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THE AGRICULTURAL GEOGRAPHY

of

SOUTH CANTERBURY.

THESIS

for

MASTER OF SCIENCE AND HONOURS

in

GEOGRAPHY.

University of New Zealand.

1951.

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INTRODUCTION.

The term 'agriculture' has been used by Whittlesey (1) to apply to both plant and animal husbandry. Although the members of the agricultural community of South Canterbury recognise 'agriculture' as meaning only arable farming, Whittlesey's definition has been followed in this thesis, the aim of which is to describe the agriculture of South Canterbury as it is today, with emphasis upon its areal character and its contribution to the pattern of South Canterbury's landscape.

It has been stated by Whittlesey that the regional pattern of agriculture is basically determined by two concurrent forces.

"One of these is the combination of environmental conditions which sets the limits of range for any crop or domestic animal and provides, within these limits, optimum habitats. (.....) The other force is the combination of human circumstance which applies the habitat possibilities of plants and animals to human needs." (2)

The extent to which environmental conditions and human circumstance determine the agriculture of a region can not be ascertained, but both of these features may be satisfactorily considered as the background to the portrayal of this agriculture. Physiography, climate and soil have been discussed as part of this background for South Canterbury's agriculture. The historical development of agriculture has been discussed as another part, more directly of the 'human circumstance'. There follows a systematic contemporary account of crops

(2) Derwent Whittlesey, ibid.: p. 208
and livestock, with reference to their areal distribution, together with mention of recent developments. This brings the description to the main objective of this study, namely, the division of South Canterbury into agricultural regions, each being portrayed in terms of its agricultural practice and the resultant landscape. A few selected examples of agricultural units, and the methods used for the collection of data and compilation of maps, have been described for the appendices.

The writer wishes to thank all those farmers who were of assistance in answering innumerable questions, and the Departments of Agriculture at Timaru, Waimate and Oamaru which provided otherwise unavailable statistics.

The following are thanked for their special additional assistance both in the field and in the provision of data:

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- Mr. Millar, Department of Agriculture, Waimate.
- Mr. Sievwright, Department of Agriculture, Lake Tekapo.

......
CHAPTER I.

THE PHYSICAL BACKGROUND.

The mutual interaction of physiography, climate and soils on the surface of the land provides the conditions under which South Canterbury may be utilised for agriculture; and without interference from man, these conditions may be regarded as constant over a relatively long period. Man has chosen to utilise some areas in South Canterbury with differing physical backgrounds in varying ways, and areas of contrasting physiography or soils or climate, or any combination of these three, may, and do in some cases, show definite coincidence with contrasting areas of agriculture.

A. PHYSIOGRAPHY.

South Canterbury is that area consisting of the four counties of Geraldine, Mackenzie, Levels and Waimate. It is bounded on the north by the Rangitata River, Forest Creek, and part of the Two Thumb Range, on the south by the Waitaki River, on the west by the crest of the Southern Alps and in the east it reaches the coast. Its surface form may be briefly described as consisting of part of the Southern Alps in the west, grading eastwards through higher hills and rolling downlands to an area of flat land on the coast. Local descriptive terms suggest three types of landforms; the foothills, the downlands and the plains, a fourth type being the mountains and mountain basins. Figure I delimitates these four
SOUTH CANTERBURY

PHYSIOGRAPHIC REGIONS

1. THE MOUNTAINS AND MOUNTAIN BASINS
2. THE FOOTHILLS
3. THE DOWNLANDS
4. THE PLAINS

FIGURE 1
major types of landforms in South Canterbury.

1. **The Mountains and Mountain Basins.**

   Physiographically this area is characterised by high mountains and hills varying in height from 4,000 feet to over 10,000 feet, steep slopes and narrow river valleys, and it also includes the rolling country of the broad Mackenzie basin. In the north glaciation has left its mark in the form of deep steep-sided U-shaped valleys now occupied by rivers flowing over extensive shingle beds. From the main chain are southward extensions of mountain ranges which decrease in height to merge with the rolling hills of glacial moraines occurring near the southern ends of Lakes Tekapo, Pukaki and Ohau. Although the area drained by the rivers flowing from the three lakes is frequently referred to as the Mackenzie Plains, little of it is actually flat; the monotonous yellow-brown tussock gives a deceptively level appearance to what is essentially an undulating area of low hills merging into numerous terraces of the larger rivers. In the south the mountain and basin country is bounded by the Kirkliston Range and in the north it extends as far east as the Mount Peel area where the Orari River drains a small basin in the heart of the mountains.

2. **The Foothills.**

   East of the mountain and basin country are the foothills. None of this area has been glaciated and the river valleys though steep-sided slope down from moderately rounded hills whose heights vary from 1,000 feet to over 4,000 feet. Structural movements at the time of the Kaikoura
Orogeny have given to the foothills, especially in the south, steep facing eastern slopes and gently dipping western slopes within the general north-south trend of the hills. Examples of this are clearly seen in the Hunters Hills and the hills to the west of the Waihao basin. Included in the foothills area is the Hakataramea Valley formed by similar structural movements during the Kaikoura Orogeny. It is bounded in the west by the steep eastern scarp of the Kirkliston Range, but between this and the Hakataramea River landforms are essentially typical of the downlands.

3. The Downlands.

This area consists of gently rounded low hills sloping down to the valleys of the numerous small streams that flow between them. Flowing right across larger streams such as the Opihi, Pareora and Otaio Rivers, whose broad flat-bottomed beds form ribbons of level land which extend well into the hills of the downlands. Although only of minor significance in the general pattern, these more marked valley plains break the downlands up into separate clusters of hills each separated by one of the larger rivers. Local relief varies from only a few feet a few miles west of Temuka to over two hundred feet in districts near the foothills. Included in the division in Figure 1 is the Brothers Range whose gradual eastern slope is composed of low rolling hills and whose steep western scarp faces the downlands of the Albury-Fairlie area, the latter extending north to a small alluvial plain formed by the South
Opuha and Opihi Rivers.

4. The Plains.

The Canterbury Plains are a significant physiographic feature of Canterbury as a whole, but very little of their area extends into South Canterbury where there are two main regions of level land, these being the plains extending north from Timaru to the Rangitata River and from the vicinity of Studholme south to the Waitaki River. A narrow strip of flat land continues north along the coast in the latter area, but from Timaru to Pareora the downlands reach the sea. The plains only have a gradient varying from twenty to thirty feet to the mile, the break in the general flatness being slight undulations denoting both former and present river courses.

B. CLIMATE.

The greatly varying relief of South Canterbury is reflected in its wide variety of climatic types. Under Thornthwaite's classification (1) these vary from the subhumid mesothermal climate of the coast (C B') to the perpetual frost and snow of the mountain peaks. (F')

Figure 2 shows the variations in average monthly rainfall and temperature at four stations in South Canterbury, and these can be taken as representative for the areas in which they occur.

The Hermitage experiences a climate which is typical for the

---

SOUTH CANTERBURY

- Average Monthly Temperature and Rainfall Graphs -

[Diagram showing temperature and rainfall graphs for different locations in South Canterbury]

FIGURE 2
valleys close to the main divide. The rainfall (nearly all occurring with a northwest wind) shows a tendency to decrease in the winter months, when the more usual form of precipitation is snow which lies for long periods. The lower limit for perpetual snow and ice is 7,200 feet. (2)

Away from the mountains there is a strikingly rapid decrease in the amount of the precipitation. Lake Tekapo recording station, only twentyfour miles from the Hermitage, has a rainfall of over one hundred inches less than the latter. This typifies the much drier conditions that prevail in the area around and especially to the south of Lakes Pukaki and Tekapo. Snow is a feature of the winter climate, although it is not as frequent as in the mountain valleys.

Fairlie, in an inland position close to the foothills, experiences a greater amount of rainfall than either Lake Tekapo or Timaru. Garnier has shown by using Thornthwaite's classification that there is a band of humid climatic type extending from the vicinity of Mount Peel along the foothills to the Hunters Hills. (3) This is in distinct contrast to the subhumid types of the Mackenzie basin to the west and the downlands to the east. Fairlie's higher rainfall figures reflect the greater precipitation of the humid region, Fairlie being just on the boundary between humid and subhumid types.

The greater humidity typical of a large area of the foothills is not only noticeable in the higher average rainfall figures but also in

(2) B.J. Garnier, ibid., p. 94.
(3) B.J. Garnier, ibid., p. 91.
the presence of low-lying clouds which are frequently seen clinging to the hills when both the Mackenzie basin and coastal downlands are experiencing clear skies and sunny weather.

The coastal area and that extending up the Waitaki Valley into the Hakataramea Valley have annual average rainfalls of less than twenty-five inches. There is no marked seasonal variation although there is a tendency towards greater amounts in the summer months.

Precipitation contributes far more to South Canterbury's climatic variety than does temperature. The latter shows greater differences between coastal stations and inland stations in winter months than it does in summer months. In his thermal categories of the South Island in winter Garnier (4) has classified all of South Canterbury except for a very narrow coastal strip as being in the cold thermal category, the coastal strip being classified as cool. Nevertheless, all districts experience frequent frosts the severity of which increases with distance from the sea. Summer temperatures are higher for the coastal districts, but greater extremes are common inland where the moderating effects of sea breezes do not penetrate.

A feature of South Canterbury's climate is the north-west wind. Most frequent in the spring and autumn seasons, and uncommon in the winter months, it is a strong warm wind with a very low humidity. Its occurrence especially in the spring is of major importance to South Canterbury's

(4) B.J. Garner, ibid., p. 110.
arable farming. Not only does it dry the soil very quickly but a ploughed field subject to such drying can frequently have much of its soil blown away by a strong north-west wind.

A direct result of climatic conditions in South Canterbury is the cessation of pasture growth in the colder winter months. Moreover in summer this growth is limited in some areas by moisture deficiencies. It has been shown that under Thornthwaite's (5) classification there is, extending along the coast from the vicinity of Temuka to the Waitaki River and up its valley into the Hakataramea Valley an area which can be recognised as being subject to moisture deficiencies at all seasons in average years. Within this region soil types vary greatly (6), and it is these soils which determine the extent to which the moisture deficiencies are reflected in pasture growth. Those pastures on the moisture-retentive soils are in actual fact little affected by moisture deficiencies revealed by Thornthwaite's classification.

The agriculturalists of South Canterbury, however, are little concerned with average climatic conditions. Rather than the average, it is the variations from this that are of immediate concern to the farmer. Subhumid areas may in dry years become regions where drought prevails. In such circumstances pastures wither and crops show poor returns per acre. On the other hand, of more frequent occurrence are periods of prolonged rain which result in heavy floodings, bringing in their wake stock losses

---

(5) B.J. Garnier, ibid., p. 91
crop destruction and spoilation of farm lands. South Canterbury has experienced two such destructive floods during the last six years. Variations from normal in the climate of the more inland areas occur in different ways and abnormally heavy snowfalls are perhaps of greatest significance to the farming economy. Not only do these cause heavy stock losses at the time, but their effect is felt in subsequent years until stock losses have been replaced.

C. SOILS.

It would appear that of the three elements discussed under the physiographical background, that of soils has been most greatly altered through the activities of man. Witting and unwitting human action has changed both soil fertility and structure. Accelerated soil erosion in all areas of South Canterbury (7) has been one of the disastrous results of this change while on the other hand substantial improvements have been effected in both structure and fertility through the use of lime and fertilisers. (8)

South Canterbury's soils reveal great variety in these two features of structure and fertility. Soils have been surveyed and mapped for the whole area (9) and the resultant pattern is both complicated and

(8) See Chapter III, p.64.
varied. Of major importance to the agriculturalist in connection with soils is their fertility, their drainage and the ease with which they can be ploughed. For the purposes of describing soils with reference to agriculture, a division into soil regions, rather than into specific soil types, has been found to eliminate but not to over-simplify the extreme complexity of South Canterbury's soil pattern. (Figure 3)

1. **Mountain Soils.**

   This area includes most altitudes above 5,500 feet, this height representing the approximate upper limit of vegetation growth. Soil in the usual meaning of the word is not present and the dominant formations are the steep scree slopes of greywacke, flowing down the sides of bare rock mountains.

2. **Skeletal Soils of the Mountains and Hills.**

   These are shallow brown and grey-brown loams developed on steep slopes from greywacke. They are generally infertile but the more eastern soils have been weathered to a greater extent and are more fertile. Accelerated erosion is an obvious feature of this region of skeletal soils and takes the form of both sheet erosion and the sliding of rock fragments from the higher altitudes.

3. **Soils of the Mackenzie Basin and Hakataramea Valley.**

   Unlike the soils of the previous two regions those in a large part of the Mackenzie Basin and Hakataramea Valley are on slopes gentle enough for ploughing. The Omarama series constitute the predominating
soils, these being of dark grey-brown loams moderately well supplied with phosphate and lime, and covered in many places with greywacke stones and boulders. They are of a soft crumb structure and have been seriously eroded, especially in the south of the Mackenzie basin. (10)


These soils are derived from loess and greywacke and grade from yellow-grey earths through transitional types to yellow-brown earths. The most westerly developments at heights of over 500 feet are the yellow-brown earths, which are strongly leached and infertile but are relatively free-draining. The yellow-brown earths are very limited in extent and cover only small discontinuous areas along the foothills and the summits of the Brothers Range and Cave Hill; the transitional type, which is the Opuha series, forms a more or less continuous strip bordering on the foothills and varies from one to ten miles in width. The silt loams of the Opuha series are strongly leached, naturally infertile and poorly drained owing to a heavy subsoil texture.

The most easterly development of the downlands soils are the yellow-grey earths. Less leached and more fertile than the previous ones there are nevertheless variations within them which are revealed by the different series. The Ngapara series occurring on the more eastern hills south of the Waihao River are the most weakly leached, and although droughty are well supplied with plant food. Their subsoils are not compact

(10) See regional description of agriculture, Chapter IV, p. 82.
and drainage is good.

Of the moderately leached class are the Timaru, Taiko and Claremont series. The former series has developed to the north of Timaru, around Timaru and to a lesser extent in the Waihao basin and is similar to the sandy loams of the Ngapara series except that drainage is somewhat impeded by a columnar pan at a depth of eighteen inches. The Taiko series situated both at Taiko and in the Waihao basin are similar to the previous soils but are even more droughty. The silt loams of the Claremont series occurring from Geraldine southwards and found to reach their greatest extent in the area between the Hunters Hills and the sea are less well drained than the Timaru series, the flatter areas being particularly prone to drainage problems. In the Fairlie basin, included in this area of downlands soils, deposits from Opua and Opihi Rivers have produced a rather shallow stony infertile soil which becomes very dry in the summer.

The Waihao basin provides South Canterbury with its only example of an intrazonal soil. It has developed from limestone and calcareous marls and as with many of the downlands soils it dries out extremely quickly. Variation in vegetation cover is the most noticeable feature of these differing soil types, but with improving agricultural techniques of drainage, and of lime and fertiliser application there is a tendency for the differing soil types to be reflected not so much in the plant cover as in the agricultural methods which are practised to produce crops and pastures of optimum value.
5. **Soils of the Plains.**

These have been formed from deposits of greywacke alluvium brought down from the mountains by rivers and streams. From the agricultural point of view their variety is extremely great, from heavy peat soils to shallow stony soils. Different combinations of soils give four subregions.

a. **Rangitata-Orari.**

This area comprising the land between the Rangitata and Orari Rivers, and between Arundel and the coast has as a broad band down the centre consisting of the shallow, stony, dry and infertile soil of the Lismore series. In either side and adjacent to the two rivers (and on Rangitata Island) the soils although stony are both more fertile and moisture retentive. In the vicinity of Clandeboye these peripheral soils are non-stony, rich but poorly drained silt loams.

b. **Geraldine-Milford-Levels Plain.**

A feature of this area is its great local variety of soils giving a roughly north-west to south-east pattern of long winding strips formed by former rivers which in their constantly changing lower courses have deposited varying alluvial sediments. Seawards from the railway line between Temuka and Orari there is a predominance of fertile silt loams intermingled with areas of poorly drained peat soils. West towards Geraldine the character changes to one of shallower silt loams with a greater proportion of stones, drainage being more free. **Levels Plain**
has a variety of fertile silt and sandy loams with a coastal development of poorly drained peat soils.

**c. Willowbridge-Morven.**

This area is characterised by the occurrence of some of the most fertile soils in South Canterbury. Formed from greywacke alluvium and glauconite, they are deep silt loams with poor drainage in the more coastal locations. Towards the north around Wainono Lagoon are peat soils similar to those occurring near Temuka.

**d. Glenavy.**

These soils are similar in character to those of the Rangitata-Orton district. Predominating are the shallow stony Lismore series with a development of more fertile but still stony soils nearer to the banks of the Waitaki River.
CHAPTER II.

THE AGRICULTURAL DEVELOPMENT OF SOUTH CANTERBURY.

Prior to 1850 South Canterbury had been scarcely visited by white people. The only representatives had been travellers through the region or whalers, for a whaling station had been established at Timaru in the 1830s. Descriptions from the whalers and travellers suggested that the area was particularly suitable for the depasturing of sheep and cattle. The report in 1849 of the surveyor, Charles O. Torlesse, was the first detailed account of South Canterbury and gives a description of the country before any permanent settlement by white people had taken place. He describes the plains as having a luxuriant growth principally of grass with scattered groves of cabbage trees (Cordyline australis). Nearer the coast there were sections of land of a richer quality, and in the central parts of the plains were remnants of ancient forests which he considered as having been destroyed by native fires. He continues:

"Judging from the excellent crops of wheat and potatoes grown upon the open plain by the natives at Horowhenua (1), there can be little doubt that a considerable portion of this district is available for agricultural purposes: and there is no question whatever that the whole of it will afford excellent grazing for sheep and cattle, particularly the Aglionby Downs (2), as from the numerous patches of wood and beautiful streams among them in addition to the fertility of the soil, they offer such tempting sites for stations." (3)

(1) Now Arowhenua.
(2) Aglionby Downs was applied indefinitely to the downlands, especially those in the vicinity of Timaru.
The forests mentioned by Torlesse had their greatest extent in the Peel Forest, Geraldine, Waihi and Waimate districts, the dominant trees being totara (*Podocarpus totara*), white pine (*Podocarpus dacrydioides*) and black pine (*Podocarpus spicatus*), but tussock grasslands comprised by far the greater part of the area. Of the variety of tussocks, the most common were hard tussock (*Festuca novae-zealandiae*) and silver tussock (*Poa caespitosa*) with smaller amounts of blue tussock (*Poa colensoi*), tall blue-grass (*Agropyron scabuam*) and plume grass (*Deueuxia crinata*). The general appearance was one of a uniformly yellow-brown surface which on closer inspection showed the bunched form of the tussocks, in the shelter of which numerous small herbaceous plants grew.

By the end of 1850 licences for 726,000 acres in South Canterbury had been applied for, by twenty-eight different people for pastoral occupation, most of the holdings being 25,000 acres in extent. Within four years many of these licences were cancelled as the terms of stocking were not complied with. They were reissued and the land thus covered comprised all the downlands and plains and much of the foothill country. The first flock to enter South Canterbury consisted of seven thousand sheep driven from the north to a holding of 159,000 acres around Timaru, and the first export of agricultural produce from South Canterbury, being wool, left Timaru by ship in February 1853.

By 1854 there were eight holders of pastoral licences with 28,273 sheep occupying 461,000 acres in South Canterbury and the first
phase of an extensive pastoral sheep economy had commenced. In 1855 the first station on the higher hills was taken over, and by 1864 the last of the stations in the mountain country had been occupied. The number of sheep increased rapidly.

**TABLE 1. (4)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sheep Numbers</th>
<th>Total area of Holdings</th>
<th>Number of Holdings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1854</td>
<td>28,273</td>
<td>461,000 acres</td>
<td>8</td>
</tr>
<tr>
<td>1855</td>
<td>39,840</td>
<td>541,000 &quot;</td>
<td>10</td>
</tr>
<tr>
<td>1856</td>
<td>73,540</td>
<td>791,000 &quot;</td>
<td>17</td>
</tr>
<tr>
<td>1857</td>
<td>93,300</td>
<td>791,000 &quot;</td>
<td>17</td>
</tr>
</tbody>
</table>

They were of a predominantly Merino breed and there was a large proportion of wethers in each flock. At this stage, fencing was unknown, boundary riders or natural boundaries such as rivers or steep slopes preventing the straying of sheep. The native tussocks and herbs formed the pasturage and this was burnt at intervals to encourage more palatable growth. Arable farming was confined to small areas mainly of potatoes and wheat around the homesteads and this was used for domestic supplies.

In 1856 the Canterbury Waste Lands Regulations opened rural land for freehold settlement at the price of forty shillings per acre. Many of the station owners freeholded large areas of their land and the small farmer, often a labourer on the sheep stations, began to buy his own land. The arrival of the first emigrant ship to Timaru in 1859 initiated Timaru's

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urban development. Elsewhere small settlements sprang up where South Canterbury's scanty reserves of timber were already being cut. On the first pattern of extensive sheep farming was impressed one of small arable holdings providing food for and clustering around the small settlements. By 1865, 70,600 acres had been freeholded but most of this was land belonging to the station owners. There were a few farms around Arowhenua and Waimate, a limited number around Timaru with Temuka being the recognised arable farming district. A flour mill was established in this latter area in 1865 although at this stage South Canterbury still had to import flour. A second mill was established in Timaru in 1868.

The pastoralists were prospering. Wool prices were high and store sheep were still in demand by people who were even yet still stocking their land. The scourge of the scab disease in sheep had practically by-passed South Canterbury. The station owners were beginning to fence their properties and plant the numerous trees which were to be so much a feature of the landscape in another fifty years. Around their homesteads the plough was being used to turn the land which was eventually to be sown in English grasses. Wheat was growing in importance as a crop, both on the small arable farms and on the sheep stations, and in 1867 flour was exported from South Canterbury for the first time. In the same year a fall in the price of agricultural products, both wool and wheat, a decline in New Zealand's output of gold, together with the continuation of the Maori Wars combined to produce by 1868 a minor depression. Julius Vogel's
forward-looking policy of immigration, public works and land settlement was inaugurated when this depression was at its culmination.

Extensive land sales took place and most of South Canterbury's leases on the downlands and plains were freeholded, but not by the small farmers so much as the station owners. The early 1870s saw the beginning of the period when store sheep became surplus sheep, and the problem of the large owners was now chiefly the disposal of their surplus sheep. A boiling down works was established at Milford in 1870 and a meat preserving works in 1871, the latter killing 100,000 sheep in the first eighteen months. The same period also witnessed the rise of South Canterbury as a major wheat growing area. The "Vogel boom" brought with it greatly increased population, better roads and more bridges. The decline in wool prices, the decrease in demand for store sheep and the easier transport facilities encouraged the more extensive growing of grains. Table II shows the great increase in area grown for wheat and oats in the period after 1870.

**Table II.**

<table>
<thead>
<tr>
<th></th>
<th>Wheat</th>
<th>Oats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1871</td>
<td>13,693 acres</td>
<td>7,797 acres</td>
</tr>
<tr>
<td>1880</td>
<td>58,979 &quot;</td>
<td>16,795 &quot;</td>
</tr>
</tbody>
</table>

In this period it was the station owner rather than the small farmer who contributed the greatest acreage grown in crops. The latter on his small holdings of fifty to five hundred acres could not make a
sufficient living from wool alone and naturally turned to wheat as the main source of his livelihood, but nevertheless these small holdings were not numerous. The runholder in ploughing his land from tussock, in order to sow grasses, used wheat as the intermediary crop. Previously cereal sowing had been by hand and harvesting by the use of scythes, but the introduction in the late 1870s of the earliest labour saving machines such as reapers, binders, traction engines, threshing machines and more efficient ploughs enabled a large scale type of wheat growing to be carried on for the first time. The sheep stations of the downlands and plains commonly had more than one thousand acres of cereal crops on each holding and it was not uncommon for one holding to have over 3,000 acres in such crops. Planting and threshing was often carried on by contract methods, the growers and harvesting contractors each obtaining a proportion of the profits. Harvesting was on a large scale with numerous reapers working a thousand acre paddock at the same time. Although the area grown in wheat in South Canterbury in the late 1870s and early 1880s averaged only about 60 per cent of the area producing wheat prior to the first World War, it was the large scale methods that were adopted in contrast to the more scattered and smaller fields of later years that gave this wheat-growing area a distinctive place in the agricultural history of South Canterbury. With the turn of the century the large estates of the downlands and plains had definitely given way to the smaller farms and it was the latter which grew most of
South Canterbury's wheat at the later period.

At the end of the 1870's the extensive sheep farming of the stations still dominated the agricultural economy. Wheat growing appeared to have come to stay and there were prospects of an export market. Smaller farms were established chiefly around closer settlement areas, but they were not yet of great importance. The land acts of the remainder of the century were to see the rise in importance of the smaller farms on the downlands and plains. There already had been much public discussion and political agitation over the subject of the subdivision of the large sheep stations. In 1876 this subdivision commenced with the partial sale of a property of 10,000 acres close to Timaru. The land boom of 1876 increased the sales, and areas of 6,000 acres at Makikihi, 56,000 acres in the Fairlie basin, 3,430 acres at Albury and 6,000 acres of the Pareora Estate belonging to the New Zealand and Australian Land Company were offered for subdivision and sale.

Although the advent of the first export of frozen meat from New Zealand to England in 1882 was to have a definite effect on the subsequent development of South Canterbury's agriculture, the effects of this new method for disposal of surplus stock were neither sudden nor marked. Up to 1890 the number of frozen carcasses exported from Timaru was scarcely in excess of the number of sheep killed for meat preserving between 1871 and 1872. Sheep numbers did not increase any more rapidly than in previous years and the acreages grown in fodder crops increased
at a much slower rate than they had in the previous decade. Nevertheless the prospect of an alternative source of income offered greater security, especially to the small farmers, whose wheat yields were already beginning to decline under the intensive system of cropping. Changes within the sheep flocks perhaps more than anything else were most marked after the introduction of refrigeration. The proportion of breeding ewes in each flock increased and breeds which previously had been changing to Merino cross types under the influence of higher prices offering for half-bred wool, now changed even more rapidly with the use of the Leicester ram for the production of fat lambs.

Meanwhile in the high country little change had taken place in farming practices since the beginning of first settlement. Repeated burnings had cleared much of the country of the wild Irishman (Discaria toumatou) and Spaniard (Aciphylla spp.) which had covered an extensive area especially along the riverbeds. The pastoralist had become accustomed to the vagaries of the climate in that area and had adapted his sheep farming techniques accordingly. Sheep up till this time had been the main grazers of the high country but the vanguard of competitors had already arrived from the south. The rabbit was soon to prove itself an even greater danger than unseasonable snowfalls.

On the downlands and plains in the last twenty years of the century, subdivision of the land together with the prospects of the frozen meat industry were of greatest importance to the agriculturalists.
SOUTH CANTERBURY

AREAS ACQUIRED BY THE CROWN FOR SETTLEMENT IN SOUTH CANTERBURY UP TO 1915


FIGURE 4
system of deferred payments for land, inaugurated in 1877, made it possible for a man of limited means to purchase land, but in South Canterbury at this time there was little accessible land left, worth two pounds an acre. In 1882, as pastoral leases fell due more land became available as a result, near Waimate and Studholme Junction, on the eastern slopes of the Hunters Hills, on Waitohi Hills and a few years later in the Hakataramea Valley and near Albury. Nevertheless, the land that had been subdivided prior to 1890 was land that had previously been leasehold. There still remained the freehold land of the large estates of the plains and downlands. The Land for Settlement Act of 1894 gave power for the compulsory acquisition of land for closer settlement, and it is this date that marked the end for many of the sheep stations, and the beginning of the era of the 'mixed' farmer. Figure 4 shows those areas acquired by the Crown for settlement in South Canterbury up to 1915, the great part of these having been acquired after 1894. The Temuka-Orari district was conspicuously absent from the negotiations, arable farming of small holdings having had its largest concentration in this area from the beginning of white settlement. With this subdivision into smaller holdings, production of wheat on the large sheep stations gradually declined, and the small farmer turned to both fat lambs and wheat. Fat lamb production increased apace from 1900. Freezing works had been established at Smithfield in 1885 and at Pareora in 1903. Thus the small farmer had two main sources of income, wheat and sheep. Average
wheat returns of less than twenty bushels to the acre, contrasting un­
favourably with returns of twentyfive to thirty bushels in the 1870s, 
in the closing years of the century were proof that the soil was losing 
much of its fertility. With the development of cropping rotations and 
the decrease in wheat acreages between 1900 and 1909, wheat returns per 
acre temporarily increased but even scientific rotation was not suffi­
cient to maintain fertility and by 1915 a reduction in returns was again 
apparent. Fertilisers and lime had yet to be used. At the same time 
fodder crops were being used more extensively for winter feed and for 
the production of fat lambs. From 1897 to 1908 exports of frozen mutton 
leaving Timaru increased threefold.

With the establishment of dairy factories at Temuka and Ger­
aldine in the 1890s dairy farming in these areas had increased, and by 
1908 dairy herds were an important feature of these districts. There 
were butter factories at Timaru, Woodbury and Temuka, cheese factories at 
Geraldine, Woodbury and Temuka and to the south of Timaru creameries at 
St. Andrews, Hook, Studholme Junction, Morven, Redcliffs and Arno were 
established as supply points for the Oamaru Dairy Factory.

The great snows of 1895 had caused heavy sheep losses in the 
high country but rising wool prices brought about demands for subdivis­
ion even in this area. Most of the leases fell due in 1911 and two 
commissions were appointed to examine the practicability of subdivision. 
The report issued emphasised features which are still of great importance
in this area. These features were the danger of unequal proportions of winter and summer pastures on a single holding and the necessity that a station holder should be able to earn sufficient income to tide him over periods of low prices and adverse weather. Eighteen of the Mackenzie runs were eventually subdivided into twenty-seven pastoral runs and five smaller grazing runs.

Thus by the beginning of 1914 it can be seen that South Canterbury had most of the features which were to characterise its agriculture for the next forty years. Wool, wheat and frozen mutton contributed the major share of the agricultural wealth. From 1900 there had been no great changes. It was a period of consolidation rather than one of new introductions.

"As with many other things, the appearance of the country did not alter much between 1900 and 1914. More maturity, the rough corners gradually smoothed down, a succession of ploughed and grassy paddocks surrounded by gorse hedges, more plantations—all these were obvious. The countryside was served by quiet country roads often between high hedges, and bumpy and badly surfaced by today’s standards, and along them passed drays, spring carts and gigs, with an occasional waggon and a traction engine; more rarely a noisy early-model motor car spluttered along, a forerunner of the changes of the future." (5)

These changes of recent decades can be summed up in the words internal combustion engines, more scientific farming, lime and fertilisers, small seeds, and last but by no means the least important, government controls. In detail these changes have not been introduced by merely simple modifications of the farming practices. The World War

period brought about the introduction of bulk purchase by the government of meat and wool. A guaranteed price maintained high acreages for wheat for a few more years, but the end of the war was to see a trend which became typical for South Canterbury. Meat prices made stock fattening more profitable and wheat acreages decreased by more than 50 per cent from 1917 to 1919. In the early 1920s meat and wool prices had fallen, sheep numbers decreased; wheat acreages again increased and cattle and dairy cows reached greater numbers than they had previously achieved or have done since. Soldier settlement on small fertile blocks suitable for dairy farming, together with establishment of additional cheese factories near Temuka helped to swell the numbers of dairy cattle in Geraldine County by over 200 per cent. As the 1920s progressed sheep numbers steadily increased and wheat acreages began to show a general decline, but the collapse of prices after 1929 altered the trends. Farmers turned towards arable farming as a source of more reliable income. The import of wheat had been subject to a tariff and at this stage to a sliding scale of duties, but local prices for wheat had fallen less than for other agricultural products. Wheat acreages once again increased.

The introduction of the small seeds industry and the header harvester together with the greater use of lime and fertilisers greatly changed farming techniques. Increasing returns per acre and longer living pastures with the use of better seed types, were a sign that farming was being placed on a more scientific basis.
The agriculture of a country is as dependent upon the knowledge and power of the people as it is upon the qualities and characteristics of the land." (6)

South Canterbury's agriculture has thus passed through many stages. First were the extensive sheep stations followed by the "bonanza" wheat growing. Then came the frozen meat industry with the subsequent rise in importance of the small mixed farms. The final major stage has seen the emphasis turn to the production of small seeds. The physical background has been shown to set very broad limits to types of agricultural practice but the changes and fluctuations in South Canterbury's agricultural development are very much a reflection of the "knowledge and power of the people".

CHAPTER III.

LIVESTOCK AND CROPS.

Those features combining to form the total agricultural character of South Canterbury are many and varied. Whittlesey (1) has listed the functioning forms which appear to dominate in every type of agriculture but within South Canterbury it is the crop and livestock associations which determine the basic patterns. Nearly all farm products are sold for cash. The methods used, the intensity of application to the land of labour, capital and organisation, the resulting products and the type and arrangement of buildings reflect very largely the various crops grown and the livestock associations.

A. SHEEP.

In April 1949 the total number of sheep in South Canterbury was 812,372, 66 per cent of this number being breeding ewes. In terms both of total sheep numbers and breeding ewe numbers South Canterbury contains about 5 per cent of New Zealand's sheep. Although this proportion is relatively low compared with the contribution to New Zealand's

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(1) Derwent Whittlesey, "Major Agricultural Regions of the Earth", Annals of the Association of American Geographers, 26:209, December 1936. These functioning forms are:-
(1) The crop and livestock association,
(2) The methods used to grow the crops and produce the stock,
(3) The intensity of application to the land of labour, capital and organisation, and the output of product which result,
(4) The disposal of products for consumption (i.e. whether used for subsistence or sold for cash),
(5) The ensemble of structures used to house and facilitate the farming operations.
total in cereal, small seed and potato acreages, sheep farming in its various types forms the basis for South Canterbury's agricultural activity.

Broadly speaking, the distribution of sheep can be said to be the most concentrated on the downlands and plains with a gradual decrease in density westwards. The dot distribution map (2) was compiled from the Annual Sheep Returns for April 1949, and as such shows the distribution for one season only. Nevertheless, it is a distribution which may be accepted as typical for the whole year except in those areas inland from the foothills, where by April sheep have been moved from summer to winter pastures. It can be seen that greatest concentrations averaging from one to over two sheep to the acre occur eastwards of Mount Peel and Four Peaks in Geraldine County, in all Levels County except for the western edge of the Brothers Range and Cave Hill, in the downlands and plains of eastern Mackenzie County, east of the Hunters Hills in the Waihao basin and in the southern part of the Hakataramea Valley in Waimate County. Within this broadly delimited area are approximately 60 per cent to 70 per cent of South Canterbury's sheep. However, distribution is not even within this area. The Orton-Rangitata district, referred to locally as "the desert" has a relatively sparse density of less than one sheep to the acre. A coastal strip broken only by the downlands reaching the coast near Timaru has very low sheep densities. This strip

(2) See back pocket.
curves inwards in the Milford and Glenavy districts and in places where coastal lagoons merge into extensive swamps, sheep are entirely absent. Greatest densities are seen in the downlands near Geraldine and Timaru, and between the sea and the Hunters Hills. Here carrying capacities average 2.5 sheep to the acre for the whole year, but on those individual holdings where the practice is to winter additional sheep, a winter capacity of five sheep to the acre is not uncommon.

There is a gradual decrease in sheep densities towards the west where on most of the foothills sheep carried average from one to one acre to one sheep to 2.5 acres. There is no sharp change except along the west facing scarp of the Brothers Range.

The remaining area of South Canterbury comprising the main range and tributary mountain ranges together with basins and valleys between has a small sheep population with a very sparse distribution. Carrying capacities vary from one sheep to about three acres to less than one sheep to fifteen acres. The distribution map shows the greater densities of the winter season when sheep are confined to areas not subject to high snow risk, but in summer densities are much less; sheep are then scattered over the 'tops' and in their search for pasture reach small areas of tussock almost adjacent to the glaciers.

There is a marked regional variety in the distribution of sheep types within South Canterbury. Figure 5 shows this distribution.
SOUTH CANTERBURY

SHEEP BREED

1. MERINO
2. HALFBRED AND CORRIEDALE
3. PREDOMINANTLY ROMNEY
4. ROMNEY WITH A GREATER PROPORTION FATTY LAMB RAMS
Most of Mackenzie County and the western portion of Waimate County comprise the area where the Merino is dominant. Only in a small district between Lakes Tekapo and Pukaki do half-breds outnumber Merinos. The Merino, a type of sheep which does not thrive in confined spaces, can cover a distance of as much as eight miles a day searching between the tussocks for small herbs which constitute the major part of its diet. To the east mainly on the drier foothills are found most of South Canterbury's Corriedale and half-bred sheep. The Corriedale has been bred in New Zealand from Merino, Romney, Lincoln, English Leicester and Border Leicester breeds to produce a dual-purpose sheep which is more suitable for conditions on these foothills than are the Merino and the long-woolled breeds. This area of half-breds and Corriedales has its greatest extent in the south where it stretches from the Hunters Hills to the Hakataramea Valley. Within the plains and downlands there are areas of stony and less fertile land, which have a predominance of half-breds, the largest and most noteworthy being in the Orton district just south of the Rangitata River.

On most of the plains and downlands the Romney or Romney cross (3) is the dominant sheep, and in the wetter foothills there is also an increasingly greater proportion of Romney sheep. Rams used vary according to the purpose for which lambs are to be produced. The Southdown ram is used for the production of fat lambs especially when it is possible

(3) Local usages of the descriptions Romney cross and half-bred require some elucidation. The term Romney cross is used when the sheep is at least three quarters Romney breed. The term half-bred is used when the sheep is half Merino. It is either the Romney blood or the Merino blood which is the deciding factor in the utilisation of each.
to fatten the lambs off their mothers. The Border Leicester ram is used principally where the growing of rape is necessary for the fattening of lambs, this being in the drier areas of the plains and downlands and in the more inland areas. The Romney ram is used in those cases where replacements are bred in each holding and this is largely a matter of the individual preferences of each farmer.

Table III shows the relative importance within each county of the various breeds of rams.

### TABLE III.

<table>
<thead>
<tr>
<th>Breeds as a Percentage of Total Rams, 1945. (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breed</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Merino</td>
</tr>
<tr>
<td>Romney</td>
</tr>
<tr>
<td>Border Leicester</td>
</tr>
<tr>
<td>Southdown</td>
</tr>
<tr>
<td>Corriedale</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

Levels County shows a marked dominance of rams used for the production of fat lambs. Mackenzie County on the other hand, with 75 per cent of its rams being either Merino or Romney breed shows the relative insignificance of fat lamb production as a major part of the farming activities, although there is a definite regional concentration of fat lamb types in the Albury-Fairlie area. The actual percentage of each ram type cannot be taken as proportional to the total number of sheep.

of that breed, as such factors as cross breeding, and fat-lamb types not being used for breeding, must be taken into account.

Within South Canterbury there is wide variety in sheep management methods. In the high gorges of the Mackenzie country where winter conditions are most adverse, one of the extremes in sheep management is found. Flocks are entirely of Merino wethers and income is from wool and wool alone. All replacements in the form of wether Merino lambs are bought from other areas. Grading gradually from this type are the Merino and half-bred flocks that have a high proportion of wethers in the total sheep numbers. Replacements may or may not be bought in, depending very largely on the weather of the previous lambing season. Within the same area holdings having good winter country (that is, good pastures and sunny slopes relatively free from snow) will breed a surplus of wether lambs, but scarcely anywhere are Merino ewe lambs in excess of what is necessary for flock replacements. In the foothills where Corriedale and half-bred sheep are more dominant and lambing percentages thus higher, sheep management is directed towards production of wool and of store sheep. Sufficient sheep are bred for replacements, the surplus being sold to the downlands and plains where replacements are bought for the purpose of breeding fat lambs. In the latter area there is an irregular distribution of management types. Some farmers use both Romney and Southdown rams, the former for breeding replacements, the latter for breeding fat lambs. On the other hand all stock bred on a holding may be for the production of fat lambs. The tendency at present with the
SOUTH CANTERBURY

MOVEMENT OF SHEEP

SCALE IN MILES

FIGURE 6
costs of replacements being high is for the farmer to breed his own replacements.

There is a fairly close correlation between sheep farming types and the size of individual flocks. Figure 7 shows the proportion of flock sizes in the four counties in April, 1949. Mackenzie County with the greatest development of sheep farming for wool production shows the greatest proportion of flocks of over 2,000 in number. Levels County on the other hand has the least development of flocks over 2,000 in number and the greatest development of sheep farming for fat lamb production, this being reflected in the high proportion of flocks under 800 in number.

The various types of sheep management are to a large extent interdependent and sheep movements within South Canterbury reveal this interdependence. Figure 6 shows the general directions of movement, most of it being through saleyards at Tekapo, Fairlie, Waihao Forks and the centres on the downlands and plains. Stock from the Merino country are usually wether lambs, and culled ewes; the former being sent to the downlands for fattening, the latter to such areas as Fairlie, Orton and out of South Canterbury for crossing usually with Romney rams. The progeny may be fattened or may themselves be treated as store sheep and sent to 'easier' (5) country for breeding of fat lambs. This illustration serves to show the complicated interdependence of the varied sheep

(5) The terms 'easier' and 'harder' as commonly applied to types of country within South Canterbury are only comparative terms and do not describe any definite type of area.
FIGURE 7. PROPORTION OF VARYING SIZED SHEEP FLOCKS IN EACH COUNTY.

FIGURE 8. NUMBERS OF SHEEP SHORN IN SOUTH CANTERBURY 1920-47.
farming areas. Store sheep from the foothills move eastwards and those of the downlands and plains are the ones that go directly to the freezing works. The whole pattern is complicated by movements into South Canterbury of stock from as far afield as Southland, the general trends being summed up in the farming explanation; "All sheep movement is from 'harder' to 'easier' country".

On the whole, sheep numbers have shown smaller percentage changes since 1900 than any other stock or crops concerned in the agriculture of South Canterbury. The greatest numbers of sheep were reached in 1938, being approximately 2,007,000. The nearest approach to these numbers was reached in the late 1920s and the middle 1890s. Figure 8 shows these fluctuations in numbers since 1920. These changes are not only a function of prices appertaining to sheep but also to other agricultural products, especially wheat. On the whole, sheep numbers are their greatest in times of general prosperity and least in periods of depression. Of the four counties Mackenzie has shown the smallest percentage fluctuations, this reflecting mainly the single commodity specialisation of much of the country. With the recent decline in acreages used for arable crops and consequently larger areas being available for grazing, it is difficult to judge whether there has been any increase in carrying capacities within South Canterbury. It would appear from statements from individual agriculturalists that there has been a gradual increase on the plains and downlands as contrasted with static and in
some cases declining capacities in the areas of extensive sheep farming. In the last twenty years there has been a definite change in some sheep breeds. The Romney and the Romney cross have replaced the Border Leicester as a breeding sheep and the Southdown ram as a fat lamb sire is now more widely used.

Since about 1900, sheep have been the basis for agriculture on most farms. Fluctuating prices have brought about varying emphases, present developments being an extreme case. The high wool prices of today have made sheep farming so lucrative that on nearly every farm in South Canterbury the major source of income is from sheep.

B. CATTLE.

Cattle play a relatively insignificant role in South Canterbury farming practices but a marked local specialisation (especially with dairy cows) gives a distinctive form of agriculture to some areas. The distribution of dairy cattle which represent about one fifth of the total cattle numbers of 55,600 may be regarded from four different aspects depending on the ultimate utilisation of the dairy product. Cows producing milk for town supplies, for farm consumption, for butter making or for cheese making all show different distribution patterns. At least 40 per cent are used primarily for the production of milk or cream to be consumed on the farms and as such their distribution is mainly a reflection of the location of individual holdings. Where farm units are large
SOUTH CANTERBURY

DAIRY CATTLE

MAXIMUM DISTRIBUTION OF DAIRY COWS SUPPLYING BUTTER FACTORIES

1 DOT = 10 COWS
TOTAL NUMBER: 6360 (approx)
BUTTER FACTORY X

Compiled from data supplied by Butter Factories
distribution is sparse but on the more closely settled areas of the downlands and plains there is a greater density. Of more restricted area but nevertheless of the same general pattern is the distribution of milking cows supplying cream to butter factories at Waimate, Timaru and Ashburton. (Figure 9) By far the greatest proportion of cream comes from those farms mentioned above where the production of dairy products for domestic consumption is the primary aim, but where any surplus is sent to the factory. Herd sizes are commonly between two and five in number, the smaller herds producing no surplus in the winter. Consequently the maximum number of cows supplying cream to the butter factories occurs in the summer. The minimum winter distribution would reveal a greatly contracted area with those districts of greater specialisation standing out clearly at that period. These latter can be seen in Figure 9 as having a greater density and occur at Arundel, between Geraldine and Woodbury, Totara Valley, on the downlands behind Timaru, Willowbridge and Ikiwai. Herd sizes in these more specialised areas vary from fifteen to over fifty cows and breeds are chiefly Shorthorn or Jersey types, whereas the smaller herds have breeds of very mixed types, typifying the unimportance of the cow in the agricultural economy.

Showing greatest local specialisation are the dairy herds supplying whole milk for town supplies and for cheese production. South Canterbury's five cheese factories are all situated in Geraldine County, one close to Geraldine and the other four within eight miles of Temuka.
SOUTH CANTERBURY
DAIRY CATTLE

DISTRIBUTION OF DAIRY COWS SUPPLYING CHEESE FACTORIES

1 DOT = 10 COWS
TOTAL NUMBER: 4026
CHEESE FACTORY X

FIGURE 10

Compiled from data supplied by Cheese Factories.
Dairy cows producing milk for cheese are all located in very close proximity to these factories. (Figure 10) Herds average about fifty cattle in number and the dominant breed is the Friesian, noted not so much for the production of milk with a high butterfat content, but for the production of milk of greater bulk. Unlike the method of collection at the farmer's gate for both cream and town milk, the cheese factory supplier is himself responsible for the transport of milk to the factory. Whey is collected when milk is delivered and is used for feeding pigs which are quite a profitable subsidiary source of income.

Herds supplying town milk have the greatest concentrations close to Timaru, in the Seadown and Otipua districts. (Figure 11) The former area has the largest herds in South Canterbury with sizes varying from thirty to over eighty in number, but the latter area is less specialised and the dairy cows play only a small part in the general practice of mixed farming. Around Waimate and extending along the wetter and heavier coastal soils from Morven to Hakikihi are the dairy herds supplying milk to Waimate and the smaller country centres. Similarly, in the north herds are situated near the towns of Geraldine and Temuka, although in this case milk is sent to Timaru for processing at the Milk Treatment Station rather than being sent directly to the country centres.

The general pattern of the distribution of dairy cows therefore shows its greatest densities where herds are used for supplying milk to the towns and to the cheese factories. Scattered along the downlands
SOUTH CANTERBURY

DAIRY CATTLE

DISTRIBUTION OF DAIRY COWS
SUPPLYING TOWN MILK

SCALE IN MILES

1 DOT: 10 COWS
TOTAL NUMBER: 2380
CHIEF URBAN CENTRES X

Compiled from Returns for Registered Dairy Herds

FIGURE II
and plains are the herds providing cream for the butter factories, with an occasional area of greater specialisation. Spreading over the whole pattern are the small family herds of two to three house cows providing farm supplies. There are usually one or two pigs on the holdings selling cream, but only where dairying is a major farm practice do pigs attain any importance, this being the case near Temuka, Willowbridge and Ikiwai.

The distribution of beef cattle differs widely from that of dairy cows. (Figure 12) The greatest sources of store cattle are the wetter foothills and the river valleys of the Mackenzie Country. Flowing into Lakes Tekapo, Pukaki and Ohau are snow fed rivers whose flat-bottomed beds stretch almost into the heart of the Southern Alps. Along these rich and well watered valleys Black Poll and Hereford cattle graze, their progeny being taken to be sold at the annual Autumn Sales at Pleasant Point and Temuka. On the eastern slopes of the foothills Black Poll cattle are dominant and there is an increasing tendency to utilise these cattle for the grazing of rough pastures on unploughable slopes. On the downlands adjacent to these foothills breeding and fattening of cattle is carried on conjointly, with herds averaging about fifty head.

In those previously described areas which also have a large number of dairy cows, cattle fattening both of stores bought at the sales and of progeny of the dairy cows is common, the Winchester district showing the greatest development of this type. The downlands as a whole have few
SOUTH CANTERBURY

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CATTLE

(excluding dairy cows)

TOTAL NUMBERS 38,708

FIGURE 12
cattle. Progeny of house cows may be sold as stores or fattened, depending largely on the seasonal weather and resultant pasture growth. A common practice is to buy calves from the foothills, keeping them one or two years and then selling as stores to the fattening districts around Winchester or Willowbridge. As with sheep the movement of cattle from one area to another is neither definite nor consistent, but cattle which on the whole contribute only in insignificant amounts to total farm incomes are bought or sold at times when it appears most profitable and not regularly as is the case with sheep.

At present trends are towards an increase in beef cattle numbers but a decrease in dairy cows. During the depression of the 1930's there was an increase in the latter reflecting largely the comparatively stable prices for dairy products, but the numbers have since declined. It is a noticeable feature that despite increase in urban populations dairy cows have not increased in total number, the expanding town milk supplies being drawn from herds that once produced milk for the cheese factories. Beef cattle are becoming increasingly important in the wetter foothill country, and today their numbers are higher than at any previous period. There is much scope for a greater emphasis upon cattle in the foothills but labour shortages retarding the construction of fences have been the main reason for farmers having been unable to increase their cattle herds to the extent to which they desired.
SOUTH CANTERBURY

PASTURES

Adapted from F.W.Hilgendorf
D.S.I.R. Bulletin No. 47

FIGURE 13
C. PASTURES.

No matter what type of farming is considered in South Canterbury the most important crops are the pastures. (Figure 13) These serve a threefold purpose. They provide grazing for both sheep and cattle, they are frequently harvested for the production of small seeds and an increasing acreage is being cut for providing supplementary winter feed in the form of hay.

1. TUSSOCK PASTURES.

The great expanse of tussock pastures covering nearly two thirds of the area of South Canterbury is used only for grazing. Varying greatly in density of vegetation cover and in plant species the tussock grasslands may nevertheless be regarded as a whole separated from the other pastures both by their relatively lower feed value and by their distinctive association of plants which are predominantly indigenous. Of the tussocks themselves, hard tussock (Festuca novae-zealandiae) is dominant on areas below 3,000 feet. It is the least palatable of the grasses and is eaten by stock only when fresh green shoots come away after burning. On south facing slopes and moister areas silver tussock (Poa caespitosa) is present, but nowhere other than at the head of Lake Ohau do they extend for more than a few hundred square yards of continuous cover. As stock feed the tussocks are little used, their main importance being due to the fact that their taller growth shelters numerous herbs and weeds growing between and that in the winter
they act as a break to an otherwise evenly spread snow cover. The inter-tussock vegetation is chiefly exotic weeds and grasses such as sorrel (Rumex acetosa), oats-ear (Hypocharis radicata), browntop (Agrostis tenuis) and sweet vernal (Anthoxanthum odoratum). In the areas of heavier rainfall towards the main range small indigenous herbs form the main inter-tussock vegetation. It is this variety of small plants growing between the larger tussocks that forms the major part of the stock feed. Occasional small patches of blue tussock (Poa colensoi) are all that is left of the more palatable tussock varieties. Above 3,000 feet the taller snow grass (Dactylis glomerata) is dominant. As a pasture it is quite valuable providing not only shelter but also a considerable amount of feed in the form of green shoots after it has been burnt.

The tussock grasslands evolved under conditions marked by the absence of grazing animals and consequently no natural selection other than that of soils and climate had taken place. Unable to survive against the onslaught of new conditions of burning and of grazing by sheep and rabbits, the once thick tussock was decreased greatly. This was especially noticeable in the area of 'climax' steppe (6) to the south of the three lakes. Today there is a wide variety in the density of the vegetation cover. In the valleys of the main range it is still thick enough to form a dense mat completely covering the ground, but to the south wide expanses of barren earth blotched with scabweed (Raoulia spp.)

provide vivid evidence of the great changes that have taken place.
Scabweed itself, although a result of deterioration of vegetative cover, is nevertheless recognised as a forerunner to rejuvenation and its presence is a sign that pastures are attempting to reassert themselves.

2. **BROWNTOP PASTURES.**

Along the foothills in a discontinuous belt are pastures of predominantly browntop types. In the first decade of this century when arable farming was at its greatest extent parts of this area were ploughed and cropped, but pastures of today bear little resemblance to the better quality mixtures that were sown down then. On this sour cold clay country of the Opuha soils (7) pastures rapidly reverted to almost pure stands of browntop. Elsewhere where the land had not been ploughed the browntop quickly ousted the original tussock vegetation. The browntop pastures are of poor feed value and of low carrying capacities, but in the last fifteen years the area has tended to contract under improved farming techniques. Gorse (*Ulex europaeus*) and bracken (*Pteridium aquilinum var. esculentum*) which spread rapidly on the Opuha soils have been cleared, land has been ploughed and given heavy applications of lime, and pastures of perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) have been established. Even without ploughing it has been possible to establish these pastures. Nevertheless browntop swards still form a significant belt between the tussock grasslands to

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(7) See Chapter I, p. 10.
the west and the more productive pastures further east. The tendency for browntop to replace tussock grasslands can be seen in its encroachment along the crest of the Brothers Range.

3. **PERENNIAL RYEGRASS – WHITE CLOVER PASTURES.**

Over most of the downlands and plains are the pastures which form the basis for South Canterbury's 'mixed' farming. Essentially of a perennial ryegrass-white clover type they can be used for grazing, for hay-making and for the production of small seeds. The introduction of seed certification and the subsequent development of the small seeds industry has led to some definite changes in pasture types within the area. Previous to this recent development, ryegrass had been sown down with cocksfoot (*Dactylisglomerata*), mixed clovers (*Trifolium* spp.), dogstail (*Cynosurus cristatus*) and meadow fescue (*Festuca pratensis*), this great variety being partly due to the fact that ryegrass itself disappeared in about eighteen months. The farmer usually saved his own seed, thereby renewing poor strains. Seed certification has eliminated the poor strains and together with the use of lime and fertilisers has lengthened the life of the better pastures. The development of the small seeds industry made it necessary that swards be essentially of one grass and one clover type so that ripening and harvesting would not be hampered by the presence of other species. These changes have produced the perennial ryegrass-white clover swards which are now dominant in much of South
Canterbury. They are short rotation pastures lasting an average of six years. There is variety within this general pattern depending largely on the aims of the individual farmers. Where shorter term pastures are desired Italian ryegrass (*Lolium multiflorum*), short rotation ryegrass (*Lolium perenne* H.I. strain) and broad red clover (*Trifolium pratense*) may form a major part of the pasture mixture. A significant feature of the developments of the last twenty years has been the lengthening of the life of the pastures. This has meant that fields have remained in pastures for longer periods, and consequently ploughing and cropping have become less frequent.

4. **PASTURES OF THE LIGHTER SOILS.**

In the Rangitata-Orton district, the Glenavy district and along a small portion of the north bank of the Waitaki River soils are light and become extremely dry in the summer. White clover will not establish under such conditions. Subterranean clover (*Trifolium subterraneum*), an annual species which re-establishes itself in the autumn and makes considerable growth in spring and early summer is consequently the main clover in the pasture swards. Where neither lime and fertiliser nor subterranean clover has been used pastures have quickly deteriorated to sweet vernal cats-ear and hairgrasses (*Aira caryophylla*, *Vulpia dertonensis*). In the vicinity of Orton some areas have not been ploughed but little of the original tussock is left, weed grasses having ousted most of it.
5. **PERMANENT PASTURES.**

A coastal strip of land near Makikihi and a broader area near Temuka and Clandeboye possess the most permanent exotic pastures in South Canterbury. These have been established on heavy swamp soils and are not used for the production of small seeds. Their constituent plants are ryegrass, clovers, cocksfoot and timothy (*Phleum pratense*).

Greater attention has been paid to South Canterbury's exotic pastures since the inauguration of seed certification. Research has been directed towards the improvement of soil fertility through the use of more scientific cropping rotations and through greater use of lime and fertilisers. Pastures are usually sown down in the autumn so that full utilisation will be made of moisture at this season as spring sown pastures are liable to suffer through lack of sufficient moisture. Pasture growth ceases from May to August on the more coastal areas and for longer periods inland. Consequently the making of hay and the growing of supplementary fodder crops are important features in the agricultural practice.

**A. HAY AND FODDER CROPS.**

Hay is of increasing importance in the management of stock, the annual acreage being cut for this purpose having increased fourfold since 1920. Meadow hay cut from the grass and clover pastures in late autumn is the most common form. *Lucerne* (*Medicago sativa*) is used to a lesser extent but as many as four cuttings for hay are possible in one year, contrasting with only the one cutting from the grass and clover pastures.
SOUTH CANTERBURY
--- HAY ---

FIGURE 14

- Hay produced chiefly around scattered homesteads
- Hay production frequent although not on every holding
- Most important area of hay production
The production of hay (Figure 14) is not confined to any particular farming type but greatest areas grown are found in the downlands and plains between the Orari and Pareora Rivers, where as much as twenty acres of pasture may be cut for hay each year, an individual holdings. With the greater use of balers a characteristic feature of the landscape is gradually passing and the haystack is giving way to the Dutch barn.

Fodder crops are an essential part of sheep management in South Canterbury and acreages devoted to their growing are usually twice as large as those for any other crops on individual farms. Crops grown for fodder vary widely in type, the variation not being one over large areas but on separate holdings so that full use can be made of the different types to suit the diverse aims of the 'mixed' farmer. A primary division can be made between root crops and green fodder crops. The root crops are the basic supplementary winter feed and as such are widely distributed, nearly all but the more extensive holdings growing either swedes or turnips. In terms of proportion to other crops, greatest acreages are grown on those areas in the foothills marginal to the tussock country and lowest proportional acreages on those areas where pasture growth is least retarded by the lower winter temperatures. Between 1938 and 1949 there has been a steady decrease in the area sown to swedes and turnips. This may be partly explained by a wartime decrease in sheep numbers but their proportional decreases were nowhere near so great as those in root crops. At the same time there has been a continually
SOUTH CANTERBURY

FOODER CROPS

SCALE IN MILES

FIGURE 15
steady rise in acreages cut for hay, these two trends (Figure 16) reflecting a gradual but basic change in sheep management from an arable to a more pastoral economy.

Rape is the major green fodder crop and it is used primarily for the fattening of lambs. Greater areas of this than of root crops are grown on the more coastal downlands and on the plains, whereas in the foothills and marginal downlands greater areas of root crops than of green fodder crops are grown. (Figure 15) Chou moellier and kale are used mainly for supplementing swedes and turnips in the winter and there is some tendency for these green fodder crops to replace the root crops. They are fed to stock by dividing paddocks into 'breaks' by temporary fences thus ensuring that the crops will be fully utilized. When fodder crops are grown a common practice is to sow down pastures with them especially where little cash cropping is carried on. This procedure though saving an extra year in the rotation does not ensure such good pasture establishment.

The part played by the various fodder crops in South Canterbury's agriculture is thus seen to be complex. Swedes and turnips are primarily for supplementary winter feed, and green fodder crops for lamb fattening. The total growth period of these types lasts from February until the end of August. The late summer and autumn growth of the green fodder crops fattens the lambs, and the later growth of root crops, together with the provision of hay, supplements the poor winter pasture
FIGURE 16. TRENDS IN THE PRODUCTION OF HAY AND ROOT FODDER CROPS IN SOUTH CANTERBURY 1920-47
growth and provides additional feed for the in-lamb ewes.

Pastures, hay and fodder crops on individual holdings are closely interrelated. The more hay a farmer is able to cut the less likely is he to grow fodder crops. Occasional examples of this tendency carried to its extreme are seen on the downlands and plains in South Canterbury. These farms have dispensed entirely with arable farming and a form of pastoral economy involving sheep breeding, hay production and fattening of lambs all based on exotic pastures is carried on. Nevertheless, these holdings show no greater carrying capacities than any others and as far as South Canterbury is concerned there is no doubt that increased carrying capacities can only be attained by the further exploitation of root and green fodder crops or by the use of these together with hay. The replacement of fodder crops by hay, although resulting in different agricultural management, does not increase carrying capacities. At present, the tendency in South Canterbury is for hay crops to replace fodder crops. How far this change towards a more pastoral type of farming will continue depends very largely on the relative prices of agricultural products, but as long as this trend continues there seems little likelihood that carrying capacities will increase.

E. SMALL SEEDS.

The development of the small seeds industry as one of the major activities in South Canterbury's farming practices has been witnessed almost entirely within the last twenty years. It has been shown that the
The agricultural history of South Canterbury has seen several major phases in its development. The first was that of the extensive sheep stations, and the second and third stages were marked by great increases in wheat acreages, and in exported frozen mutton. The last major stage has been marked by the increasing importance of pasture seed production.

About 1920 an official investigation of pasture plants in New Zealand revealed a great lack of uniformity in nearly all types. Perennial ryegrass gave a poor producing pasture and was of markedly low permanence except in Hawkes Bay and Poverty Bay. In South Canterbury perennial ryegrass and Italian ryegrass had been sown together in pastures for many years. Hybridisation had produced strains which were sold under the name of either type according to market demands. Names applied to varieties of red and white clovers were no indication of the worth of the plants; white clover, particularly, varied from truly permanent leafy, and high producing strains to strains that had deteriorated to annuals.

Cocksfoot and browntop were also of great variability in different strains.

The introduction by the Department of Agriculture (in 1929) of a seed certification to identify lines of seed of superior strain has not only assured the buyer of Certified seed as to the type he is purchasing but also has led to improvement in the general quality of seed being marketed. It has also had an indirect but far-reaching effect on seed production in different areas and has enabled methods of production to be employed which were not previously possible without grave risk of deterioration in the types of the various species. Certification has completely changed the attitude towards the harvesting of pasture seeds. Previously, production had depended largely

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(8) See Chapter II.
SOUTH CANTERBURY

SMALL SEEDS

SCALE IN MILES

PERENNIAL RYEGRASS

1 DOT = 10 ACRES

TOTAL AREA = 5076 ACRES

Compiled from Certification Records 1948-49

FIGURE 17
SOUTH CANTERBURY
— SMALL SEEDS —

WHITE CLOVER

1 DOT = 10 ACRES

TOTAL AREA: 5399 ACRES

Compiled from Certification Records 1948-49

FIGURE 18
ITALIAN RYEGRASS

1 DOT = 10 ACRES
TOTAL AREA: 754 ACRES

Compiled from Certification Records 1948-49

FIGURE 19
SOUTH CANTERBURY

SMALL SEEDS

SHORT ROTATION RYEGRASS

1 DOT = 10 ACRES

TOTAL AREA: 3285 ACRES

Compiled from Certification Records 1948-49

FIGURE 20
SOUTH CANTERBURY
——SMALL SEEDS——

MONTGOMERY RED CLOVER

1 DOT = 10 ACRES
TOTAL AREA: 4938 ACRES

Compiled from Certification Records 1948-49

FIGURE 21
SOUTH CANTERBURY
---SMALL SEEDS---

BROAD RED CLOVER

1 DOT = 10 ACRES
TOTAL AREA: 1434 ACRES

Compiled from Certification Records 1948-49

FIGURE 22
SOUTH CANTERBURY

SMALL SEEDS

COCKSFOOT

1 DOT = 10 ACRES

TOTAL AREA: 660 ACRES

Compiled from Certification Records 1948-49

FIGURE 23
SOUTH CANTERBURY
——SMALL SEEDS——

BROWNTOP

1 DOT = 50 ACRES
TOTAL AREA: 10,262 ACRES

Compiled from Certification Records 1948-49

FIGURE 24
SOUTH CANTERBURY

SMALL SEEDS

SCALE IN MILES

RAPE

1 DOT = 10 ACRES

TOTAL AREA: 830 ACRES

Compiled from Certification Records 1948-49

FIGURE 25
upon the amount of surplus growth in any one season, and this varied greatly with the various strains of seeds used for pasture establishment. This haphazard technique has now changed to one where production of a seed crop is as basic a feature of the farming economy of South Canterbury as the production of a wheat crop. The usual practice in pasture seed production is to sow down in late summer or autumn, graze in the springtime, close the pasture in October and harvest for seed in January or February. The method differs within narrow limits for different types of seeds.

Perennial ryegrass and white clover account for over half the seed production in South Canterbury. (Figures 17 and 18) (10) Areas harvested for these seeds amounted to 13,582 acres in 1949. Perennial ryegrass and white clover, sown together for the establishment of pastures, are harvested separately for seed production. In the first season perennial ryegrass seed is cut and in the second season white clover seed. In the subsequent years the pasture may or may not be harvested depending on the growth, and the extent of surplus feed.

Other pasture seeds harvested are Italian ryegrass (Figure 19), short rotation ryegrass (Figure 20), Montgomery red clover (Figure 21), broad red clover (11)(Figure 22), cocksfoot (Figure 23) and browntop (Figure 24).

(10) In the compilation of maps showing areas cut for seed, certification records have been used and consequently do not show the actual amounts, but areas where certification is the practice are the main production centres. Appendix I discusses this subject in more detail.
(11) An alternative name for broad red clover is cowgrass.
TABLE IV.


<table>
<thead>
<tr>
<th>Pasture Seeds</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial Ryegrass</td>
<td>8122</td>
</tr>
<tr>
<td>Italian Ryegrass</td>
<td>777</td>
</tr>
<tr>
<td>Short Rotation Ryegrass</td>
<td>2479</td>
</tr>
<tr>
<td>White Clover</td>
<td>5460</td>
</tr>
<tr>
<td>Red Clover</td>
<td>4280</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>786</td>
</tr>
</tbody>
</table>

The distribution of pastures used for seed production shows no marked areas of specialisation. The ryegrasses and white clover are well distributed over most of the downlands and plains with a small area in the Hakataramea Valley. The focus of production is however on the downlands of Levels County. Distribution of other pasture seeds reflects a changing emphasis in pasture swards, especially in the case of the red clovers. Montgomery red clover has its areas of greatest production inland from Geraldine along the downlands west of Fairlie and Albury and in the Hakataramea Valley. Broad red clover is confined to the more coastal locations where soils do not become droughty in the summer.

Unlike the other pasture seeds, browntop seed production is not part of a farming programme in which the seed is sown with the purpose of ultimately harvesting it. Figure 24 shows that the area where browntop seed is produced is that of the deteriorated pastures (12) bordering on the foothills. No effort is made to foster the growth of browntop and its seed is used chiefly for supplying an export market to the United States.

The growing of rape seed is becoming increasingly important.

(12) See Chapter III, p.42.
Normally imported, its production was increased as a wartime project to supply local requirements and to meet United Kingdom demands. Today South Canterbury is one of the leading growers of rape seed, with areas of main production being confined to the Glenavy district and to Levels Plain. (Figure 25)

Pasture seed production is perhaps one of the most complex of all farming operations carried on in South Canterbury. Grazing of these pastures must be uniform, the degree to which they are actually grazed depending on seasonal growth. The time at which they may be closed and the correct time for harvesting all add to the complexity of work which can be made worthless by a week of rain at harvesting. The introduction of the header harvester has revolutionised harvesting methods and has led to the operation being carried out with the minimum of delay, thus reducing risks of crop failure due to adverse weather.

During the war years there was a large increase in areas used for producing pasture seeds, which were exported to assist in the great expansion of wartime farming in Great Britain. With accumulation of stocks the British Government imposed an embargo against various grass and clover seeds and there was a marked decline in seed production in South Canterbury. New Zealand provides her own market for the disposal of most of the small seeds and previous to 1940 Australia and the United States had absorbed the majority of the exports. Since the end of the war small seeds production has declined and it would appear the export market
no longer offers any great hope for future expansion. It is the New Zealand market which must be supplied but the demand is not increasing. The small seeds industry has probably been developed to its greatest extent, and in South Canterbury any further progress will be consolidation and the evolution of even better strains, rather than expansion. Although this region has less than one third of total acreage used for seed production in Canterbury it is nevertheless the centre of the small seeds industry. Certified seed, on which this industry has been based, has its greatest use in South Canterbury, and the seeds produced have a consistently higher quality than in other areas.

F. CEREAL CROPS.

Wheat is one of the basic crops in South Canterbury's agricultural economy, but since the end of the war has declined greatly in importance. This downward trend had become obvious by 1938, but was temporarily stopped by a wartime increase in the importance of wheat. The 1949 figures show South Canterbury with an area of only 23,984 acres in wheat for threshing, this being 16 per cent of New Zealand's total acreage in wheat. A significant feature is that South Canterbury's wheat acreage in 1949 barely exceeded that cut for small seeds.

Wheat growing is confined to the plains, downlands and the southern part of the Hakataramea Valley. (Figure 26) It extends inland to the Fairlie basin, being grown particularly in the Allandale area, but has only a scattered distribution on the downlands west of the Brothers
SOUTH CANTERBURY

--- WHEAT ---

1 DOTT 10 ACRES
TOTAL AREA THRESHED
1948-49: 23,984 ACRES

FIGURE 26
In the south it is grown in the Waihao basin as far north and west as Waihaorunga. On the coastal downlands and plains its distribution is relatively even except for the small acreages in the Rangitata-Orton and Glenavy districts. Greatest densities are seen in the Waimate-Willowbridge area and on the downlands and plains to the north of Timaru.

Unlike the persistent cropping methods of the 1870's and 1880's wheat growing today is essentially part of a cropping rotation. Except for the more extensive fields of the Hakataramea Valley individual areas of wheat average about 50 acres. This is in distinct contrast to the extensive fields of over 500 acres grown in wheat during the bonanza period.

Within South Canterbury there is a regional variety in the types of wheat that are grown, and this is mainly a reflection of soil conditions. Cross Seven, a New Zealand variety, has in the last fifteen years become the dominant type, and is admirably suited to soil conditions on the downlands. On the other hand, in the heavier soils of the Willowbridge-Morwell district Dreadnought wheat is the most important and gives some of the highest yields, of over forty bushels to the acre, in South Canterbury.

Methods of cultivation and harvesting do not differ greatly. Most wheat is sown with one to two hundredweight of superphosphate per acre. The common practice of autumn sowing ensures that full utilisation will be made of soil moisture before the beginning of an only too frequently dry spring. Harvesting takes place in January and February, about

(13) Descriptive terms for seasons as used by agriculturalists appear to vary greatly in application to different cropping or stock management procedures. Autumn sown wheat is regarded as any wheat sown before and including July. After this it is regarded as winter sown wheat.
FIGURE 27  WHEAT PRODUCTION IN SOUTH CANTERBURY 1916-49
75 per cent of South Canterbury's wheat acreages being harvested by the header harvester, the use of this method having shown a steady increase since its introduction in 1930. The threshing mill is nevertheless still used to a large extent in those areas where the wheat variety is liable to 'shake'. In the Willowbridge district with its high proportion of bread-nought wheat, which is characterised by its tendency to 'shake' the threshing mill is more frequently used than the header harvester.

Estimates of wheat acreages for South Canterbury in the 1951-52 season reveal that the area sown to wheat will be the smallest since that of the early 1870's. Fluctuations in South Canterbury's wheat acreages (Figure 27) cannot be explained only in terms of wheat prices. Prior to 1910 New Zealand was a wheat-exporting country, but with increasing population there has been no surplus for export. Various controls have offered to the wheat industry a certain amount of protection from external competition, namely from Australia. However, this has not mitigated against competition from higher prices offered for other agricultural products within New Zealand. Hilgendorf (14) has shown that between the years 1920 to 1937 a high price for lambs coincided with low acreages for wheat, and the high ruling prices of today for both wool and lambs go far towards explaining the unprecedented low acreages of wheat in South Canterbury. When all prices for agricultural products are low, as in the early 1930's, areas under wheat have tended to increase, this being a reflection of quicker cash returns offered by an annual crop, whereas any

attempts to increase stock numbers must of necessity involve the selling of fewer numbers. When it is considered that 15 per cent of the total occupied area of Levels County was grown in wheat in 1910, and only 4 per cent in 1948, it can be seen that the contribution of wheat both to the agricultural economy and landscape has declined greatly in importance. The percentage decreases in acreages in the four counties from 1915 to 1948 reveal where the reduction has been the greatest.

<table>
<thead>
<tr>
<th>Mackenzie</th>
<th>Waimate</th>
<th>Geraldine</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>78%</td>
<td>77%</td>
<td>76%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Levels County in the heart of South Canterbury's wheat growing country shows the smallest percentage decrease. Where the contraction has been proportionately greatest has been on those areas marginal to the downlands and bordering on the foothills. Together with the decrease in acreages has gone an increase in yields, resulting not only from the contraction to more suitable wheat lands but also from improved farming techniques.

Oats and barley are the only other two cereal crops of importance in South Canterbury. All these cereal crops are used for the production of seed, for making hay or chaff, or for feeding as green fodder to stock, but the proportion of wheat and barley which is used for chaff or green feed is negligible. On the other hand, the acreage of oats used for chaff and hay almost equals the area which is threshed.
SOUTH CANTERBURY

OATS

Oats grown around scattered homesteads
Oats occasionally grown
Most important areas of production

FIGURE 28
South Canterbury's acreage of oats in the 1948 to 1949 season was 28,048 acres. This was greater than the wheat area, but only 46 per cent of it was threshed, the remainder being used chiefly for the production of hay and chaff, with a small proportion being used as green feed. The distribution of oats (Figure 28) follows very much the same pattern as that of wheat, being confined to the downlands and plains, but the emphasis varies. Whereas the Timaru downlands and Levels Plain are the main areas of wheat growing, the amount of oats grown is comparatively small. Further to the north between the Opihi and Orari Rivers, where wheat is less important, oats are proportionately more so. Unlike wheat, oats do not require such long sunshine hours for ripening. To the east of the Hunters Hills is an area where sunshine is less and humidity greater than the country nearer to the coast. Here oats are the predominant cereal crop. They are also grown in the Waihao basin and the Hakataramea Valley, but not so much for seed as for chaff and green feed. Autumn is the usual time for the sowing of oats and they may be first utilised as green feed (a much more common practice than with wheat) before closing for the production of a grain or chaff crop.

The trend in the production of oats has been very similar to that of wheat. There has been a steady decrease in acreages since 1918, both in terms of oats for threshing and oats for hay and chaff. The latter trend has been due mainly to a decrease in demand caused by greater mechanisation on farms and the consequent decrease in the use of horses.
Areas growing barley.

Most important areas.
Of recent years there has been an increase in the area of oats that are fed off and not harvested but this trend has by no means offset the all-over decrease in oats production. Whereas the cause of the decline in wheat acreages can be found mainly in the higher prices offering for sheep products, that of most of the oats decline can be attributed chiefly to a decrease in demand.

Barley, the only other cereal which is of importance in South Canterbury, is grown primarily for the production of malting barley. Its increase since the end of the war to over 10,000 acres in 1948 is in marked contrast to the decline in acreage of the other two cereals. Barley is a spring sown crop and it requires less moisture in its growing period than either wheat or oats. Consequently, the growing of barley achieves a greater emphasis on the sandier soils of the plains, and less moisture retentive soils of the downlands. Scarcely any is grown in the downlands west of the Brothers Range and areas of greatest importance occur on Levels Plain and the downlands extending from Timaru to the Waihae basin (Figure 29).

It can be seen therefore that cereal production taken as a whole is today in South Canterbury greatly reduced in importance. Over the last thirty years the essential character of the 'mixed' farming of South Canterbury has been gradually changing. Today a typical farm of this area grows 40 acres of either wheat, oats or barley but very few grow more than one cereal crop in a year. This decline, especially in wheat growin
has been of significant importance in New Zealand's economy as a whole. Australian wheat has had to be imported, sometimes at higher prices than that offering for New Zealand grown wheat. When the Australian harvest has failed Canadian wheat has been imported. Nevertheless it has been estimated that New Zealand is quite capable of growing her own wheat requirements and at the same time maintaining soil fertility. (15) Farms in South Canterbury which have grown wheat consistently for over seventy years, today no longer crop any, and many of those farmers who still grow wheat do so out of a sense of patriotism rather than one of a desire for or prospect of higher returns. The position of wheat in South Canterbury is uncertain. Changes, either in the form of prices or government controls, may rapidly alter the position. Sheep are today the basis for nearly all South Canterbury's agriculture but wheat growing cannot be regarded as having reached any degree of stability. It is quite feasible that future changes may once again see the rise in its importance with consequent effects both in South Canterbury's agricultural economy and the agricultural landscape.

G. OTHER CASH CROPS.

As in many other areas of agricultural activity, there are in South Canterbury extremely small total areas of minor cash crops adding little to the overall agricultural character. Such crops in this area are onions, maize, carrots and peas. Nevertheless, there are others,

SOUTH CANTERBURY
— POTATOES —

1 DOT = 5 ACRES
TOTAL AREA: 1847 ACRES

FIGURE 30

Compiled from Certification Records 1948-49
each exceeding 2,000 acres in area, which are of significance both in their areal distribution and in their contribution to New Zealand's economy. These are potatoes, linen flax and linseed.

Potatoes averaging about 3,200 acres and representing about 14 per cent of New Zealand's production have shown the least fluctuation over recent decades. Their localised pattern of distribution is most marked. (Figure 50) Definite centres of production occur in the following districts: Orari, Temuka, Milford, Seadown and Willowbridge-Morven, and show a close correlation with areas of more fertile alluvial soils. The remaining areas growing potatoes are sparsely scattered over the downlands and plains. As with wheat varieties there is also a definite pattern in the distribution of potato varieties. In the south around Willowbridge 70 per cent of the potatoes grown are of the Arran Chief variety while north of Timaru about 85 per cent are of the Aucklander Short Top variety. This difference can partly be explained in terms of varying soil types, Aucklander Short Top being suitable for growing in 'medium' to 'lighter' soils and Arran Chief in 'medium' to 'heavier' soils, (16) the latter being dominant around Willowbridge.

Methods of production of potatoes differ greatly from those used for other crops. The average size of the individual potato fields is about ten acres and this contrasts strongly with the usual thirty to forty acres grown in cereal or fodder crops. Contract cropping is confined largely to the production of potatoes and the farmer may either

Hand planting of potatoes is rare now, but hand digging is quite extraordinary outside garden patches.
rent his land to, or receive a certain percentage of the crop from, the contractors. There is a much greater labour demand in the growing of a crop of potatoes. Planting, which is done in September and October, is commonly by hand; during the growing period inter-row cultivation is frequent; and in the harvesting from April onwards hand digging is quite usual. With the introduction of mechanised planters and diggers, the amount of manual labour required has certainly decreased but this mechanisation has not yet been widely applied.

South Canterbury has an export trade in potatoes, mainly to the North Island. Before the operation of price controls potato acreages varied greatly with fluctuating prices. After a year of low prices, South Canterbury’s potato acreages would decrease, and similarly would increase after a year of high prices. Large acreages and favourable seasons have frequently produced a potato surplus. At times potatoes have even been 'dumped' but fortunately in 1950 a shortage in Australia provided an outlet for the unusually high yields of that season in South Canterbury. Export to areas outside New Zealand is not usual and the export market is not reliable. Consequently potato production is liable to give very fluctuating returns. Attempts have been made to stabilise conditions and the establishment of the Potato Board in 1960 may provide means whereby a grower is offered greater security.

The present tendency is for a decrease in areas growing potatoes in South Canterbury. Partly a result of the labour shortage, and
SOUTH CANTERBURY

LINSEED

---

Scale in miles

~Are1o.s growing linseed.
~Mo~t important arrta.

Compiled from data supplied by Dominion Industries

FIGURE 31
partly a result of farmers wishing to 'spoil' areas which were heavily cropped during the war, the decrease has been sufficient to cause speculation as to whether next season's production will fulfil New Zealand's requirements.

Linseed growing in South Canterbury has shown extremely great fluctuations, over 6,000 acres being grown in the 1923 to 1924 season and almost nothing in 1937 to 1938. A factory operated in Auckland by the New Zealand Cattle Cake and Oil Company between the years 1921 to 1935 was the focal point for all South Canterbury's linseed. Since 1942 Dominion Industries have operated a factory in Dunedin and are at present offering very high prices to growers of linseed. This has resulted in an expansion of production in South Canterbury and the estimated area for the 1951 to 1952 season is 2,200 acres. It is a very short term crop, being sown in October and harvested (usually by the header harvester) in February or March. The Timaru downlands are the centre of production and produce about half the total acreage, the remainder being scattered throughout the delimited area. (Figure 31) New Zealand aims at being ultimately self-sufficient in its linseed output. It is protected by tariffs from external competition and areas grown in linseed will probably increase, but it is unlikely that it will form a basic crop in South Canterbury's agriculture.

Contrasting with the apparently hopeful prospects for linseed, is the present situation of linen flax production. Solely a wartime
Compiled from data supplied by Linen Flax Factories

FIGURE 32
development to supply Great Britain whose supplies in Europe had ceased, linen flax growing was in fact uneconomical (although not to the grower) but necessary at the time, and South Canterbury contributed about 50 per cent of the total production of the linen flax crop. Four factories were established at Makikihi, Washdyke, Fairlie and Geraldine, and the flax was produced in the surrounding districts. Now only of historical significance in the two former areas, flax is still grown to supply the factories at Fairlie and Geraldine. (Figure 32) Last season, of the 2,000 acres grown 67 per cent was for supplying the latter factory. The reduction in acreages grown for linen flax has been an example of contraction from marginal areas. Around Washdyke the linen flax produced gave the least suitable fibre and the factory was closed; the remaining areas where it is grown are those where returns are most favourable. Linen flax is not regarded as a crop which is necessary to New Zealand's economy; tariffs do not greatly favour its production and its importance is steadily declining.

This discussion of the crops and livestock in South Canterbury's agriculture has served to show how greatly dependent the agriculture is on overseas conditions. Fluctuating prices together with government controls largely determined the various trends which have been evident over the last two decades. Today high prices for wool and sheep have produced a farming emphasis which is far removed from that of
thirty years ago. Nevertheless, this is regarded as only a temporary phase and changing economic conditions will continually be reflected in the farming landscape of South Canterbury.

H. LIME AND FERTILISERS.

A discussion of those more important features contributing to the present day characteristics of agriculture in South Canterbury cannot be complete without mention of the use of both agricultural lime and fertilisers. South Canterbury's use of lime can in no way be compared with the scale on which it is employed in Southland, nor can the contribution of fertilisers, mainly superphosphate, be compared with their contribution to the development of the Waikato. Although both lime and fertilisers are much less important than in the other two respective areas, they have played and are playing an important part in South Canterbury's agriculture.

With the high acreage returns, especially of wheat, in the first years of arable farming, it was thought that soils were naturally fertile but with steadily declining yields twenty years after the first ploughing of the land it was realised after all that practically the reverse was true and that much of South Canterbury's soil was inherently infertile. Centuries of undisturbed tussock growth had given the ephemeral fertility to the soils. The use of fertilisers, mainly blood and bone, appears to have been practised with the sowing down of crops from the beginning of the 1880's, but this did not develop to any great extent
SOUTH CANTERBURY
--- LIMeworkS ---

ANNUAL CAPACITY
- 10,000 TONS
- 20,000
- 30,000
- 70,000

X PRIVATE LIMeworkS
----- RAILWAY

FIGURE 33
until after the turn of the century. Phosphatic fertilisers came into use after the opening of a fertiliser works near Christchurch in 1922.

Today, the main use of fertilisers, which are chiefly phosphatic, is in the sowing down of crops and pastures, only a very small proportion being used for topdressing. The customary practice is to sow down from one to two hundredweight of the fertiliser with the crop, a little more perhaps being used for the production of potatoes.

When these phosphate fertilisers were first used in the 1920's production increases were not as great as were expected. South Canterbury's soils were of a naturally acid or 'sour' type and the soluble phosphate of the fertilisers became fixed in an unavailable form by the action of iron, aluminium and other substances within the soils. The use of lime was found to counteract this acidity and to increase the value of the fertilisers. Not only was this found to be so but the use of lime alone released soil elements which thus became available to plants, and consequently lime alone had the apparent effect of being a soil fertiliser. Today the use of lime has been found to be of more importance, at least for the present, than the use of fertilisers.

South Canterbury is fortunate in possessing large amounts of limestone (Figure 33), which are mined in ten different areas, and smaller amounts which are mined by a travelling limeworks. Except for the Cave and Sutherlands works, limestone production is for local consumption. The lime is used for the sowing down and topdressing of pastures.
Usually they are sown down with about two tons of lime to the acre, but topdressing although important has not yet been fully developed. Lime unlike fertilisers is not so much a plant food as a soil improver and therefore the amount lost through leaching is far in excess of that used by plant growth. Consequently once the initial requirements of lime are met, further liming depends on the amount of leaching. The estimated amount of lime required in South Canterbury’s soils varies with the soil type but six tons to the acre have been estimated as not being excessive for the Opuha soils. These soils with their browntop pastures show remarkable responses to lime application, and the present tendency towards a greater use of lime in these areas is indicated by the fact that Fairlie had larger amounts of lime delivered to it than to any other railway station in South Canterbury in 1949.

As a measure of the productivity of an area the amount of lime used in the sowing down of crops and pastures, and in topdressing, is little indication, as once the initial requirements have been met, eight hundredweight of lime per acre per year appears to be the maximum amount required (17) to make up losses through leaching and plant demand.

The use of lime together with superphosphate has encouraged and given longer life to the clover growth of the pastures of the downlands and plains. The trends in the utilisation are shown in Figure 34. In the case of lime the increase has been over 100 per cent since 1946. On the other hand, the use of superphosphate has remained comparatively

Data from Dept. of Agric.

FIGURE 34. RAILWAY DELIVERIES OF LIME AND SUPERPHOSPHATE IN SOUTH CANTERBURY.
steady, this being probably more due to an inelasticity of supply rather than a steady demand.

The most recent development in South Canterbury has been that of aerial topdressing. It has so far been used only to a very limited extent, and time has not yet been sufficient for any visible results to be confirmed. Where lime is the chief deficiency in the soils, aerial topdressing with fertiliser would appear to offer little prospect for increases in pasture production; and as yet aerial topdressing of useful amounts of lime is not feasible.

As far as South Canterbury is concerned, the productivity of its soils appears to lie in the continued use of lime and fertilisers and the permanent elimination of the browntop pastures is only possible with the continued expansion in the use of lime.
In applying Whittlesey's (1) proposals of functioning forms as a basis of classification for the agricultural regions of New Zealand, Cumberland (2) has shown that excluding minor areas of specialised horticulture, three of Whittlesey's types are present. These are Commercial Ranching, Commercial Dairy Farming and Commercial Livestock and Crop Farming. South Canterbury was shown to present the former and latter types of agriculture, together with a certain amount of agriculturally unproductive land. On a closer examination Commercial Dairy Farming is also found to be of significance.

Whittlesey has stated that his classification
"attempts to recognise agricultural regions of the first order of magnitude. Therefore it invariably lumps regions which differ in details of their agricultural pattern, structure and procedures. For the purpose of earth-wide survey these differences are believed to be details. If desired each major agricultural region can be subdivided into lesser units on the basis of these differences." (3)

A classification of agricultural types must of a necessity be empirical and based upon self-evident principles. Thus in using Whittlesey's agricultural types as a basis for subdivision into agricultural reg-

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(3) Derwent Whittlesey, op. cit., p. 207.
ions of smaller areas, such as South Canterbury, it is possible that transitional types may assume a magnitude of the first order within that area. In studying the agriculture of South Canterbury it became evident that there were three farming types, covering significant areas, which fell into the main categories of Whittlesey's Livestock Ranching, Commercial Dairy Farming and Commercial Livestock and Crop Farming; but that a transitional type between the former and the latter assumed an importance equal to that of those types stated above. This importance was gauged by the fact that the members of South Canterbury's agricultural community recognise this transitional type as being distinct from and as important as the other types. Thus in the primary division of South Canterbury four generic agricultural regions were recognised.

<table>
<thead>
<tr>
<th>Generic Agricultural Regions in South Canterbury</th>
<th>Position in Whittlesey's Major Agricultural Regions of the Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Extensive Sheep Farming.</td>
<td>1. Livestock Ranching.</td>
</tr>
<tr>
<td>B. Store Sheep Farming.</td>
<td>2. Transitional between (1) and (3).</td>
</tr>
<tr>
<td>C. Commercial Livestock and Crop Farming - 'Mixed' Farming.</td>
<td>3. Commercial Livestock and Crop Farming.</td>
</tr>
<tr>
<td>D. Commercial Dairy Farming.</td>
<td>4. Commercial Dairy Farming.</td>
</tr>
</tbody>
</table>

The delimitation of these regions was largely subjective and based on observations in the field, both of methods of agriculture and the agricultural landscape. Nevertheless, it was found that statistical limits especially with reference to crop and livestock associations showed a
A. EXTENSIVE SHEEP FARMING
1. The Gorge Country
2. Mount Peel - Foxes Peak
3. The Mackenzie Basin
4. Upper Hakataramea

B. STORE SHEEP FARMING
1. Orton District
2. The Foothills
3. Hakataramea - Pentland Hills

C. COMMERCIAL LIVESTOCK AND CROP FARMING
1. Coastal Downlands and Plains
2. Ringitata - Arundel
3. Fairlie - Albury
4. Hunters Downlands
5. Willowbridge - Morven
6. Glenavy District
7. Lower Hakataramea Valley

D. COMMERCIAL DAIRY FARMING
1. Temuka - Clundeboya
2. Seadown District

Perpetual snow and ice

FIGURE 35
definite coincidence with regional boundaries. The following table shows these limits.

<table>
<thead>
<tr>
<th></th>
<th>Extensive Sheep Farming</th>
<th>Store Sheep Farming</th>
<th>Commercial Livestock and Crop Farming</th>
<th>Commercial Dairy Farming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock units (4) per 1000 acres.</td>
<td>Less than 400.</td>
<td>400 to 1000.</td>
<td>More than 1000.</td>
<td>More than 1000.</td>
</tr>
<tr>
<td>Proportion of total land area in indigenous pastures.</td>
<td>More than 90%.</td>
<td>More than 40%.</td>
<td>Usually negligible.</td>
<td>Usually less than 10%.</td>
</tr>
<tr>
<td>Proportion of total land area in all crops.</td>
<td>Less than 3%.</td>
<td>3% to 15%. Usually less than 8%.</td>
<td>More than 15%.</td>
<td>Usually more than 20%.</td>
</tr>
<tr>
<td>Proportion of total land area in cash crops.</td>
<td>None.</td>
<td>Negligible.</td>
<td>More than 10%. Usually less than 10%.</td>
<td></td>
</tr>
<tr>
<td>Proportion of dairy cows to sheep in livestock units.</td>
<td>Negligible.</td>
<td>Negligible.</td>
<td>Usually less than 70%.</td>
<td>More than 100%.</td>
</tr>
</tbody>
</table>

These limiting ratios were not exclusively used for the delimitation of the regions and as a result there are within every region holdings which are exceptions, but nevertheless these ratios represent

(4) Livestock units are estimated in terms of sheep. 1 sheep = 1 livestock unit, 1 cattle = 7 livestock units, 1 pig = 1 livestock unit, and 1 horse = 10 livestock units.
typical conditions, and as such can be compared with those used in other areas. (5) For the purpose of this survey separate holdings were regarded as units and methods used for acquiring information are outlined in Appendix I. In taking individual farms as the units, consideration of the complex pattern of varying land use types was eliminated. This complexity is particularly noticeable on the downlands where stretches of rough grazing along stream beds and the steeper valley sides form a ribbonlike development extending at times right through the area.

A. EXTENSIVE SHEEP FARMING.

This area is characterised by its specialisation in the single commodity of sheep and the extremely large size of holdings. Carrying capacities vary from 400 sheep to 1,000 acres in the more eastern parts to less than 70 sheep to 1,000 acres in the 'gorge' country of the main divide and the size of holdings varies from 6,000 acres to over 100,000 acres. Sheep are by far the predominant livestock and wool is the main product, with store sheep being of proportionately great importance in the eastern areas. In the north and south the boundaries of the extensive sheep farming region are those of South Canterbury. In the east the approximate limits are from north to south, Mount Peel, Four Peaks, the upper reaches of the North and South Opuha Rivers, the Dalgety and Rollesby Ranges, the western slopes of the Hunters Hills and a more indefinite boundary cutting off the upper part of the Hakataramea Valley. To the west the extreme limit

(5) Wellington D. Jones, "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance", "Annals of the Association of American Geographers, 20: 177-187, December, 1930. Although methods of arriving at statistical limits are different from those employed for South Canterbury, the limiting ratio values for the four major types of agriculture in Central Northern United States make an interesting comparison with those limits devised for South Canterbury.
is set by the line of perpetual snow and ice.

Historically, the agriculture of this area is unique in that farming practices have scarcely altered since the time when the land was first occupied by white settlers. The extensive sheep farming which comprised nearly all the agricultural utilisation of South Canterbury in the 1860's retreated against an onslaught of subdivision, cereal cropping and fat lamb production. The present area is the remnant of an agricultural type which formerly covered almost all South Canterbury and it has about it an aura of romance unassociated with the more mundane agriculture of the plains and downlands.

The landscape is one of clear cut mountain Skylines, and steep slopes meeting broad expanses of deceptively level country. In the general pattern of snow tussocks at higher levels, hard tussocks on the lower areas, and the broad stony beds of the rivers, the area has changed little in one hundred years, but closer inspection reveals trends and problems which are a source of both local and national concern.

Although agricultural practice is based almost solely on sheep, their presence in the landscape is scarcely noticeable and a whole day can be spent travelling through the region without a single sheep being observed. Breaking the monotony of the tussock landscape are the scattered homesteads sheltered by coniferous and deciduous trees. Adjacent to the homesteads are numerous sheds, for shearing and storage, sheep dips and sheep yards, the latter being used for the herding of sheep at mustering
time. The yearly farming programme is dominated by the seasonal musters of sheep, by no means a small undertaking when holding blocks on some sheep stations cover hundreds of acres of steep and rugged country.

Sheep are of Merino, half-bred and Corriedale breeds, lambing averages being about 80 per cent, although in the case of Merino breeds this is inclined to be lower. Lambing takes place from early October, in the warmer localities, to the last weeks in November in areas close to the Southern Alps. This season is one of constant vigilance, and late snows or periods of unseasonable cold weather can greatly reduce stock numbers. The first large muster after the lambing season is the shearing muster which takes place in late November and December. Permanent labour on each sheep station is not large and gangs of shearers moving from one station to the next are employed in the shearing season. Although most homesteads are supplied with electric power sheep are usually shorn by blades. This does not allow of close shearing and the small amount of wool not shorn acts as a protection for sheep, in the not uncommon periods of colder weather after shearing. Sheep are then turned out onto summer country which is likely to be the most inaccessible part of each station. The weaning and dipping muster takes place in late February, broken-mouthed sheep and any surplus lambs being culled at this stage. Crutching takes place about May and after this sheep are turned onto the winter pastures which are usually nearer the homestead. This serves as a brief summary of the seasonal routine on an extensive holding, but it is by no means a full account. Practices differ from
area to area, depending largely on the individual preferences of each station holder. Musters may occur at any time and shearing before the lambing season is not unknown.

A feature of the extensive sheep stations is the division of each holding into blocks by either fences or natural boundaries such as streams or steep slopes. The greater number of blocks on a station, the easier is the management, especially at mustering times. A form of rotational grazing is carried on from season to season, the warmer north-facing slopes being used for winter grazing, and low-lying areas, south facing slopes or areas of higher altitude being used for summer grazing. The use of supplementary winter feed in the form of hay is common. The pastures used for hay-making are usually situated in fields adjacent to the homestead. Root crops for winter feeding are seldom grown or used.

On stations where no cropping is carried on, chaff and hay are bought from other areas, many station owners finding that the value of producing their own supplementary winter feed does not warrant the additional labour, accommodation, machinery and machinery sheds that are required.

The agricultural products of the extensive sheep farms are wool and store sheep, although the latter product is not as important as wool production. The number of store sheep produced is unreliable and very dependent on weather conditions especially at lambing time. Surplus sheep are usually sold at the sales at Geraldine, Tekapo or Kurow. A significant feature is that most of the store sheep in the form of cast-
for-age ewes are sold to areas beyond South Canterbury, especially to the farms on the lighter land of Ashburton County. All South Canterbury's fine wool comes from the extensive sheep farms and the bales are usually taken by truck from the individual stations to be sold at wool sales at Timaru, Dunedin or Christchurch. As typical of the sheep in the agricultural practice are the horses and dogs. Although in numbers extremely insignificant, they are essential factors in the mustering of the sheep.

Characteristic of the region are numerous problems which are closely associated with its agricultural development. Rabbits, the burning of the tussocks, and in some cases overstocking, have led to serious depletion of the vegetation cover, and this in turn has led to accelerated erosion. Among station owners there is a certain amount of disagreement as to which factor is the most important, but nevertheless the resultant depletion has caused a decline in carrying capacities in numerous areas. County statistics for this area are offset by the inclusion of sheep numbers on the downlands and the increase there, consequently more than compensates for a decline in sheep numbers on the stations, but individual holdings show this decrease in numbers. The decrease can not be attributed entirely to a decline in carrying capacities. Two factors must be taken into account. A change over from Merino to halfbred sheep in the early 1930's on some holdings resulted in a decline in numbers, chiefly because carrying capacities are less for halfbred sheep than for Merino sheep. The second factor is that with present high wool prices
many station owners have purposely reduced their sheep numbers in order to give the vegetation a spell from continually heavy grazing.

The extensive sheep farming region depends almost exclusively upon sheep for its prosperity. In periods of low wool prices, there is no other form of agriculture which can be adopted and instead stock numbers are increased, thus leading to overstocking in order to make sufficient profit. Today, high wool prices have given to this region almost unprecedented prosperity. Finances are no hindrance to the building of new fences, sheds and houses. The lack of available labour is at present the greatest handicap to the making of such improvements.

Distinguishing this region from the remainder of South Canterbury is the higher proportion of land which is leased either from the Crown or educational bodies. Since the Land Act of 1948 there has been much simplification in the system of Crown tenures, but there is still not sufficient allowance for a tenant to be credited in property values for his improvements, when the lease expires. Absentee landowners either as individuals or companies are common, and men with a lifetime experience of extensive sheep farming usually manage these stations.

Isolation, which was a great handicap to initial development, has been largely overcome. Roads as elsewhere in South Canterbury are serviceable except in times of flood and heavy snows. A few of the stations are isolated by snow during several of the winter months, but road transport, both private and commercial, brings every homestead within
Plate 1. The Gorge Country. Streams flowing in steep V-shaped valleys join the larger rivers winding across broader-bottomed valleys of former glaciers. In this case can be seen the broader valley of the Cass River which flows into Lake Tekapo. Hard tussock and the wire fence are typical of most of the extensive sheep farming region. Poles carrying telephone wires connect nearly every homestead with the 'outside'.

Plate 2. The Gorge Country. In the foreground around the homestead are fields of exotic pastures and weeds. A barely perceptible fence six feet high once protected crops from the ravages of deer. The latter are no longer a cause of great concern in this region.
time

ten hours travelling; in the summer months, of one of the coastal towns. Within the region itself there are no larger centres of settlement than the ephemeral establishments of Public Works, such as at Tekapo and Pukaki.

The extensive sheep farming region may be subdivided into four specific regions, each having a distinctive character.

A.1. THE GORGE COUNTRY.

Sheep farming attains its most extensive form in this area. Station sizes are large, averaging over 50,000 acres in extent. Carrying capacities are extremely low in terms of number of sheep to the total area of each holding, and range from seven to twelve sheep per hundred acres; but in consideration of these carrying capacities it must be realised that as much as two thirds of a holding can consist of bare rock faces, mountain tops devoid of vegetation and steep scree slopes. Merinos are the only breed of sheep in the gorge country. Each flock has a high percentage of wethers in it and breeding ewes represent usually less than 35 per cent of total sheep numbers.

The gorge country is mountainous with the long flat-floored but narrow valleys of the glacier fed rivers dissecting it. Along the valley sides grow small stands of mountain beech (*Nothofagus cliffortioides*) and mountain totara (*Podocarpus nivalis*). The higher rainfall and the cold winter temperatures of this area partly contribute to the lower rabbit numbers. Depletion of vegetation and accelerated erosion are not so great as to the south and the inter-tussock vegetation shows a predominance of
native herbs over exotic weed grasses.

The hazardous work which must be undertaken for the mustering of sheep is a distinctive feature of the gorge country. During the summer, sheep have been grazing the high 'tops' and the autumn muster entails the shifting of the sheep from these mountains. Much of the mustering must be carried out on foot, on the steep slopes and ice faces, before all the sheep can be gathered. These are then kept under fences until a sufficient winter snow boundary has formed. The extremely high snow and the marked seasonal movement of the sheep contrasts with the other areas of extensive sheep farming. Lambing percentages are low, and in an unfavourable season are less than 50 per cent. Scarcely any sheep move from this area and wool is the major source of income.

Very few stations have fields for the production of supplementary winter feed, but around the homestead areas of up to 400 acres devoid of tussock and covered with weeds indicate the extent of former ploughing.

Cattle achieve a greater degree of importance in the gorge country than in the other subdivisions. Hereford cows and Black Poll bulls graze in the swamp pastures of the river flats at the heads of Lakes Tekapo, Pukaki and Ohau. The droving of over 700 half-wild cattle from the area in late autumn down to the cattle sales at Temuka is an annual event which attracts as much interest as the sheep sales at Tekapo.

The gorge country forms one of the extremes in sheep management
in South Canterbury and is distinguished from the other subdivisions of extensive sheep farming by the larger size of the holdings, the dominance of the Merino sheep, the low lambing averages, an almost total lack of cropping, and the comparatively smaller amount of deterioration in the form of both pasture depletion and accelerated erosion.

A.2. MOUNT PEEL - FOXES PEAK COUNTRY.

This area comprises the mountains and higher hills north-west of Geraldine and north-east of Fairlie. Its main distinguishing criterion is the dominance of half-bred and Corriedale sheep. The one exception is Lochaber Station (6) which carries Merino sheep. Carrying capacities are higher than in the gorge country and average from 30 to 35 sheep to 100 acres. Lambing percentages are greater and a larger proportion of store sheep leaves this area.

Variety both in station sizes and in sheep management is most characteristic of this region. Clayton Station in the upper reaches of the Phantom and North Opuha Rivers is now, through recent additions to its area, 70,000 acres in extent and covers about one third of the entire region. Elsewhere holdings are as small as 9,000 acres.

Snow risk is not so great, but rabbits, pasture depletion and accelerated erosion are more significant problems than in the gorge country. Flooding of the Orari, Waihi and Opuha Rivers makes part of the area inaccessible for days at a time, while even graver consequences of this flooding, in the form of burst river banks, are felt in the downlands and

(6) See Distribution of Sheep Breeds, Figure 5.
plains. Unwise subdivision of some stations has in part contributed to the sheep management problems of the area. With subdivision, the smaller holdings have often received uneven proportions of winter and summer grazing country. Thus a farmer having a small proportion of winter grazing country is forced to reduce his sheep numbers to prevent winter overstocking, even though the area will be understocked in summer. The result of unwise subdivision is especially noticeable in the west of this region on the eastern slopes of the Two Thumb Range. Winter conditions are such that winter carrying capacities are extremely low and outside pasturage is necessary in order to maintain full carrying capacities in the summer months. This feature of feeding sheep on fodder crops and winter pastures, (not adjacent to the main station, is typical in this small district, and this procedure places it very close to the store sheep farming type. On the other hand slopes east of the North Opuha River facing northwest provide a high proportion of winter grazing country, this being in direct contrast to the previously mentioned district. Further towards the east most of the area was formerly covered by part of the Peel Forest and Orari Gorge stations. These were the first stations in the mountain country to be taken up, but have since been subdivided, the inland parts now forming blocks of extensive sheep stations, and the more coastal areas parts of the store sheep country. The mark of the early pioneers is seen in the homestead at Peel Forest. Surrounded by gardens and native bush it is one of the most attractive homesteads in
Plate 3. Trees around the homestead and, in this case, pine plantations, stand out clearly in the rolling to flat country of the Mackenzie Basin. In the foreground is red snow tussock (*Danthonia raeulii* var. *rubra*) - a common feature in the poorly drained land between Lakes Tekapo and Pukaki.

Plate 4. Black Poll cattle grazing on swamp pastures near Lake Alexandrina. The snow line is that of late autumn.
Canterbury. The Mount Peel-Foxes Peak region extends east and slopes steeply into the valley of the Rangitata River. The whole area shows diversity in agricultural management within the limits of extensive sheep farming. Sheep breeds, and the problems brought about by subdivision are its most distinctive characteristics.

A.3. THE MACKENZIE BASIN.

This area is bounded on the north by the gorge country, on the east by the Grampian Mountains and Kirkliston Range, and on the south and west by the Waitaki and Ohau Rivers. It is essentially rolling country broken by chains of higher hills, and in these respects forms a contrast to the more mountainous character of the rest of the extensive sheep farming region. Holdings are typically of about 20,000 acres with carrying capacities of 20 to 30 sheep to 100 acres. Although the Mackenzie basin is regarded as being most suitable for Merino sheep there is a definite development of half-bred sheep between Lakes Tekapo and Pukaki. Both English Leicester and Merino stud sheep are produced in the area. Lambing is earlier and lambing percentages higher than in the gorge country and although snow risk is not so great the river flats are subject to long-lying snows, sheep as a result being shifted onto higher areas in the winter. Practically every holding has a certain amount of arable land and it reaches its greatest extent on the Grampions Station which has over 3,000 acres of farmland. Oats, lucerne and pastures are used for the production of hay and chaff, but
Plate 5. A small lake in the rolling morainic deposits of part of the Mackenzie Basin. The depleted hard tussock is obvious, although this depletion is insignificant in comparison with that in areas further south towards the Waitaki River.

Plate 6. A pocket of arable land in the Mackenzie Basin. The lighter patches are oat crops. The line of trees along the road is an unusual feature, these having been planted to act as shelter belts for the cropped land.
the low rainfall of less than 25 inches is a limiting factor in the development of arable farming. Irrigation is practised on one station with very favourable results.

Within the area there is normally a surplus of wether lambs. The wether Merino lambs are commonly sent to the gorge country as replacements, while the surplus half-bred lambs are sent to the Fairlie district for fattening. Cast-for-age ewes are sold to areas outside South Canterbury, and also to the Orton district where they may be bred for one or two seasons, before being fattened.

This area suffers from pasture depletion, accelerated erosion and the rabbit pest to a much greater extent than the other subdivisions. This is especially the case towards the south where scabweed (*Raoulia* spp.) sorrel (*Rumex acetosa*) woody mullein (*Verbascum thapsus*), thistles (*Cirsium* spp.) and sweet vernal (*Anthoxanthum odoratum*) are the main constituents of a very sparse vegetation cover. Erosion is extreme both on the flat and on the hills. Carrying capacities have declined and at Black Forest Station all stock has been removed, within the last few years.

Homesteads with their surrounding trees stand out clearly against the rolling brown hills of tussock. Long winding roads extend through the region and the continual passing of tourist buses and public works trucks along the main roads at present breaks down the isolation still marked in the other areas of extensive sheep farming.
A.4. **UPPER HAKATARAMEA.**

Whereas the previous region was characterised more by its agricultural problems of erosion and rabbits together with the lack of country liable to great snow risks, the Hakataramea subdivision is typified by the distinctive breed of Corriedale sheep, its higher carrying capacities and a character which is marginal to store sheep farming. The second registered Corriedale flock in New Zealand is on Hakataramea Station and through the large proportion of sheep that are sent from this station as store sheep many of the adjacent holdings have now predominantly Corriedale flocks. Carrying capacities varying from 300 to 400 sheep to 1,000 acres are the highest in the extensive sheep farming region. Similarly the proportion of supplementary crop and exotic pastures on each holding are the largest, but the extensive nature of the holdings which vary from under 10,000 acres to 70,000 acres in size nonetheless make the area typical of the extensive sheep farming region. Store sheep are of relatively greater importance, large numbers being sent to the downlands for fattening while a few may even be fattened within the area. Wool is nevertheless of prime importance. The Upper Hakataramea region has characteristics of both the extensive and store sheep farming types, and it may be regarded as a marginal area where the two types merge.

Extensive sheep farming has changed little with the passing of
time. The major factor in its prosperity is the price for fine wools, and the present high prices have enabled owners to pay off mortgages, to make improvements and to establish a degree of security for times in the future when wool prices may once again decline. The region can be regarded as a 'problem' area, the chief problems of which are reduced carrying capacities, pasture depletion, the rabbit pest and accelerated soil erosion. Holdings have been destocked, very little burning of the tussock is now carried on and Rabbit Boards, Catchment Boards and Sheep Commissions are attempting to define and solve the numerous problems.

B. STORE SHEEP FARMING.

Somewhere in the vicinity of the boundary between the extensive and store sheep farming, holdings are no longer referred to locally as 'stations'. The common term is 'run' and this change in terms coincides largely with the difference in farming types between the two areas.

South Canterbury's store sheep farming area extends as a narrow band along the foothills, marginal to the extensive sheep farming region. It reaches its greatest width in the south and has a finger-like projection from the north along the crest of the Brothers Range as far south as Cave Hill. A small outlier occurs on the plains in the Orton district. It is distinguished from the extensive sheep farming by the smaller size of the holdings, higher carrying capacities, lower proportion of native pastures and the higher proportion of each holding in crops, chiefly fodder crops.
This region provides the fattening farms of South Canterbury with most of their store sheep. Predominant types are Romney sheep with a smaller element of half-breds. The proportion of breeding ewes in each flock is above 60 per cent and with higher lambing averages of 80 to 90 per cent the number of surplus sheep that are bred is great. Ewe lambs are sent to the plains and downlands as replacement stock, and wether lambs and old ewes may either be sold for fattening or be fattened within the area. More often than not, though, old ewes are sold for breeding purposes.

The basic pattern on each farm is one in which a fairly high proportion of its area is in rough pastures, usually tussock vegetation. The remainder is in rotational pastures of the ryegrass-clover type with quite a definite emphasis upon Montgomery red clover. These pastures are usually kept down for a period of seven to ten years, after which they are ploughed and sown in turnips or swedes before the sowing of new pastures. The sheep are grazed on the rough pastures in the summer and on the rotational pastures in the winter. Both root crops and hay are used as supplementary feed in this latter period. Cash crops are of little importance, although occasionally a catch-crop of small seeds may be harvested from one of the younger pastures.

The boundaries of the store sheep farming region are indefinite, especially where it borders on the livestock and crop farming region. There is an almost imperceptible transition, with the area of each holding in rotational pastures becoming proportionately larger.
carrying capacities for sheep increasing, and cash crops becoming relatively more important as the store sheep farming type grades into the 'mixed' farming type. Delimitation is also complicated by the fact that store sheep farms may be managed in conjunction with 'down country' 'mixed' farms. A subdivision into three specific regions reveals the variation within the store sheep farming region.

B.1. ORTON DISTRICT.

This area is unique in South Canterbury in that it is the only part of the plains on which tussock pastures still survive, although they are gradually being invaded and ousted by exotic weeds. Agricultural practices largely reflect soil types. An occasional strip of fertile alluvial deposits extends through the region of predominantly dry infertile stony soils, and farms of the more fertile soils resemble those of the 'mixed' farming type rather than the store sheep farms. Apart from these exceptions holdings are about 1,000 acres in area and carry an average of one sheep to two acres. Little cropping is done, and turnips with hay provide the supplementary winter feed. Large paddocks of over 100 acres in size, brown coloured pastures for nearly the whole year, a noticeable absence of trees, the encroachment of gorse (Ulex europaeus) along the roadsides and in the fields, and occasional cabbage trees all contribute to make this area contrast strikingly with that immediately to the south. (7)

The tendency is for the tussock and weed pastures to be gradua.

(7) See Chapter IV, p.108.
Plate 7. The margin of the foothills. Tussock covered hills, steep-sided bush clad valleys and farm houses on flatter land, surrounded by arable fields, typify much of the store sheep country. Further back this area grades into the extensive sheep farming of the Mount Peel-Foxes Peak Region.

Auster Airviews.
ploughed up, sown in a fodder crop for a season and then sown in permanent pastures with subterranean clover as the main clover constituent. Unlike the other store sheep farming areas where much of the land is too steep for ploughing, the Orton area can be ploughed and with the use of better strains of grasses, fertilisers and lime the probability is that more cropping could be undertaken with the ultimate effect of the store sheep farming becoming a 'mixed' farming type.

B.2. THE FOOTHILLS.

This region is commonly regarded as the typical store sheep country. Holdings average about 3,000 acres in extent and stretch from rolling hills in areas adjacent to the downlands to steeper tussock covered hills further inland. The homesteads and arable fields are situated on the rolling frontal hills and the rougher pastures extend over the hills and steep valleys behind. In the numerous gullies dissecting the steeper areas small stands of native bush are common. Carrying capacities are higher than in the Orton district and vary from four to five sheep to five acres. There are no typical farms and variations in agricultural practice are largely a reflection of the amount of land that is available for ploughing. Where a relatively high proportion is in exotic pastures and winter fodder crops, carrying capacities are much higher and fattening of the wether lambs may be carried on. Occasionally a crop of small seeds may be harvested, but usually excess summer pasture growth is cut for hay. No arable cash crops are grown, although at times when wheat production
Plate 8. Tussock, browntop and a few fields of better pasture on the more level land - the foothills store sheep country, west of Cave. Auster Airviews. H. A. Arthur.
is profitable, a wheat crop may be grown.

The combination of exotic and indigenous pastures gives the store sheep farming its essential character. Without the exotic pastures holdings of only 3,000 acres would not carry sufficient sheep to be profitable, and without the indigenous pastures store sheep farming would become a type of commercial livestock and crop farming. Where there are holdings with very high proportions of tussock pastures, livestock are sent to the downlands and plains for the winter either to conjoint down country farms or to those farms where agistment is a common practice.

In terms of proportion of cattle to total livestock the foothills have the highest numbers in South Canterbury. The herd size is commonly from 25 to 70 cattle, with Shorthorn and Black Poll cattle breeds being predominant. They are bred on the holdings and perhaps fattened, although more often they are sent to the downlands and plains for fattening. Although the importance of cattle is gradually increasing, they nevertheless are of minor significance in comparison with sheep.

The higher carrying capacities, the smaller size of holdings, the greater relative importance of cattle and the smaller proportion of each holding in tussock pastures all form points of contrast with extensive sheep farming. In agricultural problems there is also a contrast. Soil erosion and rabbits, although present, do not assume such great
Plate 9. The Brothers Range. The steep west facing scarp is separated from the Albury-Fairlie downlands by the shingle strewn bed of the Tengawai River. Towards the east the store sheep farming of the higher altitudes of this range grades into the mixed farming of the coastal downlands. Auster Airviews.
significance in this region. In the Hunters Hills the wallaby has proved a greater pest than the rabbit. The overall problem is that of the invasion of the country by gorse, bracken and weed grasses. Gorse can easily be controlled in the ploughable slopes but once it is established on steep valley sides the main method of controlling it is by the planting of pine trees (*Pinus* spp.) which quickly outgrow the gorse. Bracken and manuka (*Leptospermum scoparium*) are also invading the better pastures but the increasing importance of cattle is an indication that attempts are being made to control this growth. The exotic pastures quickly revert to browntop, but improved techniques (8) are eliminating this tendency. Browntop has also invaded the tussock pastures and in so doing has reduced their feed value.

The belt of the foothills store sheep farming is very narrow north of Fairlie, where the mixed farming of the Sherwood district is almost adjacent to the extensive sheep stations of the Clayton area. The crest of the Brothers Range is similar to the rest of the region, its location between crop and livestock farming areas both to the west and east, being its most distinctive feature.

B.3. HAKATARAMEA—PENTLAND HILLS DISTRICT.

This region, like the adjacent Upper Hakataramea extensive sheep farms, is somewhat indefinite in character. The sizes of the holdings are larger than in the foothills or the Orton district and average about 5,000 acres in extent. An exception to this is the 20,000 acres

(8) See Chapter III, p. 69.
Plate 10. Hakataramea-Pentland Hills District. Depleted tussock and the lack of trees except around the homesteads contributes in part to the landscape similarity of this region and the Mackenzie Basin. Matagouri covers the steeper slopes of the valleys.

Auster Airviews.
of the Pentland Hills run, which in size is typical of the extensive sheep farms but which in management and production is characteristic of the store sheep farms.

This area has a drier and sunnier climate than the foothills and stands of native bush are not common. Erosion is a greater problem than elsewhere in the store sheep farming region and is particularly noticeable to the east of the Hakataramea River.

Sheep breeds are chiefly Corriedale and contrast with the Romney breeds of the foothills. Lambing percentages and carrying capacities are lower than in the latter area and cattle are comparatively insignificant. The country is rather minutely dissected and the largest area of flat land is a narrow strip bordering the Waitaki River. Along this, crops of lucerne, oats, barley, rye-corn and turnips are grown to provide winter feed for the sheep on those runs which extend from the Waitaki River in the south to depleted tussock pastures further north.

In actual landscape this area bears a closer resemblance to parts of the Mackenzie basin than to the store sheep farming of the foothills. Depleted tussock, the lack of trees except around the homesteads and a marked absence of any green colour in the landscapes contributes to this similarity, but nevertheless its agricultural characteristics are those of the store sheep farming region.

Of the three generic regions in which sheep are dominant, that of store sheep farming has perhaps received the least benefit from the
Plate 11. A transitional area between store sheep and 'mixed' farming regions. The marked ridge is of limestone and it is from such outcrops that South Canterbury's agricultural lime is obtained.

Plate 12. Gorse, cabbage trees and manuka characterise the sheep unploughable slopes of the more marginal areas of mixed farming. In this case the area shown will be eventually fenced and planted in pine trees.
high prices being offered for wool and sheep. There has been a tendency amongst those farmers who normally buy store sheep for replacements, to so alter the composition of their flocks, by using Romney rams, that they are able to breed their own replacements and consequently do not have to buy them at the present high prices. This tendency has been felt by the store sheep farmers in the decline in demand for store sheep. Dependence on other farming areas is basic to the agricultural economy of this region and although high wool prices have brought high returns, the decline in demand for store sheep is at present causing concern to the farmers.

C. COMMERCIAL LIVESTOCK AND CROP FARMING.

The commercial livestock and crop farming region of South Canterbury is distinguished from the two previous generic regions by its much smaller holdings, the higher carrying capacities for livestock and the far greater proportion of each farm in cash and fodder crops. Within this region nearly all of South Canterbury's fat lambs, cereal crops, small seeds and potatoes are produced. It extends from the Rangitata River in the north to the Waitaki River in the south and covers all the downlands and parts of the plains. There is a small outlier on the western side of the lower Hakataramea Valley.

The various farming types which have marked the successive stages in South Canterbury's agricultural development have all had their
expression within this region. Since the beginning of this century there has developed a system of cropping rotations in which cash crops, winter fodder crops, fattening crops and pastures play an integral part. Today, sheep are essentially the basis of the agricultural practice, and form the major single source of income for nearly every holding. Even since the development of 'mixed' farming, this has not always been the case. Changing prices, in many instances due to causes whose centre is far removed from New Zealand, are reflected in the changing emphasis within the region. When the growing of cereals has been most profitable these crops have formed the major source of income on many farms. Thus this region can be distinguished from both the extensive sheep farming and store sheep farming regions by the ease with which the farmers can adapt their agricultural practices to give maximum monetary returns. Today extreme conditions prevail and the commercial livestock and crop farming of South Canterbury is closer than it has ever been to an intensive form of purely pastoral economy based on sheep. Levels County, although not entirely within the region, has shown a decrease of approximately 60 per cent in its area of cropped land (excluding pasture hay) within the last thirty years. This typifies the tendencies within the whole region and in considering South Canterbury's 'mixed' farming, the fact that significant changes are possible over a comparatively short period of time cannot be overlooked.

Whittlesey has stated that commercial livestock and crop farming
Plate 13. Romney Cross sheep, smooth pastures, gorse hedges, rolling hills and mountains in the background - a typical 'mixed' farming scene in South Canterbury.

H. A. Arthur.
"displays maximum diversity in detail amid essential uniformity in outline." (9) The uniformity of South Canterbury’s 'mixed' farming lies in the provision of fodder crops for sheep and the production of fat lambs, small seeds and to a lesser extent cereal crops. The diversity is displayed not only in the varying emphases upon these factors, but also in the varying importance of cattle, dairy cows, potatoes, linseed and linen flax.

Holdings are generally less than 1,000 acres in extent, and the average size is about 400 acres. These are divided into fields usually less than 100 acres in extent. At least 10 per cent of each holding is devoted to the production of supplementary feed for stock and another 5 per cent at least for the production of cash crops. The yearly activities of the farmers are more varied and less seasonal in nature than on the extensive and store sheep farms. There is no season in the year in which the farmer is not occupied with some aspect of farm management. Lambing commences in late August in more favourable districts and extends into early October in more inland areas. During this season spring sown crops and pastures are put down. As the year progresses lambs are weaned, sheep are shorn and winter fodder crops are sown. Late summer and autumn are the periods of greatest activity. Harvesting of crops, the cutting of hay, the disposal of fat lambs and the sowing down of crops and pastures add to the variety. In the winter, hay is fed out to the sheep and fodder crops are fenced into 'breaks'.

(9) Derwent Whittlesey, op. cit., p. 251.
Plate 14. The heartland of South Canterbury's 'mixed' farming - the coastal downs. The wooden one-storeyed farm house, the small orchard, the hedges, the sheds, the pond and the small pigsty are features typical of many holdings. In the foreground on the left pasture has been closed for seed production.

Auster Airviews.
for feeding. Throughout the whole year stock are changed from pasture to pasture, this rotational grazing ensuring the utilisation of the various pastures at their most suitable stages.

After an old pasture has been ploughed a rotation involving turnips or swedes, rape, kale or chou moellier and a cereal is followed after which pastures are sown down again to last for another four or five years. This procedure gives a typically seven to eight-year rotation. Small seeds may be harvested from the pasture in its first two or three years. Thus for the greater part of the rotation production is directed towards the provision of feed for stock. Root crops, kale, chou moellier, and rape provide supplementary feed and the pasture provides for both hay and grazing. Ensilage production is an uncommon feature in South Canterbury. This basic pattern of rotation has numerous variations. Cash crops of potatoes, linseed, linen flax or rape for seed may be introduced into the rotation while on the other hand some of the fodder crops may be eliminated. The tendency of recent years has been for hay production to replace the growing of fodder crops.

Sheep are predominantly of a Romney or Romney Cross breed. The average flock size is about 700 and at least 75 per cent of that number are breeding ewes. Lambing averages vary from 100 per cent to over 125 per cent. Cattle are generally unimportant in the agricultural practice. Nearly every farm has at least one or two milking cows and in scattered areas herds may be as large as thirty in number.
Farming techniques are highly mechanised, practically every farm possessing a plough, tractor, grubber, harrows, discs, drill and a mower with a large proportion possessing header harvesters and balers. Rural population is much denser than in the regions of extensive and store sheep farming, and this is reflected in the close network of roads covering the area. Farm homes usually no more than a mile apart are typically one-storeyed buildings of wood lying back a few chains from the road, and are sheltered by hedges. Around each farm house is a collection of sheds for storing implements, wool and grain. Sheep yards much smaller in size than in the two previous regions are adjacent to the shearing shed. A henhouse and an invariably dilapidated pigsty, containing one or two pigs, are common on many farms.

The landscape in general is one of gently rounded low hills and plains covered by compact fields fenced by gorse hedges. Rows of trees and small plantations usually no greater than a few acres in extent act as shelter belts protecting the fields from the warm dry gusty 'nor-westers' and the cold 'southerly' winds. The latter wind can have particularly disastrous results at lambing times and during this season sheep are commonly placed in fields sheltered by trees. The rather scattered nature of the trees gives a much softer appearance to the landscape than do the larger and more regular plantations of shelter belts on the plains in Ashburton County. Trees are typically pines (*Pinus* spp.) and gums (*Eucalyptus* spp.) but along the water courses willows (*Salix* spp.) are dominant. Except for a few months in spring and early
Plate 15. Although not greatly different in farming techniques from the area illustrated by Plate 14, the above region in the vicinity of the Orari River forms a vivid contrast in landscape pattern. In the foreground is one of the larger homesteads which are scattered throughout the downlands and plains.

Auster Airviews.
summer, fields are predominantly of yellow-brown shades. The gorse hedges which are so very typical are a legacy of the past. Where areas are not ploughed frequently, the gorse tends to invade the fields and now when new fences are required wire fences usually replace the gorse hedges.

The commercial livestock and crop farming region was the first area used for the pasturage of sheep in South Canterbury. Here the early pastoralists built their homes and planted numerous English trees. Today these large mansions surrounded by deciduous trees form a contrast to the smaller farm houses with their macrocarpa (Cupressus macrocarpa) hedges and pine trees.

The agricultural problems in this area although insignificant in comparison with the problems of depletion and erosion in the extensive sheep farming region are nevertheless important. Poor drainage, excessive stoniness and noxious weeds are some of the major problems but receiving first recognition is that of the grass grub (Odontria spp.). Despite the use of chemicals and more resistant plants brown patches of dead pasture give evidence of its widespread activities. Soil erosion (especially of the sheet and rill type) although not widely recognized by farmers is apparent, but techniques of soil improvement by the use of lime and fertilizers appear to have masked the insidious losses which it causes.

Subdivision of the 'mixed' farming region is possible only in very broad terms, otherwise each separate holding becomes a distinctive unit in itself. The general landscape pattern can be very deceptive.
Plate 16. Small streams winding through the downlands, often possess more fertile and more moisture retentive soils, in their narrow flat floored valleys, than do the actual hills of the downlands. In this example, south of Timaru, arable farming extends over the hills and also over the small river plains. Auster Airviews.
An area of flat land covered with a large number of trees and having gorse hedges contrasts strongly with an area of rolling hills, with very few trees and wire fences and yet agricultural practices can be almost identical. Consequently the following subdivisions may have within them widely diverse landscapes. Because of the diversity in detail of mixed farming, exceptions to the general description of a subdivision are not uncommon.

C.1. THE COASTAL DOWNLANDS AND PLAINS

This area extending from north of Woodbury south into the Waihao basin could perhaps be called: the type area for South Canterbury's 'mixed' farming. Nearly every farm carries over two sheep to the acre, has at least one field in an arable cash crop, and harvests small seeds every year. The size of the holdings is commonly from 300 to 400 acres, but apart from these basic features which give a unity to the region there is wide diversity.

Methods of sheep management vary from farm to farm. A farmer may breed his own replacements and sell only his called ewe lambs and wether lambs. On the other hand, all lambs may be sold fat and all replacements bought. Fattening procedures differ, some lambs being fattened off their mothers while others are fattened on rape. Many of the farms make a practice of sending cream to the butter factories in the summer months at least, and scattered throughout the region are those holdings where dairy herds become quite significant features in the farm-
Plate 17. The shingle strewn beds of the larger rivers extend right across the downlands and provide only rough grazing - a contrast with Plate 16 is provided by this view of the Opihi River bed.
ing practice. Herds are usually over fifteen in number and definite areas of specialisation occur near Woodbury, Geraldine, Totara Valley, immediately to the west of Timaru and in the vicinity of Waimate. Correspondingly beef cattle are of greater importance in these dairying areas, the greatest emphasis being placed upon them in the district between Geraldine and Temuka.

Varying crop types and differing agricultural problems add to the diversity of this region. In the north around Geraldine linen flax is grown. Here soils are not subject to marked drying in the summer and the greener summer pastures, the numerous willow trees along the streams, and the level surface of the land forms a landscape pattern which is in marked contrast to the rolling downlands to the south, with their browner pastures and more scattered macrocarpa and pine trees.

The Downlands Water Supply and the irrigation on Levels Plain have been factors in the development of the farming on soils which dry rapidly in the summer. The Downlands Water Supply has provided water for stock and for domestic use on much of the downlands of Levels County and adjoining areas. This has greatly facilitated stock management, especially where, previously, lack of drinking water in the summer had prevented pastures from being grazed. On Levels Plain, irrigation has made pastures much less subject to summer drying.

Around most of the towns and townships such as Timaru, Geraldine, Temuka, Waimate, Pleasant Point, St. Andrews and Pareora are small
holdings usually less than 50 acres in extent. Owned by part time farmers they are used for grazing a few dairy cows and sheep, and for growing an occasional crop, but they are of little importance in the general pattern of agriculture. Market gardens and areas of specialised horticulture occur around Timaru and Waimate, but the area which they cover is extremely small.

To the south in the Waihao basin cereal crops are of importance and the agriculture of the area is very similar to that of the Timaru downlands, except that in the latter area linseed crops are more significant. On the predominantly droughty soils of the Waihao basin large expanses of Californian thistles (Cirsium arvense) give a deceptively infertile appearance to what are some of the most fertile of the downlands soils.

Despite all these minor differences within the region, wheat, fat lambs, and small seeds are the unifying factors. Each farm is similar in its management. Each farmer knows the varying soil types in all of his fields and so adapts his methods to obtain maximum monetary returns from each.

C.2. RANGITATA-ARUNDEL DISTRICT.

This small area including Rangitata Island has a large proportion of stony and rather infertile soils. The agriculture is similar to the previous region although cash crops are less important. Holdings are larger and average about 500 acres in extent, each holding
Plate 18. A more extensive mixed farm of the Rangitata-Arundel district which is adjacent to the area portrayed by Plate 15. The lighter patches in the fields are areas where hay has been fed out. Auster Airviews.
having a larger or smaller amount of the infertile soils according to its location. The more fertile soils are situated along the river margins, except for Rangitata Island where they are in the more central part. This distribution is reflected in the cropping pattern, such crops as cereals and potatoes being grown on the fertile soils in rotation with shorter term pastures, while the stonier and more infertile soils possess longer term pastures which are usually cropped for only a year before returning to pastures. Pasture seed production is not as common as in the previous region and carrying capacities which are lower are between one and two sheep to the acre. There are very few cattle, although in the vicinity of Arundel a few small herds of dairy cows provide cream for the butter factory at Ashburton.

In contrast with the other mixed farming regions, there is no transition belt of downlands between the plains and the more rugged hills; the level land of the Rangitata-Arundel district meets the hills of the store sheep farming region at a very definite line of demarcation. Heavy rollers in addition to the usual farm equipment, together with piles of stones gathered together in the fields, give evidence that the stony nature of the soil is one of the chief agricultural problems in this district.

C.3. FAIRLIE-ALBURY DISTRICT.

This region extends from Sherwood Downs in the north, along the downlands west of the Brothers Range to as far south as the Upper Pareora
Plate 19. Stones and a windmill - typical features on the dry stony soils of the Rangitata-Arndel district.

Plate 20. Lucerne sown down in autumn was subject to heavy rainfall in the same season. Sheet and rill erosion are obvious but lime and fertilisers mask any deterioration in soil fertility. This example occurred in the Albury-Fairlie Downlands, but is common throughout the downlands.
River. It is characterised by the emphasis upon the production of fat lambs and the relative unimportance of arable cash crops. Towards the north on the rolling hills around Fairlie agriculture is very similar to that of the coastal downlands and plains, with a larger proportion of each farm in cash crops such as wheat and linen flax. Otherwise the main crops in the region are root and green fodder crops. Holdings vary in size from 500 acres to over 1,000 acres in areas adjacent to the store sheep farming region. By far the great proportion of farmers breed their own sheep replacements andfatten their surplus sheep. Pastures are typically of the perennial ryegrass-white clover type although Montgomery red clover is also of importance. Its late seasonal growth provides very useful feed in this region where early frosts cause the cessation of much pasture growth. Areas of browntop and tussock are found in varying amounts on nearly every farm. On the flat plain of the South Opuha River north of Fairlie, browntop pastures are very prevalent and the ease with which these pastures on flat land can be harvested make the area the main centre for browntop seed production in South Canterbury. In the winter the funnelling of air currents between the Brothers Range and the downlands to the west give the Tengawai riverbed and its environs bitterly cold weather. There is an almost complete absence of stock in this area during the winter months.

The general landscape pattern is more regular than on the coastal downlands. Long gentle slopes face north and are covered with
Plate 21. The Fairlie Basin. The mixed farming of Sherwood downs is separated by only a narrow band of sheep farms from the extensive sheep stations of the Mount Peel-Foxes Peak Region. (See p. 92) In the background are the eastern slopes of the Two Thumb Range which are subject to bitterly cold winters. H. A. Arthur.
fields of 50 to 100 acres in extent. Steep unploughable south-facing slopes are covered in browntop and tussock. Following the stream valleys country roads wind into the area from the main road between Cave and Fairlie. Most farm houses generate their own electricity, but apart from this they are of the same types that are found on the coastal downlands. Of recent years this region has shown practically the greatest proportional decline in wheat acreages in South Canterbury, and today on many of the farms no cash crop other than small seeds are produced, and the production of supplementary feed and fat lambs are the main objectives.

C.4. HUNTERS DOWNLANDS. (10)

This region extends along the downlands immediately east of the Hunters Hills. It is similar in general agricultural practice to the previous region. Holdings are over 500 acres in size, and there is comparatively little wheat production, but here the similarity ceases. The greater humidity is a handicap in the harvesting of crops and the making of hay, and as a result small seeds production and haymaking are of lesser importance. Cattle are used to a greater extent, especially for controlling rough growth.

Here, more than in any other part of South Canterbury, can be seen differences in agricultural management from farm to farm. Formerly an area where browntop pastures were dominant in practically every field, it now possesses in many places highly productive pastures with

(10) The term "Hunters Downlands" is not used within South Canterbury and has been used to apply to this area which has no specific local name.
Plate 22. Willowbridge-Morven district. - Market gardens are scattered throughout the area. The above is an example of one of the larger market gardens.

Auster Airviews.
greater carrying capacities. Neat gorse trimmed hedges, weed-free pastures and sheep in good condition on one farm form striking contrasts with gorse and weed infested pastures and poor looking sheep on an adjacent farm. These variations can be explained solely in terms of different management through the use of lime and better pasture seeds. Although high wool prices have enabled the farmers to improve their properties they have on the other hand made it possible for farmers to secure reasonable returns from farms which are mainly clothed in gorse and browntop. Although the area is largely dominated by poorer type pastures there has been since about 1935 a tendency for these to decrease and the future development of this region appears to depend on the greater use of lime.

C.5. WILLOWBRIDGE-MORVEN DISTRICT.

This region which possesses some of South Canterbury's most fertile soils is also characterised by being the most intensively cropped region. Farm sizes are typically less than 300 acres and over half of each holding is cropped (including small seeds and hay production). The cash crops are chiefly wheat, potatoes and small seeds, while all types of fodder crops are grown. Potato production has its greatest emphasis in the Willowbridge-Morven district and high yields of over 15 tons to the acre are not uncommon. Similarly, wheat has high yields commonly over 55 bushels to the acre. Fat lamb production is of importance and although carrying capacities per farm are not high (because of the large
Plate 23. Potato bagging— a familiar scene in the Willowbridge-Morven area in late autumn.
proportion of each in cash crops) they are per area in pastures and feed crops usually over three sheep to the acre. On nearly every farm sheep are bought from other areas for fattening and in the winter agistment is common. Dairy herds of five to ten in number supply cream to the butter factory at Waimate. Around Waimana Lagoon and along an extremely narrow coastal strip to the north as far as Makikihi a small number of farms specialise in dairy herds providing both town milk supplies and cream. Scattered throughout the area are a few small holdings specialising in market gardening.

The intensive cropping procedures on many farms especially during the war years have meant that some fields have been continually in crops for over eight years. The tendency at present is for the acreages in crops to decrease and those in pastures to increase. Not only is this a reflection of the overall trends in South Canterbury, but it is also a reflection of the trends within this region to 'spell' intensively cropped fields.

The landscape pattern is one of closely adjacent farmhouses, compact holdings and small rectangular fields usually less than 30 acres in extent. Pastures are not prone to summer drying as on the downlands and throughout most of the year shades of green predominate.

C.6. GLENAVY DISTRICT.

This region has its closest parallel in the Arundel-Rangitata district both in the agricultural methods and landscape. It is an
Plate 24. Glenavy district - level land, light soils and holdings over 500 acres in extent. The mouth of the Waitaki River can be seen in the distance. Auster Airviews
area of level land with stony soils very subject to summer drying. Holdings are over 500 acres in extent and carrying capacities are generally less than two sheep to the acre. Wheat, oats, small seed and fodder crops are produced although they comprise only comparatively small proportion of each holding. Distinguishing the region from others is the emphasis upon the production of rape for seed. Whereas moister soils produce rape with much leaf and stem the drier soils of this district are conducive to the production of rape seed. To the north separating the Glenavy area from the Willowbridge-Morven district is an area of Maori land typically gorse infested. Water races supplied by windmill pumped water provide for the stock and towards the west irrigation from the Waitaki River is of assistance in providing adequate summer moisture. There is a strip of rough grazing along the bed of the Waitaki River but this is liable to flooding at any season.

C.7. LOWER HAKATARAMEA VALLEY.

The agriculture of the lower Hakataramea Valley is of a more extensive nature than the other areas of the commercial livestock and crop farming region. Holdings are typically over 700 acres in extent. The production of cereals and small seeds is characteristic, but the emphasis is upon the production of fat lambs, with the provision of supplementary winter feed and fattening crops. Lucerne for the making of hay is of greater relative importance in this area than elsewhere and the dominance of Corriedale sheep contrasts with that of Romney breeds in other areas of 'mixed' farming. As in the Fairlie-Albury district Montgomery red clover is an important constituent in the pastures.
Plate 25. Lower Hakatārāmea Valley - larger fields, lack of gorse fences and the comparative lack of trees contribute to form an open and rather bare landscape.
The large fields of up to 100 acres in extent are situated along broad flat-topped interfluvies between which are areas of rough grazing along the valley sides. Not only is the farming distinctive in the larger scale methods that are used but the landscape itself is in marked contrast to the remainder of South Canterbury's mixed farming region. The larger fields, the lack of gorse fences and the comparative lack of trees all contribute to form an open and rather bare landscape.

Occurring within the commercial livestock and crop farming region are all the major centres and nearly all the minor centres of urban settlement in South Canterbury. All except Timaru are primarily servicing centres for the various tributary regions, but only Timaru and the larger townships are the receiving centres for the agricultural produce. Flour mills at Timaru, Temuka and Geraldine, seed dressing machines at Timaru, Fairlie and Waimate and the freezing works at Smithfield and Pareora are the initial receiving depots for much of the agricultural produce. Along Timaru's waterfront are numerous buildings for storing wool and seeds prior to their being exported. Stock and station agents, government departments and suppliers of farming equipment are all situated in the larger centres and provide services for the agricultural community, for which Timaru is the main centre. The only farming area which does not regard it as such is the Hakataramea Valley from where most agricultural produce is sent to Oamaru.
Plate 26. A scene on a smaller dairy farm north of Wainono Lagoon. Poached pastures and a rather unkempt appearance are typical of dairy farms situated on coastal swamp soils.
The 'mixed farming' region although revealing wide diversity within itself has essential unity in those features which are regarded as typical of, and as characterising, South Canterbury's arable farming. These features are fat lambs, small seeds and wheat.

D. COMMERCIAL DAIRY FARMING.

Scattered throughout the plains and downlands in South Canterbury are occasional small holdings which specialise in dairy farming, but only in two districts, near Seadown and near Temuka, does the importance of dairy farming exceed that of other forms of agriculture. Elsewhere collections of three or four adjacent dairy farms may be of local importance, but really they are insignificant features in the total agricultural pattern of South Canterbury. Such small areas occur at Ikiwai, along a coastal strip north of Wainono Lagoon, immediately west of Timaru and near Geraldine.

Most of South Canterbury's cream supplies for butter making come from small dairy herds on the 'mixed' farms; but practically all the milk supplies for cheese production and the bulk of Timaru's town milk supply come from commercial dairy farms. These are distinguished from the commercial livestock and crop farms by the much greater emphasis upon dairy cows. There is no gradual transition from 'mixed' farms to dairy farms, but definite lines of demarcation appear. All the commercial dairy farms have at least half of their total livestock units in
dairy cows whereas very few 'mixed' farms have more than 10 per cent of their total livestock units as dairy cows. Together with this contrast in livestock proportions are contrasts in many of the other features of the agricultural practice. Holdings are typically less than 200 acres in extent and apart from small crops of potatoes, pasture seeds and occasionally wheat, cash cropping is unimportant. On the heavier swamp soils pastures are permanent. The rotation pastures on the more easily ploughed land have timothy, short rotation ryegrass, and broad red clover besides the usual perennial ryegrass and white clover as plant constituents. The provision of winter fodder crops and the making of hay are important features in the farming programme.

D.1. TEMUKA-CLANDEBOYE DISTRICT.

Situated within this region are four co-operative cheese factories and it is to these that all milk produced is taken. Holdings are from 50 to 200 acres in extent and the dairy herds vary from 10 to 70 cattle in size. Friesian breeds are dominant, although there are very few pure bred cows in the whole region. Soils are typically of a heavy alluvial type, with small patches of swamp soils. Extending as a band through the centre of the region, from east to west, is a strip of lighter alluvial soils. The changing soil types are greatly reflected in the varying methods of utilisation of the fields. On the lighter soils seed and wheat crops are produced and sheep are grazed. There is practically a continuous band of typically 'mixed' farms separating the northern part from the southern part of the Temuka-Clandeboye district, and these occur
Plate 27. Temuka-Clandeboye District - "the general landscape pattern is dominated by long lines of poplar trees." Auster Airviews.
on the lighter soils. Cattle fattening and the production of pigs are profitable sources of income, the greater part of which is derived from the production of milk for the cheese factories. A few sheep are possessed by most of the farms and lambs are fattened, but this is of insig-
nificance in the general economy of the region. Milking machines and swamp ploughs typify the agriculture of this region.

The general landscape pattern is dominated by long lines of pop-
lar trees (Populus fastigiata) which were amongst the earliest tree types to be planted in South Canterbury. Large ditches running parallel with the roads drain off excess moisture. The Clandeboye-Temuka district saw the first development of arable farming within South Canterbury, and today the older house types, the smaller fields and the long lines of poplars give a mellowness and maturity which contrasts markedly with the agricult-
ural landscape of much of South Canterbury.

D.2. SEADOWN DISTRICT.

A collection of about seventeen dairy farms forms this region. Milk production is for the provision of town milk supplies and herds averaging fifty in number are generally larger than in the previous region. Pigs are absent from the farming economy, but sheep are of greater import-
ance than in the Temuka-Clandeboye district. A recent subdivision of a large estate has provided five or six dairy farms of about 150 acres in size for soldier settlement, but milk supplies have not been sufficient for Timaru's growing population. Additional supplies have been drawn from dairy farms which formerly sent milk to the cheese factories, near
Winchester and Geraldine.

Commercial dairy farming although insignificant in its contribution to South Canterbury's overall agricultural wealth is, however, of local importance. South Canterbury is self-sufficient in her milk supplies and cheese products, some of the latter being exported. In the summer surplus cream from the 'mixed' farms ensures adequate butter supplies, but during the winter months additional butter is imported. Nevertheless the Seadown and Clandeboyes-Temuka districts play an important part in the agricultural economy and contribute distinctive landscapes to the regional pattern of agriculture in South Canterbury.

South Canterbury thus reveals a wide variety both in its agricultural methods and in its agricultural landscape, but common to all types is the fact that the agricultural is based upon a commercial form of economy. The inability to acquire sufficient labour is one of the major problems on many farms and stations. Although not of great concern to the farmers the decrease in wheat acreages has been of vital importance to New Zealand's economy as a whole. Possible changes should not be forecast in this study, but in the light of past events it seems likely that wheat acreages will increase when, and if, wool prices decrease. The varying prices offering for agricultural products are reflected not only in the changing emphases upon crops and stock, but also
in the degree of prosperity which prevails.

Today South Canterbury's agricultural community is experiencing a prosperity unknown at any previous stage. Greater monetary returns for wool and sheep can be regarded as the direct cause. Nevertheless, on the mixed farms, especially, the use of lime and better pasture seeds has greatly increased productivity per acre. Consequently, in this area, larger monetary returns have resulted not only from higher prices but also from increased agricultural efficiency. The contemporary prosperity of South Canterbury's agriculturalists is revealed in the new farm houses and sheds being built, in the new implements and agricultural machinery on many holdings, and in the frequently modern cars and trucks which are seen at saleyards, wool sales and at any other gatherings in which the farmers of South Canterbury are vitally interested.
APPENDIX I

COLLECTION OF DATA AND COMPILATION OF MAPS.

Agricultural and Pastoral Statistics for New Zealand provide much useful information on agriculture in South Canterbury, but the figures published are for counties only. None of the four counties of South Canterbury, Mackenzie, Geraldine, Levels and Waimate, possesses uniformity in its agricultural pattern, and although the Agricultural and Pastoral Statistics did not reveal variety within a county, they were of assistance chiefly for comparative purposes.

Observation in the field and interviews with farmers provided the basic information for the description of South Canterbury's agriculture, but it was found impossible in the time available to interview as many farmers as was necessary for the accurate delimitation of regions, and field observations alone could not provide sufficient evidence. This was particularly so in the areas of commercial livestock and crop farming. Observations made during the winter months revealed districts where the growing of supplementary winter feed was practised, but little indication was given of the type of cash crops which were grown or of the areas which produced small seeds. On the other hand, observations made during the summer months showed those pastures which had been closed, but whether they were for hay or for small seeds production could not be ascertained without interviewing individual farmers. Similarly in this season the importance
of fodder crops could not be gauged. Consequently the following question-naire with special emphasis upon aspects of commercial livestock and crop farming was sent to various agriculturalists, especially those with holdings on the downlands and plains.

AGRICULTURAL QUESTIONNAIRE.

Locality of your farm?
What percentage of it is on:-
(a) Flat land?
(b) Rolling to hilly land?
(c) Steep land?
What is the size of your holding?
Is this size typical of your area?
If not, what is the average size of holding in your area?
What type of farming do you carry out? (Cross out those that do not apply.)
(a) Wool production, breeding own replacements.
(b) Store sheep and wool.
(c) Agricultural and pastoral farming:
   (i) Sheep – main source of revenue.
   (ii) Cropping.
   (iii) Seed production.
(d) Dairying.
(e) State any other types.

How many sheep do you carry?
How many breeding ewes?
What breed?
What breed are your rams?
Do you buy in replacements?
If so, how many yearly?
Do you buy from a definite area consistently?
If so, what is the area?
Do you sell all your lambs fat?
Or only those which are not kept for replacements?
If you sell as store sheep, do they go to any area consistently?
To which area?
Is shearing by machine or blades?
How many cattle do you carry? (incl. milking cows)
How many milking cows?
Is the dairy produce just for domestic consumption?
If not where is it sent?
And for what purpose? (i.e. town milk supply, butter, cheese etc.)

What breed are your cattle?
Are they for fattening or are they store cattle?
If store cattle, where are they sold?
If for fattening do you breed them?
If not from where are they bought?

How many pigs have you?
How many horses?
How many ducks?
How many hens?
Is the poultry produce for domestic consumption?
If not where do you send it?

What is your yearly acreage threshed in:
  (a) Wheat?
  (b) Oats?
  (c) Small seeds? What are your small seeds?
  (d) Any other cash crops? What are the other cash crops?

What is your acreage in:
  (a) Green feed? What type?
  (b) Fodder crops for fattening? What type?
  (c) Winter feed? What type?

What acreage do you usually cut for hay each year?
What type of hay is it?

What is your usual rotation?
How long do you keep your grass down?
What area of your holding is down in grass?
What are your grasses and clovers in your permanent pasture?

Any significant areas of (a) native grasses? What size?
  (b) browntop? What size?
  (c) gorse, bush etc.? What size?

How many tons of lime do you use per annum?
How many cwt. of superphosphate do you use per annum?
Any other fertiliser?
Is your farm typical of your area? That is, in general management. If not how does it differ?
What agricultural machinery and implements do you possess?
Are there any particular agricultural problems in your district? (e.g. gorse, stones, rabbits, soil erosion etc.)

Have there been any important changes in farming in your district in the last thirty years?
What have they been?
What has caused them?
What are the present tendencies?

How many houses on your farm?
Is this sufficient for present needs?
If not what is necessary?
Do you have most of the amenities of an average town house? (i.e. electricity, H, and G. water etc.)
Are the farm houses of wood or brick?
How many sheds and farm buildings do you have?
What are their uses?
What labour do you employ on the farm?
Do you possess (a) a dip?
(b) a woolshed?
(c) shearing machine?

As a result, 45 questionnaires were answered from 55 selected farmers, and this together with 55 personal interviews gave detailed information for about 100 holdings, and at the same time provided descriptions of surrounding areas. The whole of South Canterbury was covered by field observations except for two districts. These were the Waitangi Basin, west of the Hakataramea Valley, and the area along the Rangitata River inland from Peel Forest. Even so, information from other sources provided adequate descriptions of these areas. The only district from which individual farm surveys were not obtained was the lower Hakataramea Valley. Field observations together with only one farm survey.

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form the basis for the regional description of the commercial livestock and crop farming of the lower Hakata-Rama Valley. Consequently this description may be less accurate than that of other areas.

Of the maps illustrating the various agricultural features, those which were compiled from official figures giving individual names and addresses are the most accurate. The following were all compiled in this manner.

Distribution of sheep. Back pocket.
Distribution of dairy cows producing milk for the cheese factories. Figure 10.
Distribution of dairy cows producing town milk supply. Figure 11.
All maps showing small seeds distribution. Figures 17 - 25.
Distribution of potatoes. Figure 30.

The first three portray total numbers and are consequently the most accurate of all. Those maps showing the distribution of small seeds and potatoes were compiled from Certification Records (2) and as a result do not show the actual acreages which were produced. The following table lists those acreages entered for certification and those recorded by the Agricultural and Pastoral Statistics for the 1948-49 season.

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(2) Entry for certification takes place before crops are harvested.
<table>
<thead>
<tr>
<th>Crop</th>
<th>Certification Records</th>
<th>Agricultural and Pastoral Statistics</th>
<th>Areas entered for certification as a percentage of total area cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial Ryegrass</td>
<td>5076 acres</td>
<td>8122 acres</td>
<td>65%</td>
</tr>
<tr>
<td>White Clover</td>
<td>5333 &quot;</td>
<td>5460 &quot;</td>
<td>99%</td>
</tr>
<tr>
<td>Italian Ryegrass</td>
<td>754 &quot;</td>
<td>777 &quot;</td>
<td>97%</td>
</tr>
<tr>
<td>Short Rotation Ryegrass</td>
<td>3285 &quot;</td>
<td>2749 &quot;</td>
<td>135%</td>
</tr>
<tr>
<td>Montgomery Red Clover</td>
<td>4933 &quot;</td>
<td>4280 &quot;</td>
<td>145%</td>
</tr>
<tr>
<td>Broad/Red. Clover</td>
<td>1434 &quot;</td>
<td>786 &quot;</td>
<td>84%</td>
</tr>
<tr>
<td>Cocksfoot</td>
<td>660 &quot;</td>
<td>2149</td>
<td>Not stated separately (estimate)</td>
</tr>
<tr>
<td>Browntop</td>
<td>10,263 &quot;</td>
<td>Not stated separately</td>
<td>More than 100%</td>
</tr>
<tr>
<td>Ripe</td>
<td>830 &quot;</td>
<td>Not stated separately</td>
<td>100% (estimate)</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1847 &quot;</td>
<td>2745 acres</td>
<td>67%</td>
</tr>
</tbody>
</table>

These figures reveal the varying degree of accuracy in the data necessarily used to compile the different maps, but in all cases the maps portray the comparative importance of various areas. The anomalies between the Certification Records and the Agricultural and Pastoral Statistics have no one single explanation. Some crops that are harvested may not be eligible for certification. In the case of short rotation ryegrass and the red clovers, all areas harvested are certified, but a varying proportion entered for certification may not be cut. As far as all pasture seeds are concerned, areas set aside for production are not necessarily harvested. This is exemplified by the ryegrass harvest in South Canterbury in 1951, when a high acreage for production was expected. A week of intermittent rain in January ruined a large pro-
portion of the crops, which were consequently not harvested for seed.

The very great area of browntop entered for certification can be explained by the fact that browntop pastures are permanent (unless altered by farming techniques) and as a matter of course are entered for certification year after year, so that when seed is eventually harvested it will be eligible for classification as certified seed. Usually less than 10 per cent of the area entered for certification is harvested.

Areas entered for certification in the case of potatoes are those where the production of 'seed' potatoes is a partial aim. Nevertheless the map portrays the relative importance in total production of potatoes in various districts.

The dot distribution maps which have not been compiled from individual names and addresses are:-

Distribution of dairy cows producing cream for the butter factories, Figure 9.
Distribution of cattle (excluding dairy cows), Figure 12.
Distribution of wheat, Figure 26.

Figure 9 was compiled from information provided by the butter factories and, although not absolutely accurate, depicts the overall pattern.

Figure 12 was compiled from evidence obtained in field work. Although this is the only dot distribution map based on this evidence alone, it is felt that it is reasonably accurate, in that cattle are a distinctive and easily observable feature of the landscape at all times of the year.
The wheat distribution map was compiled with the assistance of statistics in the New Zealand Wheat Review. (3) In this publication South Canterbury is divided into eight wheat growing districts, with details given for each district. Although wheat acreages stated do not represent total acreages, they represent a fairly constant proportion except in the case of Mackenzie County.

<table>
<thead>
<tr>
<th>New Zealand Wheat Review Figures, 1949 Harvest</th>
<th>Agricultural and Pastoral Statistics, 1949 Harvest</th>
<th>Percentage of area (given by New Zealand Wheat Review), to total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geraldine East 1224 acres</td>
<td>4865 acres</td>
<td>56%</td>
</tr>
<tr>
<td>Geraldine West 1520 &quot;</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Levels North 1503 &quot;</td>
<td>7439 &quot;</td>
<td>51%</td>
</tr>
<tr>
<td>Levels South 2520 &quot;</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Mackenzie 389 &quot;</td>
<td>1891 &quot;</td>
<td>20%</td>
</tr>
<tr>
<td>Waimate North 2387 &quot;</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Waimate Main 2634 &quot;</td>
<td>9789 &quot;</td>
<td>55%</td>
</tr>
<tr>
<td>Hakatamea 404 &quot;</td>
<td>&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Figure 26, representing the total area of wheat threshed in the 1949 harvest, was compiled with the assistance both of the above figures and of information obtained in field work. The writer considers this the least accurate of the dot distribution maps.

The remaining maps showing the distribution of various crops have been compiled chiefly from information collected in field work,

(3) "Surveys of Wheat Growing Districts", New Zealand Wheat Review, 1948 and 1949, pp. 55-60. (Wheat Research Institute, Publication No. 64)
unless otherwise stated. Their accuracy is no greater than the method of representation would suggest, and boundaries, except in the case of the linseed and linen flax maps, are not to be accepted as definite.
APPENDIX II.

FARM SURVEYS.

In these several farm surveys a few holdings from each of the four generic agricultural regions in South Canterbury have been taken as examples. A few have been chosen because they represent typical conditions, while others have been chosen because they reveal the variety which is possible. The diagrams representing crop and livestock associations are drawn on scales which are comparable within each generic region. Livestock are represented by linear measurement, the length being proportional to livestock units, (1) although actual livestock numbers have been stated. These latter are the stock numbers for the winter season. The acreages of tussock, crops, etc. are proportional to areal measurement. In the separate figures, for sake of brevity, the term 'pasture' is used for indicating pastures of the essentially ryegrass-clover types, in contradistinction to the tussock and browntop pastures.

(1) In terms of sheep, 1 horse = 10 units, 1 cow = 7 units, 1 pig = 1 unit.
EXTENSIVE SHEEP FARMING

SIZE: 103,700 acres

BARREN
56,000 acres

TUSSOCK
47,300 acres

SHEEP 7000

CATTLE 1000

FIGURE 36
LOCATION: At the head of Lake Ohau, in the gorge country (Region A1). Except for a broad river valley extending almost completely through the holding, steep slopes predominate.

STOCK: Sheep breed. Merino.
Breeding ewes. 2800.
Hoggets. 1400.
Wethers and Rams. 2800. (1)
Lambing average. 50-80%.
Cattle breed. Hereford cows.
Black Poll bulls.

PASTURES: The barren area has scattered tussocks and native herbs, but is practically useless consisting chiefly of bare rock and scree slopes. Tussock is predominantly snow tussock at heights of over 3,000 feet. Below this is hard tussock and along the river valley are patches of silver tussock intermingled with swamp vegetation and clovers. Around the homestead is an area of exotic pastures which have reverted to weeds, especially sweet vernal, and browntop.

CROPS: Formerly about 60 acres of oats, but at present there is no cropping.

MANAGEMENT: Typical of the extensive sheep farming region. Sheep are grazed below the snow fence, which is at about 3,000 feet, in the winter. Cattle are grazed along the river flats, nearer the mountains in the summer, and nearer to the homestead at the head of the lake in the winter. There are the usual seasonal musters. Main source of income is wool. Usually about 500 calves each season. Surplus sheep amount to no more than 800 in favourable seasons, and in unfavourable seasons there are no surplus sheep.

Except for the greater emphasis upon cattle, this station is typical of the more extensive holdings in the extensive sheep farming region.

(1) Rams are included with wethers or hoggets in these surveys. In numbers they are usually less than 3% of breeding ewe numbers.
EXTENSIVE SHEEP FARMING

SIZE: 16,240 acres

TUSSOCK
15,740 acres

FIGURE 37
**LOCATION:** On the rolling hills of the Mackenzie basin, between Lakes Tekapo and Pukaki. (Region A3).

**STOCK:**
- Sheep breed: Merino.
- Breeding ewes: 3000.
- Hoggets and rams: 1000.
- Lambing average: 75-80%.

**PASTURES:**
- Hard tussock greatly depleted towards the south.
- Exotic pastures of perennial ryegrass, cocksfoot, white clover, and Montgomery red clover. Each year about 60 acres of new pasture are sown, and 1 ton of lime and 1 cwt. of superphosphate is used per acre.

**CROPS:**
- 60 acres oats for chaff. Sold over a wide area, but especially to stations in the gorge country.
- 10 acres of turnips for supplementary winter feed.
- 10 acres lucerne - 2 hay crops per year. Also for supplementary winter feed.

**MANAGEMENT:**
- No great snow risk, consequently no definite winter and summer country. Wool is the main source of income. About 1500 sheep sold each year. Most of these are wether lambs and are sent to the gorge country. The remainder are cast ewes and are sent 'down country'. Flock numbers have purposely been reduced in the last few years.

This station is situated on some of the 'easiest' country of the Mackenzie basin, and consequently wethers are absent from the sheep flock. There is greater surplus of sheep than is usual, but apart from these two features this holding is typical of the smaller stations in the extensive sheep farming region.
STORE SHEEP FARMING

SIZE: 4870 acres

TUSsock
3000 acres

BROWNTOP
900 acres

PASTURE
845 acres

Gorse 25 ac.

Turnips 100 ac.

Small seeds
20 ac.

Cattle
1 dairy cow
1 horse

SHEEP 3500

FIGURE 38
The two areas comprising the holding are 22 miles apart, the larger one being on steep hills marginal to the extensive sheep farming region. The smaller or homestead block is in the foothills.

**STOCK:**
- Sheep breed: Romney
- Breeding ewes: 2250
- Hoggets and rams: 1350
- Lambing average: 80-90%
- Cattle breed: Polled Angus

**PASTURES:**
- Hard tussock
- Browntop
- Perennial ryegrass, Montgomery red clover, white clover and crested dogstail

**CROPS:**
- 100 acres of turnips for supplementary winter feed
- 20 acres of small seeds, either perennial ryegrass, Montgomery red clover or white clover. Small seeds production is not practised consistently
- Rotation: Grass, Turnips, Turnips and grass, Pastures down about 7 years.
- The new pastures are topdressed with 1½ tons lime and 2 cwt. superphosphate per acre for the first year

**MANAGEMENT:**
- All sheep except the lambs are grazed on the tussock block from February until the end of May when all are shifted on to the homestead block. The hoggets are shifted back to the tussock in late spring, but the breeding ewes not till February. Most wether lambs are sold for fattening, but the greater proportion of ewe lambs are kept, and about one third of these are culled and sold as two-tooths at Autumn sales. About 500 cast ewes are sold every year as store sheep, to the Temuka district. Unlike most other store sheep runs this holding buys cattle and sells them fat.

In all the agricultural regions of South Canterbury are examples of non-adjacent holdings managed conjointly, but in the store sheep farming region this practice has its greatest emphasis. The holding illustrated by Figure 38 provides an example of this feature.
STORE SHEEP FARMING

SIZE: 1860 acres

TUSsock
1400 acres

PASTURE
400 acres

Small seeds
32 ac

Hay
112 ac

Turnips
60 ac

SHEEP 1370
Cattle
Horse
30
2

1 dairy cow

FIGURE 39
FIGURE 29. STORE SHEEP FARMING.

LOCATION: In the foothills west of Cave. (Region B, 2)

STOCK:
- Sheep breed: Romney
- Breeding ewes: 1010
- Hoggets and rams: 360
- Lambing average: 85-90%
- Cattle breed: Black Poll-Shorthorn Cross

PASTURES: Similar to the previous holding except for the absence of browntop.

CROPS: Similar to the previous holding except that hay is produced, and small seeds are a definite annual feature.

MANAGEMENT: Also similar, but cattle are bred on the holding and sold as breeding cows or for fattening. The large number of horses is not typical, the runholder breeding them for sale.
STORE SHEEP FARMING

SIZE: 1300 acres

TUSSOCK 500 acres
BROWNTOP 400 acres
PASTURE 320 acres

Small seeds 2.5 ac
Hay 10 ac
Swedes 30 ac
Rapeseed 20 ac

SHEEP 1400
Cattle 50
3 dairy cows
3 horses
1 pig

FIGURE 40
**FIGURE 40. STORE SHEEP FARMING.**

<table>
<thead>
<tr>
<th>LOCATION:</th>
<th>Marginal to the 'mixed' farming of the Albury-Fairlie downlands. (Region B.2 and C.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASTURES:</td>
<td>Similar to Figures 38 and 39.</td>
</tr>
<tr>
<td>CROPS:</td>
<td>Also similar, except that swedes replace turnips, and rape is grown.</td>
</tr>
<tr>
<td>MANAGEMENT:</td>
<td>All lambs, except the ewe lambs sired by the Romney rams, are fattened. The latter are used for replacements. Cattle are all bred and fattened on the holding.</td>
</tr>
</tbody>
</table>

This holding was chosen to illustrate one of the numerous anomalies which occur in dividing South Canterbury into agricultural regions. Although classified under the heading of store sheep farming, no store sheep whatsoever are produced. In a more detailed subdivision of South Canterbury's agriculture, a region, showing crop proportions similar to store sheep farms, but producing fat lambs, would most likely be revealed.
COMMERCIAL LIVESTOCK AND CROP FARMING

SIZE: 324 acres

<table>
<thead>
<tr>
<th>Tusock</th>
<th>Pasture</th>
<th>SWEDES &amp; CHOU MOELLIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 acres</td>
<td>164 acres</td>
<td>20 acres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RYE CORN</th>
<th>RAPE</th>
<th>WHEAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 acres</td>
<td>30 acres</td>
<td>30 acres</td>
</tr>
</tbody>
</table>

Small Seeds 30 acres

SHEEP 650
- 2 dairy cows
- 1 horse
- 7 cattle

FIGURE 41
FIGURE 41. COMMERCIAL LIVESTOCK AND CROP FARMING.

LOCATION: On the coastal downs. (Region C.1)

Breeding ewes. 600.
Others, chiefly rams. 50.
Lambing average. 110%.
Cattle breed. Shorthorn.


CROPS: As shown. Rape is used for lamb fattening, swedes, chou moellier and ryecorn for supplementary feed.

MANAGEMENT: All lambs sold fat. About 120 replacements are bought each year.
Usual rotation, Rape,
Wheat,
Swedes, Chou Moellier;
Pasture for 5-6 years.

This holding is a fairly typical 'mixed' farm, although it is doubtful as to whether any 'mixed' farm can be regarded as typical. In this case the rather large area of tussock, the absence of hay production, and the growing of ryecorn, all serve to make this farm distinctive, from the hypothetical average.
COMMERCIAL LIVESTOCK AND CROP FARMING

SIZE: 400 acres

- PASTURE: 320 acres
- SMALL SEEDS: 100 acres
- WHEAT: 40 acres
- FALLOW: 40 acres
- SHEEP: 900
- 2 dairy cows
- 2 horses

FIGURE 42
FIGURE 42. COMMERCIAL LIVESTOCK AND CROP FARMING.

**LOCATION:** On the coastal downlands. (Region C.1)

**STOCK:**
- Sheep breed: Romney.
- Breeding ewes: 880.
- Hoggets and rams: 240.
- Lambing average: 120%.

**PASTURES:**
- Certified perennial ryegrass. Certified white clover.

**CROPS:**
- Wheat and small seeds are an annual practice.
- Hay production varies greatly.

**MANAGEMENT:**
- About 200 ewe lambs are kept for replacements, the remainder being fattened on pasture.
- The usual rotation: Wheat, Fallow, Pasture, for 4 years.
- Wheat is sown with 1½ cwt. of superphosphate per acre.
- Newer pastures are topdressed with 1 ton of lime per acre.

This holding serves as an example to illustrate two tendencies which are common in South Canterbury's 'mixed' farming: namely, the decrease in areas used for fodder crop production, and the increase in numbers of 'mixed' farmers breeding their own sheep replacements. The method of farming as illustrated by this holding is far from common. Extremely great efficiency has been achieved in pasture management, through the use of the best available strains of pasture seed, and most years stock are grazed on pastures for the entire year. This holding is not only distinctive in the farming methods, but it stands out in marked contrast to adjacent farms. All gorse hedges have been replaced by wire fences, and the usually weed infested roadsides have been ploughed and sown with perennial ryegrass and white clover.
COMMERCIAL LIVESTOCK AND CROP FARMING

SIZE: 478 acres

PASTURE
466 acres

HAY
120 acres

LUCERNE
12 acres

SHEEP 1300

CATTLE 150

1 dairy cow
2 horses

FIGURE 43
LOCATION: On an area of flat land to the south of Fairlie. (Region C.3)

Breeding ewes. 900.
Hoggets and rams. 400.
Lambing average. 147%.
Cattle breed. Shorthorn.

PASTURES: Perennial ryegrass, broad red clover, white clover, cocksfoot, timothy.

CROPS: The emphasis is upon pasture hay production. Lucerne or rye grass may be grown both for green feed and hay production.

MANAGEMENT: All Southdown sired lambs are sold fat off their mothers, and Romney ewe lambs are kept as replacements. Cattle are bought as calves and sold as two-yearolds for fattening. Pastures are kept down for as long as 20 years, and every year all are toppedressed with ½ ton of lime and 1 cwt. of superphosphate to the acre. When the present owner took over the farm, every pasture received 4 tons of lime to the acre.

As with the previous holding, this type of farm management is by no means common, in South Canterbury. It is an extreme example of the present tendency for hay production to replace the growing of fodder crops. An unusually high water table prevents the summer drying of the pastures and consequently assists in the production of hay. Perhaps of even more significance is the fact that the present owner was originally a farmer in Southland.
COMMERCIAL LIVESTOCK AND CROP FARMING

SIZE: 140 acres

FIGURE 44
FIGURE 44. COMMERCIAL LIVESTOCK AND CROP FARMING.

<table>
<thead>
<tr>
<th>LOCATION:</th>
<th>Willowbridge, (Region C.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASTURES:</td>
<td>Perennial ryegrass, Italian ryegrass, white clover.</td>
</tr>
<tr>
<td>CROPS:</td>
<td>As shown. The production of chou moellier for seed is not common. Rotation practices are not consistent, but a wheat crop is usually follows a potato crop, and pastures are not kept down for longer than four years.</td>
</tr>
<tr>
<td>MANAGEMENT:</td>
<td>All lambs bred on the holding are fattened off their mothers. Replacements in the form of cast-for-age ewes are bought from the foothills. About 150 lambs and 200 ewes are bought each season for fattening on rape. Surplus dairy produce is sent to the butter factory. Lime is not used, but 1 cwt. of superphosphate is usually sown down with each crop.</td>
</tr>
</tbody>
</table>

This holding represents the more intensively cropped type of farm in the Willowbridge district. As far as South Canterbury's commercial livestock and crop farming is concerned, the four examples given by no means illustrate all types; but no matter how much farms differ, there is always one feature common to all, and that is the breeding of sheep for the production of fat lambs.
COMMERCIAL DAIRY FARMING

SIZE: 180 acres

PASTURE
150 acres

HAY
12 ac.

SMALL SEEDS
15 ac.

RAPE
14 acres

CHOU MOELLIER
8 acres

FALLOW
8 acres

SHEEP 240

DAIRY COWS 60

OTHER CATTLE 20

HORSES

FIGURE 45
LOCATION: Seddon. (Region D.2)

STOCK: Cattle breed. Half are pedigree Jersey. The remainder, Friesian Crosses.
Dairy cows, 60.
Progeny, 20.
Rams.
Breeding ewes, 240.
Rams, 10.
Lambing average, 103%.

PASTURES: Short rotation ryegrass, white clover, timothy.

CROPS: Chou moellier and hay - supplementary winter feed for both cattle and sheep. Rape - lamb fattening. Small seeds - not consistently produced.
Rotation, Rape,
Chou moellier,
Fallow,
Pasture - usually down for 4 years.

MANAGEMENT: Milk is sent to Timaru for town milk supply.
Progeny of dairy cows are kept for fattening and for building up the herd. All lambs are fattened, and cast-for-age ewes bought as replacements. About 1 ton of lime and 2 cwt. of superphosphate per acre are used for topdressing new pastures.

This holding is similar in most aspects to adjacent dairy farms, although there is a greater emphasis upon sheep and fat lamb production.
COMMERCIAL DAIRY FARMING

SIZE: 70 acres

PASTURE
53 acres

HAY
10 acres

SWEDES
4 acres

CHOU MOELIERS
5 acres

POTATOES
8 acres

DAIRY COWS 30

Other cattle 10

6 pigs

FIGURE 46
FIGURE 46. COMMERCIAL DAIRY FARMING.

LOCATION: Clandeboye. (Region B,1)

STOCK: Cattle breed. Friesian.
Dairy cows. 30.
Cattle for fattening. 10.

PASTURES: Broad red clover, perennial ryegrass, cocksfoot.

CROPS: As shown.
Rotation, Swedes,
Potatoes,
Chou Moellier,
Grass - for about 4 years.

MANAGEMENT: All milk produced is taken to the Clandeboye Cheese Factory. Many of the dairy cows are dried off during the winter months, and frequently milk is sent at this time to supplement the town milk supplies. Progeny of the dairy cows are fattened, or used as replacements. A few store cattle are frequently bought for fattening. There are 6 breeding sows, and progeny are sold both as weaners and porkers.

This holding is smaller than most dairy farms supplying milk to the cheese factories, and there is not usually such a complete absence of sheep. Most dairy farms would vary in size and management methods between the two that are given as examples.
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SOUTH CANTERBURY

DISTRIBUTION OF SHEEP
1 DOT EQUALS 50 SHEEP

SCALE OF MILES

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