheep feed permanently damaged the tussock association. They altered its composition to such an extent that it would be
Fig. 27. Severe tussock depletion and weed infestation on the lower northern slopes of the Beemore Range at the southern end of the basin.

Fig. 28. Rill erosion developing on the higher slopes of the Beemore Range.
impossible now to restore the land to its original state. Unless some satisfactory new type of pasture can be found to replace the native tussock vegetation the weeds and low quality grasses which have established themselves in its place have come to stay.

Although the composition and condition of the tussock grasslands could hardly be expected to remain unchanged after more than fifty years of sheep grazing, a good deal of depletion can be attributed to overstocking. In the early days heavy stocking was often carried out in conjunction with heavy burning by men with a poor knowledge of husbandry and a desire to make money quickly. With increased subdivision, however, other factors entered. Through subdivision some runs were made too small to allow sufficient spelling while others were given too little "winter country". It was not the actual method of subdivision that was entirely to blame, however. Subsequent history has shown that, in several instances, the land should never have been subdivided at all. On the smaller runs farmers were often tempted to overstock in order to show a reasonable profit but in a poor season the country suffered. Under the circumstances the runholder was often inclined to blame the weather rather than blame himself. Even today the Royal Commission asserts that "depletion is due to low rainfall". "We can say without fear of contradiction that the cause of depletion has been that the tussock grasslands have not stood up to the grazing
to which they have been subjected under the rainfall
conditions prevailing in depleted areas". It would appear
from the report that the climate and the tussock grasslands
are as much to blame as the grazing.

Rabbits have long been recognized as the major cause
of the declining sheep carrying capacity throughout the high
country. When sheep have to compete with rabbits for the
same feed the vegetation must suffer. Unfortunately
rabbits prefer the open ground of depleted areas to places
where there is a dense tussock cover, thereby accelerating
depletion and assisting soil erosion. On the warm, dry
slopes of the hills behind Halden station rabbits present
a particularly serious problem. Carrying rabbits is a
highly undesirable and destructive form of overstocking which
every runholder wishes to avoid but, because rabbiting has
been a lucrative means of livelihood for some men, no large
scale attempt to eradicate the pest has yet been possible.
Before any improvement can be made in the depleted areas
of the basin the rabbits will have to be exterminated as
far as possible.

Rabbits are most numerous and do the most damage in
the eastern portion of the basin but in the western ranges
where the climate is wetter and colder and the vegetation
cover is thicker there are not so many. In this area

1 Report, p. 104
Fig. 29. Large patches of red sorrel are common in the drier, south-eastern portion of the basin. Sorrel and catsear are regarded as sheep feed in this area.

Fig. 30. A large patch of "hairgrass" growing in the same locality. The spread of this weed has become something of a problem in the area.
deer, chamois and thar cause destruction of the vegetation. Chamois and thar are found mainly in the vicinity of Mt. Cook while in the upper Dobson Valley at the head of Lake Ohau herds of up to sixty deer have been seen.

Another pest which has aided the destruction of tussocks is a leaf-eating insect which has become particularly common in the south-east portion of the basin. "In the drier parts of the Mackenzie Plains every tussock is infested and on one paddock closed to stock the insects devoured all the green shoots from existing tussocks and completely prevented recovery. Insects must therefore be regarded as an important contributory factor to the erosion of these soils". ¹

METHODS OF CHECKING TUSSOCK DEPLETION AND SOIL EROSION.

The fundamental requirement to check the fall in the carrying capacity of the Mackenzie country runs is revegetation, but before this can be undertaken the rabbits will have to be killed out as far as possible. Runholders have realized this and, as a result, two Rabbit Boards have recently been established, one at Tekapo and one at Pukaki. These boards have adopted the "killer policy" which aims at the complete extermination of the rabbit. In the past rabbiting has been too much of a commercial enterprise to allow this

¹ Bulletin 92. p. 35.
policy but, in the event of devaluation of rabbit skins, "rabbit farming" would no longer be profitable and the "killer policy" would have a good chance of success.

With a reduction in the number of rabbits, spelling of grazing blocks would be much more effective than it is today. Longer spelling would also greatly assist revegetation but, under the present pattern of subdivision, it is not economic for the runholder to pay rent for land unless he is going to use it for at least part of the year. If he were to spell his grazing blocks in the best interests of the land, he would either have to run fewer sheep or else rent more land. By either method the number of sheep to the acre would be reduced still further and his income would be less. In his present economic position the average runholder cannot afford to shut up blocks of land for any length of time when they could be used for grazing. Under the system of spelling used today most of the land in the basin is neither deteriorating to any great extent, nor is it being allowed to improve. One solution to the problem appears to be in the amalgamation of adjacent runs which can no longer be managed successfully as independent units. This has already taken place to some extent, for instance, at Pukaki Downs, Dusky and Dusky Tophouse; also at Haldon and Black Forest stations. With an increase in the size of the runs better subdivision of blocks would be possible,
Fig. 31. Briar spreading over the morainic downs at Pukaki.

Fig. 32. Woolly mullein (Verbasum thapsus), thistles and soft brome growing on shallow stoney soils at Tekapo. These weeds are common along the drier eastern margin of the basin, especially on the warm hill slopes and the stoney riverbeds.
provided that the present cost of fencing (2500 per mile) is reduced.

Several experimental plots have been established in the Mackenzie basin by the Department of Agriculture to explore the possibilities of regrassing the depleted areas. The first of these plots were laid down in the eastern part of the basin in 1921 by R. McGillivray who subsequently reported on their progress\(^1\), but interest seems to have lapsed until just recently when the Department established another series of plots near Holbrook station. The earlier plots were fenced in to protect the plants from animals and pine trees were planted around them for shelter. Under these artificial conditions most of the species planted thrived but when the fence was removed the more palatable species were soon eaten out. Weeds such as sorrel and catsear continued to stand up to the heavy grazing and some clover, lucerne, yarrow and Chewings fescue have remained. The shelter of the trees may partly account for their survival. The problem of how to establish pasture grasses on the grazing blocks has yet to be solved. On the bare-patches where revegetation is most necessary the task seems virtually impossible. Seed sowing on damper country sometimes achieves good results for a few years if seasons are good. With heavy grazing, however, the pasture soon

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deteriorates unless it is top-dressed. Aerial seed-sowing and top-dressing are being tested on a run near Omerama, just south of the Mackenzie basin, but the results in such a dry area are hard to foretell. Even should the experiment be successful it is doubtful whether the average runholder would be able to afford the high expense involved.

Instead of increasing the size of the runs as previously suggested, there is an alternative method by which the land could be given a chance to improve. Increased production of winter feed by agriculture would enable many runholders to spell their grazing blocks to a greater extent while still maintaining the same number of sheep. Several stations have already adopted this method, notably the Grampians, Holbrook, Tasman Downs, Braeside, the Wolds and Simons Hill. Hay, oats, lucerne and turnips are the main crops grown. Agriculture adds considerably to the cost of production and requires more labour but where arable land is available it is the simplest solution to the problem of declining sheep carrying capacity. The Grampians station which has the biggest acreage of land under crops is the only station in the basin which has been able to increase its stock numbers over the last twenty years.

Care has to be taken in cultivating the ground to prevent loss of topsoil by wind erosion, but the risk could be lessened considerably by the planting of more shelter belts
around the paddocks.

The big handicap to agriculture in the Mackenzie basin is the risk of summer drought. In Central Otago this has largely been overcome by the use of irrigation, but few attempts at irrigation have been made by Mackenzie runholders. One small scheme at Holbrook station, however, gives some indication of what can be achieved under favourable circumstances. On 120 acres of irrigated land excellent crops of hay, ryegrass, clover, oats, lucerne, linen flax and swede turnips have been grown. The runholder is singularly fortunate in that he possesses a flat area of deep silty loam adjacent to a permanent stream issuing from the Two Thumb Range. By planting pine shelter belts the efficiency of agriculture on the irrigated land has been increased.

The Department of Agriculture is now preparing to make a detailed study of the soils in the basin, but it is doubtful whether any areas suitable for large scale irrigation will be found. Unlike the fertile schistose soils of Central Otago which respond readily to irrigation the soils which cover most of the basin floor are thin, stoney and porous. In any case, now that the decision has been made to store as much water as possible in lakes Tekapo and Pukaki during the summer it does not seem likely that sufficient water will be available for any large irrigation schemes.
Suggestions have occasionally been put forward recommending the planting of coniferous trees in depleted areas as an alternative form of land use to sheep grazing. On the leeward side of several small plantations young trees may be seen growing of their own accord where the wind has carried seeds off the trees originally planted. Planting on a large scale, however, would present many difficulties. The cost of labour is high and fencing wire to protect young trees from stock and vermin is almost unprocurable. From the commercial aspect forestry in the Mackenzie basin would not be profitable. Tree growth is slow compared with that in the exotic plantations of the North Island and other parts of the South Island. The summer fire hazard is also greater. Disposal of the timber would present another difficulty. No market for the timber exists within the basin and Timaru, the nearest port, is fifty miles away from Burkes Pass.

Production of fine wool undoubtedly makes the best economic use of the land but some changes are necessary if vegetation depletion and soil erosion are to be checked. Increased destruction of the rabbits, increased use of supplementary feed to spell the grazing blocks as much as possible and increased use of shelter belts to check wind erosion would all assist the maintenance of an effective vegetation cover, which, after all, is the ultimate source of the runholders' livelihood.
Fig. 33. Young self-established pine trees thriving on the leeward side of a plantation at Tekapo. Unfortunately these trees are not likely to grow in the same manner where they are most needed, i.e. on the depleted areas.

Fig. 34. A good shelter belt established in an exposed area on depleted land. The costs and difficulties of obtaining fencing wire are holding up this valuable work.
CHAPTER V

OTHER ASPECTS OF OCCUPATION AND LAND USE

THE HYDRO-ELECTRIC SCHEMES

The shortage of electric power which, at present, is causing great inconvenience throughout New Zealand has spurred the Ministry of Works into developing the most readily available water power resources as quickly as possible. Many of the most favourable sites for the generation of hydro-electric power are to be found in the South Island high country and several schemes which had been contemplated before the recent war are now being pushed ahead.

The Mackenzie basin forms the northern part of the inland catchment area of the Waitaki River, the largest producer of hydroelectric power in the South Island. The three lakes Tekapo, Pukaki and Ohau provide a great volume of water for the river which is harnessed at the Kurow power station. Unfortunately the flow of the river is subject to wide seasonal variation and, in spite of the large dam at Kurow, serious shortages of water often occur in winter just when the demand for power is greatest. In order to regulate the flow and to even out the seasonal variation in the river regime a large scale project has
recently been put into action. The aim of this project is to dam the lakes Tekapo and Pukaki, and possibly Ohau, for use as storage reservoirs. Work on this huge undertaking began at Tekapo in 1939 but was discontinued during the war. After the cessation of hostilities work started again at Tekapo and shortly afterwards the Pukaki scheme was also put into action. At present work on both schemes is in full progress.

**The Tekapo Scheme.**

Because the site at Tekapo is suitable for power development a generating station is being installed as well as a storage dam; in fact, the dam will not be constructed until after the power house is operating. By means of a tunnel nearly one mile long and nineteen feet in diameter, driven through the terminal moraine which ponds back the lake, water will be fed to a point approximately 100 feet above the power house. Here a single Kaplin turbine driving a 25,200 K.w. generator is to be installed. Once through the turbine a tail race will carry the water one mile away to join the Tekapo river. In this way the water can be used again to generate power at Kurow. If work progresses according to plan the Tekapo station will be producing power in 1951.

The lake level is to be raised by the construction of
Plate 5. Lake Tekapo occupies a long, shallow depression at the mouth of the Godley valley. The lake is ponded back by glacial moraine and alluvium through which a tunnel has been pierced to supply water for the hydro-electric power station. A dam to control the storage level of the lake is to be built across the Tekapo river near the bridge.
a dam on a site just below the present highway bridge. This
dam will allow the storage of 25 feet of water above the
level of the tunnel plus a further 3 feet to accommodate
floods. With the turbine working at full capacity, however,
all this water could be used in two months; consequently,
power will be generated only when there is an excess of
stored water. The prime object of the Tekapo scheme is to
store the water of the spring and summer floods in the lake
for use in the winter when the supply is generally lowest.
The power station will be largely automatic but, because of
distance from the nearest centres of population, operators
will be available in case of snow trouble or break-downs.

The Pukaki Scheme.

The object of the control works at the outlet to Lake
Pukaki is to impound the summer run-off from the Mt. Cook
area and to release it gradually during the winter to supply
the power station at Kurow. When completed, these works
will consist of a sluice structure for discharging the
impounded water, and "earth fill" dam, and a spillway for
releasing floods which are too big to be held in the lake.
The dam will enable water to be stored to a height approximately
30 feet above the present level. As the lake is some 34 square
miles in area control of this huge volume of water will be
of great benefit to the Waitaki power station. At present
Fig. 35. The tunnel at Lake Tekapo excavated through moraine and silt.

Fig. 36. The power station at Tekapo under construction. When completed it will be capable of generating 25,200 kilowatts.
the Public Works Department has no intention of building a station at Pukaki but it has been suggested that the fall from Tekapo to Pukaki could be made use of to generate power. This would necessitate the diversion of the Tekapo river into Lake Pukaki, an expensive but not impossible task. The development of schemes elsewhere, however, is much more likely.

Other Schemes.

Plans regarding the development of the water power resources of the Mackenzie basin have been modified several times. So far there has been no move made to dam Lake Ohau but it is possible that an attempt will be made in the future. Once the Tekapo and Pukaki schemes are completed the attention of the Ministry of Works will probably be diverted to the construction of the dam and power station at Black Jacks Point in the upper reaches of the Waitaki gorge, but it will be several years before this scheme is completed. With the development of the huge project at Coal Creek in Central Otago work on the Waitaki scheme may be retarded somewhat.

Land-Use Changes Introduced by the Hydro-electric Schemes.

As a result of activities connected with the hydro-electric schemes the landscape at Tekapo and Pukaki has been
Fig. 37. The approximate site of the dam at Lake Takapo. When constructed the bridge will have to be removed and possibly Takapo House also.

Fig. 38. The coffer dam at Pukaki. In the background the camp can be seen strung out along the terraces in the terminal moraine.
altered considerably. With the removal of the bridge and the hotel and the installation of an earth dam Pukaki has assumed a totally different appearance. Hills have been removed and islands in the lake have disappeared except for the tops of trees projecting above the level of the water. At Tekapo the change, so far, has not been so great. The driving of the tunnel has not altered the appearance of the place to any great degree, but when work begins on the dam construction a change similar to that which has taken place at Pukaki is bound to occur. The highway bridge, which has been a landmark for many years, will be removed and Takapo House may have to be rebuilt in a position higher above the future lake level than the present site.

A more serious problem resulting from the raising of the lake levels at Tekapo and Pukaki is one which is going to affect the stock carrying capacity of the land. To increase the storage capacity of the lakes the lake-head swamps will have to be squalified. These swamps which support a dense tussock association together with a high proportion of English grasses such as cocksfoot, timothy, fescue and clover are, at present, used for grazing both sheep and cattle. When the swamps are permanently flooded the runholders will have to reduce their stock numbers and adjust their grazing system accordingly. If Lake Ohau
should ever be dammed Glen Lyon station would no longer be able to graze 800 cattle on the flats and a valuable source of income would be lost. It can be said that the swamps occupy only a small proportion of the total area of the Mackenzie basin and that the flood danger has always been fairly high, but their loss will be felt by several runholders, especially those in the Taaman Valley.

Changes in the Settlement Pattern Introduced by the Hydro-electric Schemes.

Besides introducing changes in land use the hydro-electric schemes have also completely altered the population distribution. Before the recent war there were no townships in the Mackenzie basin. Now there are two. With the establishment of large Public Works camps at Tekapo and Pukaki an entirely new element has been introduced into the settlement pattern. At both camps rows of wooden huts have been erected on the morainic ridges and river terraces to accommodate the workers and their families. At present 250 men are employed on the hydro-electric scheme at Tekapo and the population, including women and children is over 900. The camp population at Pukaki has risen to over 500, most of whom are single men.

Every effort is made to provide the usual services associated with town life. Electricity is installed in the
Fig. 33. A single man's hut at Tekapo with electricity and small stove installed.

Fig. 40. A married quarters hut at Tekapo. An attempt has been made to form a garden on the patchy soil.
huts and water is pumped from the lakes but there is no sewage. Stores in the camps provide some groceries and general requisites but all the milk, meat and bread has to come from Fairlie and Timaru by bus and freight car. Mt. Cook buses pass through Tekapo everyday and a special bus runs from Tekapo to Timaru three times a week to allow people to do their town shopping. On week-ends special buses also run from Tekapo and Pukaki to Christchurch.

In each camp a number of public amenities has been provided, including a Post Office and Savings Bank and a modern primary school. A resident nurse at Tekapo attends to sick cases and casualties brought in by the camp ambulance while a policeman attends to the maintenance of law and order.

To provide entertainment Y.M.C.A. buildings and Social and Dance Halls have been erected. Pictures are shown once a week and dances are held frequently. Football, cricket, badminton and table-tennis clubs have been organized and members play in Fairlie district competitions. In summer, people may swim in the lakes while during the winter the skating rink at Tekapo is a popular attraction.

In spite of all these services and amenities the isolated situation and the discomforts of the climatic extremes have caused many labourers to leave the camps, some of them after only a few days. During one particularly severe winter workers left Pukaki in busloads. Other people, however,
quickly become accustomed to the climate and prefer the economical existence of camp life to life in the town.

The large influx of town dwellers into the Mackenzie basin has not been without its social implications. The "settlers", who are now outnumbered by approximately four to one by a group who have a different social and political outlook are concerned about their present position. Not only has their political influence been swamped but the presence of the camps has also tended to aggravate their labour problems. The high wages and the social amenities offering in the camps makes it difficult for the runholders to keep rabbiters and seasonal labourers. Once the hydro-electric schemes are completed, however, these problems should, for the most part, remedy themselves.

There has been little social contact between the "settlers" and the camp population; consequently no assimilation has taken place. The camps are essentially of a temporary nature so that when construction work is completed at Tekapo and Fukaki the workers will leave, the huts will be removed to other Public Works camps, and only a few technicians and their families will be left.

THE IRISHMAN CREEK ENGINEERING WORKSHOPS.

Besides the state hydro-electric schemes, there is
another industrial enterprise in the basin which must be unique in the history of New Zealand manufacturing. The engineering workshops at Irishman Creek station, which have been admirably described by Dr. H. C. Pappe, secretary of the firm, in an article "Manufacturing in New Zealand: A Specific Example" are certainly the most unusual enterprise to be found in the Mackenzie Country. Situated at what appears to be a prohibitive distance from the market, it seems almost incredible that heavy engineering goods manufactured on the station should be able to compete with imported goods. Nevertheless, that is what has occurred.

In his article, Dr. Pappe explains that, "the location of the enterprise at Irishman Creek was apparently uneconomic. The original factory, now used mainly as an experimental workshop, is .... forty miles from the nearest railhead. The road leading there is often impassable for trucks during the winter. The distance from Christchurch is 180 miles; and material has to be carried to the factory and end-products have to be returned over this distance. The site was not selected for its special advantages, but because the founder of the factory happened to be the owner of a typical Mackenzie sheeprun - an expanse of mountain grazing land extending over more than 20,000 acres".

In spite of additional cartage costs, the disadvantages of the site were outweighed by the efficiency of the workshop.

Fig. 41. The engineering workshops at Irishman Creek station.

Fig. 42. The cookshop and bunkhouses at Irishman Creek.
team and the scope allowed for experiment.

The start of manufacturing at Irishman Creek was made a few years before the recent war with a minimum of capital outlay. As Pappe says, "more time was available than money", and such equipment as it was possible to make was constructed on the station. The experience gained in designing and building the workshop equipment was then applied to the construction of machinery specially adapted to suit New Zealand conditions. New machines were invented and the efficiency of overseas equipment was improved upon. Most of the early work was done on earth moving machines such as angledogers, loaderdozers, scrapers and roadgraders, but hydraulic equipment, cranes, elevators and certain types of agricultural machinery have also been designed and produced.

During the war the workshops were devoted to the production of earth moving equipment and munitions. "The plant was soon taxed to capacity and an additional workshop had to be established . . . in the rural township of Fairlie, forty miles away". These factories turned out finely machined M.G. carrier, rifle, machine gun and trench mortar components and bombs.

When war-work ceased, the existing plant was found to be insufficient for the new lines of manufacture. Accordingly
a factory was established at Christchurch and the original workshop at Irishman Creek was devoted principally to experiment. "A dozen picked employees are now engaged there on the design and construction of new machines and improved models of old ones. However, side by side with this goes the production of control units and hydraulic jacks, as well as the making of certain parts requiring specialized machining processes".

Although the main factory was transferred to Christchurch, "it was subsequently proved that it would not have been necessary for reasons of economic production, had it not been for the limited power available and the accommodation difficulties experienced at Irishman Creek".

The greatest problem the enterprise has had to contend with is the difficulty of obtaining labour. There was no local supply of skilled engineers and little monetary inducement could be offered to attract suitable labour from the towns. Consequently "the labour supply had to be created on the spot" ........ "Of forty employees only four came to the firm as skilled engineers. Most of the others were employed on the land". The first helper was a rabbiter while several of the senior workers were originally cowmen or stationhands.

In order to attract industrial labour into the "wilderness" of the Mackenzie country the management had to make living
and working conditions as attractive as possible. Huts were erected and each worker was given a separate room with electric light and an iron stove. Married couples and families were housed in cottages convenient to the workshops.

"The smallness of the settlement and the identity of interests provide a strong tie between the members of the community." Unlike the nearby Public Works camps at Pukaki and Tekapo the people have organized their own recreation. "There are no pictures, no regular sports events to watch, no pubs to visit." Instead, an ice rink has been constructed and, during an average winter, good skating conditions may be expected for two or three months. Skating has become the most popular sport in the community. For summer recreation a tennis court is provided while the five-acre power plant dam offers facilities for fishing, swimming, boating and aquaplaning. The radio now provides most of the musical entertainment but, before the main factory was established in Christchurch, a pipe-band flourished in the settlement and played at communal gatherings.

Pappe sums up the present situation by stating that "the problem that now presents itself to the enterprise - since the move to Christchurch - is to keep the original spirit in the new and enlarged conditions of the town. Irishman Creek is a place with a strong local colour, and not everything
can easily be transferred to different surroundings. However, all that is outstanding, all that makes the place different from other high country runs, as well as from other industrial undertaking, is not necessarily peculiar to the site at Irishman Creek. The conditions have been created by an enterprising man, and the lesson they provide, can, it is anticipated, be applied on a larger scale in a different environment."

THE TOURIST TRADE.

Early visitors to the Mackenzie country were quick to appreciate the beautiful alpine scenery of the western ranges. Recording his trip into the area in 1862 von Haast gave a vivid description of the view from a point near the present site of the Ball Hut. "It is impossible for me to describe in adequate words the majestic scenery by which we were surrounded; the weird mountain chains with their crowning peaks in stately forms, the numerous tributary glaciers on their flanks, often broken into innumerable seracs, of which the glorious ice cascade of the Hochstetter Glacier was the most conspicuous, and the wide ice stream itself carrying slowly its enormous load of debris to its terminal face, crevassed and with deep ponds all around us - all this impressed our minds with deep admiration. But the

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1 Geology of Canterbury and Westland.
magnificent pyramid of Mount Cook, or Aorangi, stood high above all, towering into the sky. As far as the eye could reach everywhere snow and ice and rock appeared around us, and in such gigantic proportions that I sometimes thought I was dreaming, and instead of being in New Zealand, I found myself in the Arctic or Antarctic mountain regions. . . . . Nothing I had previously seen can be compared with the sublimity of the scenery, which certainly has not its equal in the European Alps.

When Governor Sir George Bowen visited the area in 1873 he was greatly impressed and notified the Royal Geographical Society of the wonderful challenge which Mount Cook presented to climbers. European mountaineers accepted the challenge and during the eighties and nineties many attempts were made to ascend Cook and the neighbouring peaks. To accommodate these daring enthusiasts the Hermitage was built in 1884 at the base of the Sealy Range about a quarter of a mile from the terminal face of the Mueller Glacier. It was an ideal base for mountaineering excursions but, with the development of the tourist trade, sight seeing became more important than climbing. In 1913 a new Hermitage was built two miles further down the valley at Governor's Bush. This new building at the foot of the bush-clad slopes of Mt. Sebastopol was in a more attractive setting and from the north-facing windows visitors were able to obtain a fine view of Mt. Cook.
Fig. 43. Takapo House. A summer health resort with an ice rink as a winter attraction.

Fig. 44. The stone church at Takapo built in honour of the pioneer settlers.
Until the First World War the remoteness of the area precluded any big development of the tourist trade but, with the introduction of motor transport, in the twenties the journey from Timaru, 156 miles away, was shortened to a day's travel. New Zealanders and overseas tourists, eager to see the highest mountains and the biggest glaciers in the country, visited the Mt. Cook area in increasing numbers and soon the Hermitage became a hostel of national renown.

Most of the mountaineering and sight-seeing took place during the summer months but, with the increasing popularity of skiing as a sport, the number of people staying at the Hermitage during the winter began to surpass the summer total. The Ball Hut, near the skiing grounds, was enlarged to take up to thirty people and sporting equipment was made available for hire. At present the Hermitage, together with the Ball Hut, offers accommodation for approximately eighty people.

In an endeavour to stimulate the tourist trade in New Zealand the Government Tourist and Health Resort Department has taken over the management of the Hermitage. Travellers from overseas are encouraged to visit Mount Cook and sight-seeing trips are arranged for them.

Although the beauty of the lakes in the Mackenzie basin has not attracted tourists to the same extent as it has in the "cold" Southern Lakes district, Tekapo is gaining popularity as a health resort.
Ever since 1863 there has been an accommodation house at Tekapo. Before the suspension bridge was built it was patronized by travellers who had to be ferried across the Tekapo river and after the opening of the bridge to traffic in 1880, the hotel remained a stopping point in the journey from Burkes Pass to Pukaki. With the advent of motor transport a new hotel catering for the tourist trade was built in 1919. The beautiful mountain and lake scenery, and the clear, dry atmosphere, gave Tekapo a good reputation as a summer health resort. Prior to the recent war an ice-rink was constructed as a winter attraction and it proved a big success. During the winter skating season large week-end crowds from Timaru and other parts of South Canterbury visit the rink where championship competitions are held. Takapo House is expanding as a tourist hotel and since the war several small huts have been erected on the premises to accommodate additional guests during holiday periods.

Lake Alexandrina, a small lake approximately eight miles from Tekapo, is a well-known sporting ground for South Canterbury anglers. Several fishermen have built huts on the edge of the lake where they spend their summer holidays.

The hotel at Pukaki has never enjoyed a tourist trade comparable with that of either the Hermitage or Takapo House.
Fig. 45. The Hermitage, a tourist resort of national renown.

Fig. 46. Mt. Cook, 12,509 feet. The "crowning glory" of the Mackenzie country.
The lake itself is not as attractive as Lake Tekapo nor is it so conveniently situated. Travellers tend to continue on to the Hermitage rather than stay at Pukaki.

Lake Ohau is the most picturesque of the three large lakes. Its beautiful deep blue water is skirted by grey shingle beaches and in some places small green patches of beech forest reach down to the lake edge. In spite of its scenic attractions, however, Ohau is the least frequented of the lakes. Most of the visitors are either fishermen or deer shooters.
CONCLUSION

After nearly one hundred years of European occupation extensive pastoralism is still the main economy in the Mackenzie basin and, unless some great change in world markets takes place, concentration on the production of fine Merino wool seems likely to continue. With the decline in the carrying capacity the recent trend has been away from further subdivision of the large runs but this tendency may be halted by the destruction of rabbits and the discovery of suitable pasture grasses to supplement the indigenous tussock association. Up till the present little research has been done on the possibilities of increased crop production and it is difficult to predict the future of agriculture in the basin. In the light of present knowledge, however, the development of irrigation on a big scale seems unlikely and the large sheep station appears destined to remain the typical unit of settlement.

The importance of the Mackenzie basin as the northern part of the inland catchment area of the Waitaki river has recently been emphasized by the construction of control dams at Lakes Tekapo and Pukaki. The main object of these schemes is to ensure a regular flow of water for the hydro-electric power station at Kurow but, in addition, power will also be produced within the basin at Tekapo for
at least part of the year. Further hydro-electric development is still possible and in the future the plan for building a dam and power house at Black Jack's Point in the upper Waitaki Gorge may be put into effect.

Although the dam building activities of the Ministry of Works have received a good deal of publicity the Mackenzie country is best known for its tourist and sporting attractions. Every year hundreds of tourists visit the Hermitage to see the wonderful alpine scenery of the Mt. Cook area and accommodation is usually fully taxed. Because the tourist trade is one means by which New Zealand can earn foreign exchange the Hermitage has been taken over by the Government and overseas visitors are being specially catered for.

Tekapo House at Lake Tekapo shares in the tourist trade to some extent but it is better known as a summer health resort. Winter sports also attract many people to both hostels. On several occasions the national ski championships have been held at the Hermitage and this year (1949) the national ice-skating championships were held on the rink at Tekapo.

Three main elements thus appear in the settlement pattern of the Mackenzie basin, the large sheepstations, the hydro-electric works and the tourist hostels. They are all independent of one another yet each one helps to give the basin its distinctive character.
### APPENDIX

**COMPARATIVE RENTALS TO CARRYING CAPACITY - MACKENZIE COUNTRY RUNS 1895-1936**

<table>
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<tr>
<th>In 1895</th>
<th>Run 1936</th>
<th>Sheep Carried 1895</th>
<th>1936</th>
<th>Decrease</th>
<th>Rent 1895</th>
<th>1936</th>
<th>Increase</th>
<th>Rate per head 1895</th>
<th>1936</th>
<th>Increase</th>
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