A review of agriculture on the Esperance Downs

J L. Shier
T. C. Dunne
E. N. Fitzpatrick

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Esperance is approaching a period of rapid development based on the results of research at Esperance Downs Research Station and on farmers' properties in the area.

This article reviews the soils, vegetation, climate, agricultural development and development costs of the area.

A BRIEF HISTORY OF THE AREA

Esperance was named in 1792 by the French explorer Rear Admiral D'Entrecasteaux after one of the ships of his fleet, the "Esperance". From then on it was largely unused, although in the 19th century, Middle Island, about 80 miles east of Esperance, was a base for sealers operating in southern waters.

The first settlers in the area were two brothers, C. E. and A. Dempster, who, in 1863, rented 304,000 acres of grazing land about 250 miles east of where Albany now stands. In 1866 they took up land in the Fraser Range, about 150 miles north-east of Esperance, where more fertile soils balanced the loose coastal lands of the original run. Andrew Dempster was granted a lease over 100,000 acres in 1866. It is believed that in one year the Dempster's sheared 32,000 sheep between the Fraser Range and Esperance holdings.

The town and port of Esperance came into being in 1893 as a port for the Coolgardie goldfields following the discovery of gold in the Murchison, Coolgardie and Dundas areas between 1891 and 1893. There was a steady flow of traffic northward and the population rose rapidly to about 1,200 people by 1897. However with the completion of the Perth-Kalgoorlie railway in 1897, the importance of the town began to wane. Initially, although the Kalgoorlie trade was lost the Norseman trade remained.

There was continuous pressure for a railway from Esperance to Coolgardie. A survey of the Esperance to Coolgardie line was made in 1902-3, and in 1909 the section from Coolgardie to Norseman was built. The Norseman trade which had been partly lost to Esperance with the completion of a good road between Coolgardie and Norseman a few years previously was now completely lost, and the town became dependent on the tourist trade and rapidly regressed.

The development of farming in the "mallee" brought another brief period of prosperity to the town. The railway from Salmon Gums to Esperance was completed in 1925 and from Salmon Gums to Norseman in 1927. Esperance became the wheat port for the mallee, and the quantity of wheat exported rose from 18,000 bags in 1925 to 191,000 bags in 1931 but had fallen to 57,000 bags by 1935. With the failure of the wheat farms in the mallee the port again regressed.

Agricultural development of the area was slow despite the enthusiasm of a few
and Esperance persisted largely as a holiday resort for people from the Goldfields. However, there was some settlement along the short rivers such as the Dalyup, where soils with a higher natural fertility occurred, and on one or two areas on the plain.

Mr. F. W. Bow is reported to have used 100 lb. of superphosphate an acre on a planting of Italian ryegrass and King Island melilot as early as 1912 and Mr. J. R. Scholey sowed a plot of subterranean clover in 1916.

Despite odd successes, the trustees of the Agricultural Bank expressed the unanimous view in 1916 that the plain country was unsuited for closer settlement. The rate of development was such that in 1948 the plain was still practically undeveloped and still affected by the problems of isolation from metropolitan markets, individual isolation of farmers, lack of finance and a poor reputation with lending institutions.

Between 1916 and 1948 enthusiasts had continually pointed out the potential of the area. Outstanding amongst these men was Mr. A. D. Helms, the manager of Esperance Pine Forests Limited, which held a lease of 45,000 acres south of Gibson between 1926 and 1936. After the partial failure of pine plantings in 1928, Mr. Helms, with the encouragement of managing director, Mr. R. G. Stuart, experimented with crops, pasture establishment, fertilisers and species in 1928, 29, 30 and 31. In 1930 and 1931 excellent crops of lupins, subterranean and drooping flowered clovers, and Tangier pea were inspected by ministerial parties. In 1932 the Company developed a plan for sowing units of 1,000 acres to pasture based on the results of Mr. Helms' work. This plan was not carried out because of the financial difficulties of the period. Government support was sought for a modified scheme but this was not forthcoming.

Mr. Helms had shown that with careful land preparation and an annual application of super at 168 lb. per acre, excellent subterranean clover and other legume pastures could be grown. His success
EARLY WORK ON ESPERANCE DOWNS RESEARCH STATION

Esperance Downs Research Station was started as a substation of the Salmon Gums Research Station (60 miles to the north, in the mallee area) at the suggestion of Mr. F. L. Shier. The site was selected in June, 1949, by Messrs. G. H. Burvill, I. Thomas and G. W. Spencer and the first ploughing (100 acres) was done in September, 1949.

The first experiments, planned by Dr. T. C. Dunne and Mr. F. L. Shier, were sown in June, 1950. These officers planned and supervised the experimental work for some years.

The station was raised to full research station status in February, 1955. This was a result of the growing importance of the district and the large volume of experimental work being done on the station.

- Top: The first ploughing on the Research Station in 1949. To hasten development the area was not logged and burnt and it was necessary to plough in some areas of tall scrub. These were scrub raked in 1950 before planting. Ploughing in scrub is not recommended; all areas being developed should first be logged and burnt.

- Left: Two of the first experiments on the station. The pictures were taken in 1951 of second year subterranean clover pasture showing (upper picture) the need for ample superphosphate and (lower picture) zinc in subterranean clover establishment.
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<thead>
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<th>Model</th>
<th>Suction and Delivery</th>
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<th>Price</th>
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<td>10,000 g.p.h., Heads to 95 ft., 7 h.p. motor</td>
<td>£160</td>
</tr>
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<td>Rex 4MP</td>
<td>1½&quot;</td>
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<td>£83</td>
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<tr>
<td>Rex 4GP</td>
<td>1¾&quot;</td>
<td>4,500 g.p.h., Heads to 90 ft., 1.6 h.p. motor</td>
<td>£72</td>
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formed a focal point for discussions on the future of the area.

The trace elements copper and zinc were not known at this stage but the higher zinc content of the super used at that time and the fact that no stock were run doubtless masked the need for these nutrients.

In later years the Hon. Mr. Emil Nulsen, M.L.A., the member for Eyre, supported the claims of the area, first by working for the establishment of the Research Station and later by supporting the work done there.

The modern era of development commenced with a visit to Esperance by the then Minister for Agriculture, the late Mr. G. B. Wood in October, 1948. This visit convinced Mr. Wood of the potential of the area. With his active support experimental work was started on Mr. A. Button's property in 1949 and the decision to establish Esperance Downs Research Station made in early 1949.

Since 1949 experimental work has largely been carried out on the Research Station, although special problems have made it necessary for some work to be carried out on farmers' properties in the area.

The present spectacular development of the area is based on research work carried out at the Research Station. The rate of development is gaining momentum and the next 10 years will see the transformation of this scrub wasteland to first class pasture lands.

There have been failures as well as successes in the area. The most spectacular failure was that of the American Chase Syndicate in 1957-58. This group entered into an agreement to develop 1½ million acres in the area. Due to poor planting techniques and an unfavourable season, the 1957 planting failed and the company did not go on with development. Although this failure was a setback to the district, it had benefited from the widespread publicity associated with the scheme.

In 1960 the Chase agreement was taken over by another group, Esperance Land and Development Company, which is developing land along orthodox lines. This company planted 42,000 acres in 1962 and will sow a further 35,000 acres in 1963.

Today Esperance stands on the edge of a period of remarkable development.

STATISTICS FOR ESPERANCE SHIRE COUNCIL DISTRICT

The data below compares development in 1962 with that in 1951 for the Esperance Shire Council District.

A big part of the 1951 development was in the northern part of the district and not on the sandplain.

Most of the development since 1951 has been on the sandplain.

<table>
<thead>
<tr>
<th>Number of Holdings Included</th>
<th>1951</th>
<th>1960</th>
<th>1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Under Crop</td>
<td>49</td>
<td>203</td>
<td>273</td>
</tr>
<tr>
<td>Area Permanently Sown to Improved Pastures</td>
<td>9,075 ac.</td>
<td>31,575 ac.</td>
<td>48,972 ac.</td>
</tr>
<tr>
<td>Newly Cleared</td>
<td>8,505 ac.</td>
<td>115,360 ac.</td>
<td>163,474 ac.</td>
</tr>
<tr>
<td>In Fallow</td>
<td>3,900 ac.</td>
<td>29,049 ac.</td>
<td>49,478 ac.</td>
</tr>
<tr>
<td>Previously Cropped but now Idle or Used for Grazing</td>
<td>6,505 ac.</td>
<td>45,548 ac.</td>
<td>74,984 ac.</td>
</tr>
<tr>
<td>Total Cleared</td>
<td>35,883 ac.</td>
<td>78,019 ac.</td>
<td>102,182 ac.</td>
</tr>
<tr>
<td>Uncleared Land on Holdings</td>
<td>83,856 ac.</td>
<td>297,546 ac.</td>
<td>458,470 ac.</td>
</tr>
<tr>
<td>Total Area of Holdings</td>
<td>101,065 ac.</td>
<td>384,717 ac.</td>
<td>692,966 ac.</td>
</tr>
<tr>
<td>Number of Sheep</td>
<td>164,924 ac.</td>
<td>682,363 ac.</td>
<td>1,131,436 ac.</td>
</tr>
<tr>
<td>Number of Beef Cattle</td>
<td>19,313</td>
<td>115,540</td>
<td>222,787</td>
</tr>
<tr>
<td></td>
<td>451</td>
<td>5,922</td>
<td>2357</td>
</tr>
</tbody>
</table>

Supplied by Bureau of Census and Statistics

(Data are for period ending March 31st of year indicated)
HATCHED AREA—Land alienated to farmers.

WHITE AREA INSIDE THE DOTTED LINE—Land held by the Esperance Land Development Company. Part of this area has been cleared and sown to pasture.
THE AREA CONSIDERED

FOR the purpose of this article the Esperance area is defined as that area between the south coast and the 18-inch rainfall isohyet, extending from 20 miles west of Hopetoun to the coast south of Israelite Bay.

The central south coastal plain of Western Australia consists of a fringe of coastal limestones and sand, averaging two to three miles wide and rising abruptly to a plain with an elevation of from 200 to 600 feet above sea level. In some areas the coastal limestone is less than a mile wide, particularly to the east of the town.

The elevated plain is gently undulating and slopes towards the coast. It consists of a variable depth of Miocene sediments overlying the Precambrian granite shield.

These sediments have been weathered to form the major soil types found on the plain: grey siliceous sands overlying gravel, gravelly clay or clay subsoils. The plain is cut in a north to south direction by a series of old river systems which are the remnants of a major drainage system of a wetter geological period. They run for periods in the winter and after heavy summer rain and dry up to pools in the drier periods of the year.

The Phillips, Jerdacuttup, Oldfield, Munglinup, Young, Lort and Dalyup rivers are found to the west of the Esperance-Norseman road and the Coramup and Bandy creeks to the east. Other short drainage lines which occur to the east are the Duke and the Munglinup creeks, the Alexander and the Thomas rivers, and the Blackboy, Salt, Jeramullup, and Weameryungup creeks.

Along the main river systems, and varying in width from half to one and a half miles, the country is generally broken by numerous smaller subsidiary creeks with steep slopes and in many instances granite outcrops. Along the lower reaches of the rivers and creeks exposed Miocene sediments are normally found. It is between these strips of broken country that the gently undulating plain occurs. More extensive areas of broken country occur to the west than to the east of the Esperance-Norseman road.

THE AGRICULTURAL POTENTIAL OF THE AREA

THE Esperance Downs Research Station carried 3½ dry sheep equivalents on the 1,420 acres under pasture in 1961. There were also 228 acres under crop. The oldest paddock was in its twelfth year and 450 acres were third year pasture.

Similar high stocking rates can be found on farmers’ properties in the district.

The figures give some idea of the immense potential of the area. It is likely that within the area receiving 19-20 inches of rain a year farmers will be able to carry between four and five dry sheep equivalents an acre on fully developed pasture, provided they maintain suitable reserves of fodder for drought feeding.

Cereal crop production is also promising after areas have been under clover pasture for a number of years. Oat crops have yielded up to 90 bushels an acre in favourable years at the Research Station. Regular yields of from 35 to 60 bushels an acre could be expected.

Linseed also appears promising and commercial crops yielding from 9 to 15 bushels an acre have been grown on clover ley country in the district.

Unfortunately barley and wheat are subject to root rots, and results are variable, depending on seasonal conditions.

The above data indicate that in 10 to 20 years time Esperance could be one of the major agricultural regions of Australia.
THE SOILS

MOST of the soils of the plain are grey siliceous sands overlying a gravel, gravelly clay or clay subsoil. The depth of sand is variable and pasture development is easier where the sand is less than 24 in. deep.

Significant areas of sand deeper than 36 in. occur on which pasture establishment is difficult. On the other hand large areas are found where the surface soils are gravelly sands or clay. Where clay occurs on the surface a gilgai microrelief is found on waterlogged areas.

Soils with gravel on the surface are more extensive to the north and west of the area while those with clay within 3 in. of the surface are more extensive to the north and east.

Free lime is found in many subsoil clays; this is common to the west of the Lort.
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river and east of Boyadup. It has been observed on some areas of the Caitup series at the Research Station. In most places where lime occurs it is found one foot down into the clay.

Although the surface soils of the plain are highly leached they are only slightly acid in reaction. This is probably associated with the absence of a marked humus horizon.

Where drainage channels or rivers have exposed the country rock, a gneissic granite is exposed by the erosion of from 30 to 50 feet of overlying material. This rock gives rise to brown sandy loams or loamy sands on which is found a woodland vegetation quite distinct from the heath association of the plain.

The Better Soils of the Plain

(i) The Soils of the Research Station

Smith (unpublished data) mapped the soils of Esperance Downs Research Station and divided them into three main series. These soil descriptions are repeated below. Appendix I gives some physical and chemical data from type samples of these soils, together with similar data from samples of clay collected from a number of other locations throughout the district.

A. THE FLEMING SERIES

1. Fleming Sand

0-15 in. Grey sand over leached light grey sand. The depth of surface sand can be 8-30 in.

15-36 in. Leached light grey sand with dense large gravel becoming a yellow clayey sand to sandy clay loam with depth containing dense small gravel.

36 in. + Yellow and grey mottled mellow clay.

2. Fleming Gravelly Sand

The sequence of horizons is as for the Fleming sand except that the depth of sand does not exceed 8 in. Surface gravel occurs where the surface sand is absent. Small conglomerate boulders can also occur on the surface.

B. THE CAITUP SERIES

1. The Caitup Sand

0-15 in. Grey sand over greyish yellow sand with some slight binding. The depth of surface sand can vary from 6-30 in.

15-24 in. Greyish yellow clayey sand to sandy clay loam containing dense small gravel.

24 in. + Yellow and grey mottled mellow clay.

2. The Caitup Gravelly Sand

The sequence of horizons is as in the Caitup sand except that the surface sand does not exceed 6 in.

C. GIBSON SERIES

1. Gibson Sand

0-20 in. Grey sand over pale yellow sand with slight clayeyness. The depth of surface sand can vary from 12-24 in.

20 in. + Yellow grey mottled mellow clay.

2. Gibson Sand (Deep Phase)

Clay horizons at depths of 24-42 in.

3. Gibson Sand (Wet Phase)

Clay usually 12 in. or less. Semi-water-logged soils although not inundated.

One type of native vegetation which occurs on areas of typical sandplain; sandy surfaced soils overlying gravel at 6 to 24 inches
(ii) Other Major Soil Types

In the western and northern parts of the area soils with gravelly surfaces are common. Small ironstone boulders are often present on the surface of these soils and they have brown or grey brown surface layers underlain by a brown or red brown columnar clay. In some instances free limestone has been found on the deeper layers of the clay. These soils appear to be similar to the Waychinicup series of the South Stirlings and Many Peaks districts.

To the north the typical plain soils give way to the greyish calcareous solonised soils of the mallee zone which are in marked contrast to the soils of the plain. Between the plain area and the mallee zone considerable areas of a complex association showing a gilgai microrelief occurs. Burvill and Teakle (unpublished data) have described a complex association which occurs in the Scaddan area as a complex of the Scaddan and Beete series. It is likely that the gilgai formations further south are a similar complex. Descriptions of the Beete calcareous sandy loam and the Scaddan Sand are given below.

The Scaddan Sand, which has a domed solonetzic clay has the following profile.

0-5 in. Light grey brown sand over a light grey sand extending down to 12 in. between the domes of the subsoil clay.

5-12 in. Dull brown and yellow mottled sandy clay in irregular domes or columns 6 to 12 in. across.

12-36 in. Yellow green and light brown mottled sandy clay pockets of calcareous nodules and soft lime.

The Beete calcareous sandy loam has the following profile:

0-9 in. Light grey to greyish brown calcareous powdery sandy loam.

9-30 in. Greyish white to very pale brown very calcareous and soft clay loam to light clay. Calcareous nodules are common.

The Deep Sands

Areas of deep sand occur throughout the area, particularly to the east of the Lort river. These soils have a surface sand layer of at least 36 in. and sites have been sampled where the sand is more than 15 ft. deep. They are usually a greyish yellow fine sand over a pale yellow fine sand becoming a yellow fine sand with depth.

The moisture relations and nutrient content of these soils are poor and legume establishment has been difficult.

Some chemical data from the surface layers of these soils is given in Appendix 1 under the heading Deep Sands; also

The native vegetation on an area of deep sand. Note the presence of Banksia speciosa which is only found where the surface sand is deeper than three feet. Pasture development on soils with a surface sand layer deeper than three feet has been difficult, and farmers should avoid clearing areas of this type.

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samples S1 and S2 in Appendix 1 represent clays under deep surface sand layers.

**The Chemical Data**

The chemical data support the agricultural experience that the nitrogen and phosphorus content of these soils is extremely low by world standards. On the other hand, the supplies of available calcium and potassium on the better soils, or even in the clays of the deeper sands, are relatively good. The data in Appendix 1 show the low inherent fertility of the deep sands. While the potassium reserves of the better plain soils are adequate, subterranean clover planted on the deep sand is seriously affected by potassium deficiency.

It is interesting to compare the levels of exchangeable cations in the clays in the Esperance area with those of some of the clays in the Jerramungup-Gairdner River area. Table 1 shows the exchangeable cation contents of four samples of clay collected along the Jerramungup-Ravensthorpe road, as compared with those of the clays of the Caitup, Gibson and Fleming series from Esperance Downs Research Station. There is a marked difference in the relative cation contents of the two sets of clays. The Esperance clays contain more calcium and potassium than the clays collected from the Jerramungup area. Appendix 1 shows that this trend holds for the clays to the east of Esperance. Further samplings will be needed in the western parts of the area.

Potassium deficiency of subterranean clover has been reported in the Jerramungup area even on the better plain soils. The clays from the Jerramungup area are also relatively higher in magnesium than those examined from the Esperance area.

**TABLE 1**

**EXCHANGEABLE METAL CATION CONTENT OF CLAYS FROM ESPERANCE AND JERRAMUNGUP-GAIRDNER RIVER AREA.**

<table>
<thead>
<tr>
<th>Site of Sampling</th>
<th>Description</th>
<th>Depth</th>
<th>Clay Content of Sample</th>
<th>Exchangeable Cations m. equiv. per 100 gms. of soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>49m. E of the Gairdner River</td>
<td>Light grey gritty sand over grey brown gritty clay</td>
<td>10-15</td>
<td>49-8</td>
<td>Ca 0-1 (1%), Mg 4-5 (2%), K 0-9 (3%), Na 1-3 (5%)</td>
</tr>
<tr>
<td>51m. E of the Gairdner River</td>
<td>Brown gravelly loamy sand over yellow brown sand over grey mottled gravelly sandy clay</td>
<td>15-20</td>
<td>39-0</td>
<td>Ca 0-9 (14%), Mg 4-0 (27%), K 0-3 (5%), Na 1-5 (8%)</td>
</tr>
<tr>
<td>54m. E of the Gairdner River</td>
<td>Light brownish-grey sand and quartz grit over light reddish-brown gritty clay</td>
<td>4-12</td>
<td>67-3</td>
<td>Ca 0-4 (5%), Mg 6-1 (15%), K 0-2 (3%), Na 0-8 (8%)</td>
</tr>
<tr>
<td>Esperance Downs Research Station</td>
<td>Fleming gravelly sand</td>
<td>21-24</td>
<td>32-5</td>
<td>Ca 1-3 (18%), Mg 2-3 (30%), K 0-6 (9%), Na 0-9 (9%)</td>
</tr>
<tr>
<td>Esperance Downs Research Station</td>
<td>Gibson sand (shallow)</td>
<td>7-10</td>
<td>45-5</td>
<td>Ca 1-9 (27%), Mg 3-5 (11%), K 1-5 (28%), Na 3-1 (32%)</td>
</tr>
<tr>
<td>Esperance Downs Research Station</td>
<td>Caitup gravelly sand</td>
<td>9-15</td>
<td>68-3</td>
<td>Ca 2-6 (23%), Mg 4-0 (15%), K 2-5 (32%), Na 2-8 (32%)</td>
</tr>
</tbody>
</table>

* Total represents cation exchange capacity calculated at pH = 7.
† Total represents total exchangeable bases plus exchangeable H+ determined at pH = 8-4.

**THE VEGETATION**

The vegetation is primarily a heath type of various low scrub species interspersed with Christmas tree or munji (*Nuytsia floribunda*), chittick (*Lambertia inermis*), black boy (*Xanthorrhoea preissii*), and stunted mallees. White or blue leafed mallee (*Eucalyptus tetragona*) and lerp or red mallee (*Eucalyptus incrassata*) are the common forms on the typical plain soils.

Banksia (*Banksia speciosa*) is the dominant species on most of the areas of deep sand.

Numerous paper bark (*Melaleuca cuticularis*) and yate (*Eucalyptus occidentalis*) swamps or flats are scattered throughout the area.

To the north where the typical “mallee” soils and the complex gilgaid soils occur, the various forms of mallee are dominant.
Native vegetation on an area of the Caltup series (sand over 6 to 9 inches of gravel over clay) showing the broad leaved blue mallee (*E. tetragona*) and the narrow leaved red or lerp mallee (*E. incrassata*) which commonly occur on soils of this type.

There is some correlation between vegetation and soil type. This is shown in a report by Mr. R. D. Royce in Appendix III. However to the east of the railway line large areas occur where the low heath scrub is interspersed with only very occasional Christmas trees, on soils which at the Research Station carry dense chittick with occasional Christmas trees.

Further east the Christmas tree is replaced by scattered mallee and sometimes wattle and becomes rare on soils which support it to the west.

Also while *Banksia speciosa* is normally found on the deep sand there are areas of deep sand where *Banksia speciosa* is not found. In some areas the best indicator of deep sand is a shrub known locally as curly root (*Melaleuca striata*)

**Poison Plants**

The undulating sand plain is virtually free of serious poisonous plants although prickly poison (*Gastrolobium spinosum*) and lamb poison (*Isotropis drummondii*) do occur. However, narrow leaved box poison (*Oxylobum parviflorum*) is found extensively on the soils showing a gilgal microrelief immediately north of the sand plain. It occurs extensively in a strip three to five miles wide stretching across the area from Ravensthorpe east as far as Boyadup. To the east of Boyadup the position is not clear. It also occurs on the Scaddan series of soils and along the river systems and near granite outcrops.

Slender poison (*Oxylobum heterophyllum*) has been found on the red alluvial soils of the Dalyup River and the Oldfield River. It may also occur along other rivers.

Clover leaf poison (*Goodia lotifolia*) is known to occur in many swamps to the east and west of Esperance, particularly where the soil is heavy in texture. It is a summer growing plant, more likely to be a problem after summer rains but of no major significance as a poison plant in the area.

(Continued on page 106.)
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