

DEPARTMENT OF AGRICULTURE

**Soil Associations
Of
Horsham Map Sheet No. 7324**

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Fig. 1. - Locality plan



SECTION 1 - SCOPE AND PURPOSE OF SURVEY

1.1 *Introduction*

The main purpose of this report is to provide research and advisory officers of the Department of Agriculture with basic information for the location and identification of soil with known or suspected agronomic problems in the surveyed area. The report contains a description of the associated groups of soils, their distribution in the area and the landscape soil relationships. Fifteen soil associations are recognised and shown on the soil association map accompanying the report. Each soil association is described in detail and brief reference is made to its current land use. Earlier soil surveys in this area were examined and their relationship to the present survey is outlined in Section 3. Approximate areas of the landscape units and of their component soil associations are given in Appendix I. Definitions of technical terms are given in Appendix II and survey methods in Appendix III.

1.2 *Location*

The rectangular area of about 250,000 hectares is located in the south centre of the Wimmera Region and represents about 2.2% of the Victorian wheat belt. Wail, Murtoa, northern parts of the Grampian Ranges, Connongorach and Wonwondah South are included in the area. The area north of the Wimmera river is used mainly for wheat production and the area south of the river for sheep and cattle production on native and volunteer pastures.

SECTION 2 - LANDSCAPE UNITS AND SOIL ASSOCIATIONS

2.1 *The Landscape –Soil Relationship*

In the surveyed area there is an overall relationship between the major features of the landscape and the distribution of the main soils. Thirteen such features, subsequently referred to as landscape units, are shown in Figure 2. An additional minor unit (river frontages) also occurs, but has been included in the flood plains unit owing to the scale used in mapping. The relative area of each landscape unit is shown in Figure 3. The dominant unit is the gently undulating plains landscape.

Each landscape unit has its own array of soil types, some of which are topographically related to each other.

These recurring soil patterns, evident in each of the landscape units, are the *Soil Associations* described in the following sub-section and shown on the Soil Association Map. A landscape unit may include more than one soil association and the same soil association may occur in different landscape units (Figure 4).

Appendix I lists the landscape units in alphabetical order and gives details of the areas of each landscape unit and its component soil associations.



Fig. 2. - Landscape Units in the Survey Area

2.2 The Soil Associations

The area surveyed includes many different soils. In the field these soils occur in groups each of which contains one or more soil types. Each group of soils is mapped as a soil association unit. Fifteen such associations are mapped in the survey and numbered from H.1 to H.15 in order of decreasing area (Table 1).

Table 1 - Soil Associations of the Area

Soil Association unit	Area (ha)	% of total area	Soil Association unit	Area (ha)	% of total area
H.1	78,720	31.1	H. 9	8,690	3.4
H.2	28,270	11.2	H.10	7,820	3.1
H.3	27,210	10.7	H.11	6,750	2.7
H.4	24,760	9.8	H.12	5,280	2.1
H.5	18,560	7.3	H.13	4,550	1.8
H.6	16,970	6.7	H.14	4,190	1.6
H.7	9,260	3.7	H.15	3,160	1.2
H.8	9,010	3.6			
			Total	253,200	100

The description of each soil association unit summarises the main landscape features and includes the recorded major and minor soils in the unit. Soils are classified under the appropriate Great Soil Group (Stace *et al.*, 1968) with some additional distinguishing characteristics added, where necessary.

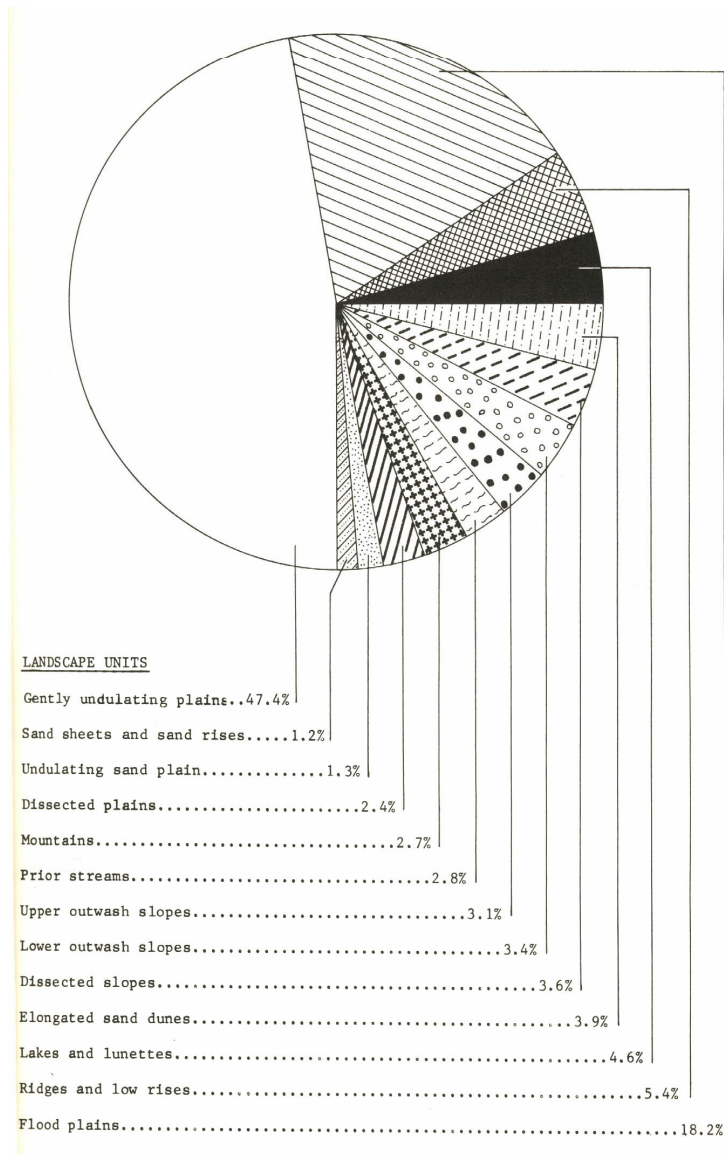


Fig. 3. - Relative areas of the landscape units

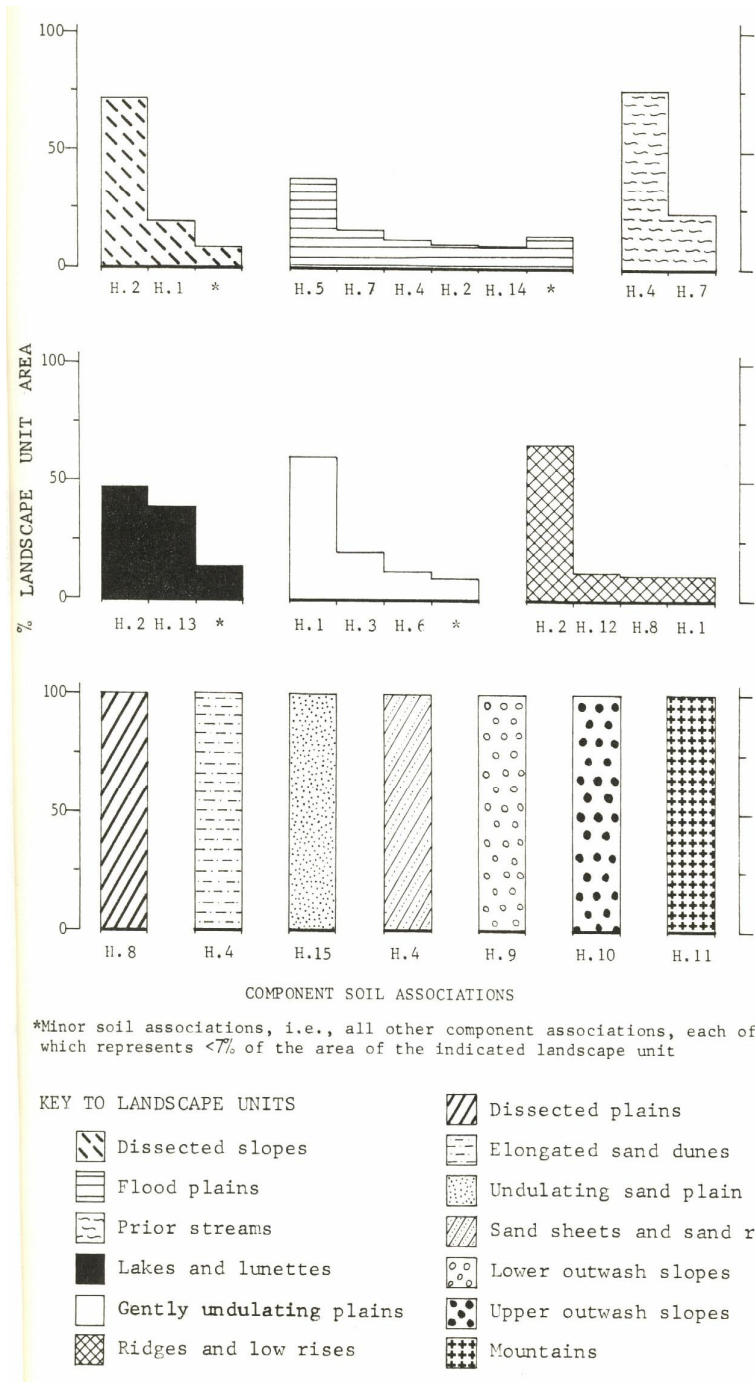


Fig. 4. - Landscape units and their component soil associations

The soil associations are described below, in the order shown in Table 1, together with comments on present land use.

2.2.1 Association unit H.1

The association occurs mostly in the northern half of the survey area and occupies most of the *gently undulating plains* landscape unit. The association is also found in other areas of the map sheet.

The main soils (grey clays) are distinguished by having uniform surfaces. The surface soil consists of a layer of up to 25 cm of remarkably friable, self mulching brownish grey to grey-brown, light to

medium clay. The subsoils, commonly occurring as microscale complexes, are mottled heavy clays of various colours. Variation in subsoil colour is partly due to infills of surface soil associated with the marked seasonal cracking of these soils. The soil reaction trend is always alkaline throughout the profile and pellets of hard lime are usually scattered on the surface.

Cracking calcareous brown clay soils are intermingled with the grey clays in different degrees of complexity. They are distinguished by having a surface of up to 30 cm of semi friable to non friable grey brown to greyish brown heavy clay, sharply separated from the tough blocky brown to red-brown heavy clay subsoils. In some areas the two soils follow a topo-sequence where, typically, the grey soils occur on the flats and shallow depressions and the brown soils occupy the mid and upper slopes.

Red-brown earths with surfaces (5 to 20 cm) of greyish brown sandy clay loam occur on some rises and low ridges.

Land use

The main soil types in this association are considered to be the most productive of the Wimmera wheatland soils and are also considered to be reasonably suitable for irrigated pastures. However, variation in depth of surface soil may result in uneven plant growth. Where profile properties affect crop or pasture production, optimum management may be complicated by the complexity of the micro-mosaics of grey and brown soils.

In years with adequate winter and/or spring rains, these soils, particularly the grey clays, have been shown to be very suitable for growing opportunity summer crops such as sunflower.

2.2.2 Association unit H.2

This soil association is mapped in five landscape units: the *dissected slopes, flood plains, lakes and lunettes, ridges and low rises* and the *gently undulating plains*. Soils of the association usually occupy the slopes and higher positions in the landscape. These soils also occur on some level areas in the *flood plains* landscape unit.

The dominant soils of the association are red-brown earths and are characterised by the dry season hard setting nature of their surfaces. The grey-brown surface soil, up to 20 cm deep, usually has a sandy clay loam texture. Sandy loam textures occur less commonly. Various degrees of bleach may occur in the lower parts of the surface soils. The subsoil is a red-brown to reddish brown medium or heavy clay. Typically, the subsoil structure consists of large prisms. These prisms break into coarse blocky pedes which normally have smooth and shiny faces. At about 50 cm the subsoil changes gradually into less red and slightly mottled clay colours. Carbonates occur at different depths in the subsoil.

Other clay soils with different characteristics represent the minor soil components in the association.

Land use

The general land use in this soil association is cereal production. However, the main soils of the unit can be difficult to manage due to their hard-setting surfaces and dense, blocky structured subsoils. Such unfavourable soil features contribute to poor initial infiltration rates and low profile permeability.

At the present time gypsum is successfully used on these soils to improve structure both in terms of increasing permeability to water and reducing the related behaviour of dry season hard setting. Gypsum application widens the moisture range over which the soil can be cultivated and facilitates seedling emergence.

2.2.3 Association unit H.3

In the surveyed area, soils of this association occur mainly south of the Wimmera river occupying a large proportion of the *gently undulating plains* landscape and small areas of the *flood plains* unit. Very small areas of this association are also scattered over other units north of Quantong.

The main soils are solonetz, solodised solonetz and solodic. Their brownish grey to greyish brown, loamy sand to sandy clay loam surface vary from 8 to 45 cm. The lower part of the surface soil is

massive and variously bleached. Subsoils are often strongly mottled, yellowish grey and brown to red-brown, tough heavy clays. They have a moderate medium prismatic to strong coarse blocky or columnar structure. Non-friable gilgaied and non-gilgaied calcareous grey and brown clay soils are also present.

Land use

Wool and fodder production with some beef production are the main farming practices on this unit.

2.2.4 Association unit H.4

This unit describes the soils of the sand rises and their associated depressions on the low undulating plains. The association occurs mainly within the *elongated sand dunes* and the *sand sheets and sand rises* landscape units. Some areas in former stream courses and in the *river frontages* and *flood plains* units are also included.

Soils on the sand dunes, sand sheets and sand rises are mainly solodised solonetz and solodic. The surface soils range from light brownish grey to greyish brown sand to sandy loam. Depth to the clayey subsoil varies between 30 and 200 cm, sometimes deeper depending on the topographic position of the soil described. An A₂ horizon (sub-surface soil layer) is usually present and is sporadically or conspicuously bleached and massive. B horizons (subsoils) are variously mottled having sandy clay to heavy clay textures and coarse blocky to columnar structures. Some calcium carbonate occur in the deep subsoils.

Soils of the interdune swales and other landscape elements are similar to those above, but have shallower surface of loams sand to sandy clay loam. Non-friable calcareous cracking grey clay soils, with up to 12 cm sandy clay loam to heavy clay surfaces, are also present.

There are minor occurrences of red-brown earths, with 5 to 30 cm grey-brown to reddish brown sand to sandy clay loam surfaces, and brown clays.

Land use

Uncleared areas are either agriculturally unused or may provide sparse grazing. Soils in this unit have been used for irrigated perennial pasture production. In some areas, particularly Quantong, certain soils are used for vegetable and fruit production.

Sand from some areas of the unit is currently used for moulding and concreting in the Horsham district.

2.2.5 Association unit H.5

This association unit occur over extensive areas of the *river frontages* and the *flood plains* landscape units. It is also found in some of the lake beds in the *lakes and lunettes* unit and in some depressions and low flat ground in the *gently undulating plains* landscape.

The main soil of the association is characterised by a tough non-friable (extremely hard) surface of 10 to 15 cm of a light yellowish grey to yellowish grey-brown, light to medium clay. This clay has a blocky structure and exhibits irregular bleaching and rusty root channel mottling. The subsoil colour is similar to that of the surface soil. Texture is light to heavy clay and the structure is strong coarse prismatic. Trace to slight amounts of carbonates occur at different depths to the subsoil.

Minor components of the association include other clay soils, whose characteristics differ from those mentioned above. Also, red-brown earths and solodised solonetz and solodic soils are present in smaller amounts.

Land use

Reasonably good perennial pastures can be produced, under irrigation, on the main soil type of this association. However, under dryland conditions, pasture and cereal production is less successful. The coarse blocky structure and the non-friable nature of the surface soil, which becomes very sticky on

wetting, makes cultivation difficult even at the optimum moisture content. It is particularly difficult to produce a fine tilth at the surface.

Topographic position and liability to periodic flooding greatly influence the use of these soils in terms of their suitability for cropping or producing good pastures.

2.2.6 Association unit H.6

The soils of this association occur mainly south of the Wimmera river. They occupy the nearly level part of the *gently undulating plains* landscape unit and small areas of the *flood plains* unit.

Non-friable gilgaied and non-gilgaied calcareous grey clays are the common soils in this association. They are distinguished by having a surface of up to 15 cm of non-friable grey to grey-brown medium to heavy clay. Their subsoils vary in colour from grey-brown to yellow-grey or brown. They have a very tough and stick heavy clay texture and a coarse blocky or prismatic structure. The soil reaction trend is always alkaline throughout profile. Varying amounts of carbonates occur at different depths within the soil profile.

Solonetz soils, intermingled with the soils mentioned above, have a 5-20 cm surface of grey-brown to greyish brown sandy loam to sandy clay loam. Their subsoils are variously mottled and have a coarse blocky to prismatic structure and a tough heavy clay texture.

There are minor occurrences of friable, cracking, calcareous grey clays, red-brown earths and solodised solonetz and solodic soils.

Land use

The main land use is wool growing with some cereal cropping and beef production.

2.2.7 Association unit H.7

This unit represents parts of the *river frontages* and *prior streams* landscape units. Within the boundary of the survey this association occur near the southern part of the McKenzie river and the eastern and north-western sections of the Wimmera river.

The soils in this unit are a mixture of varied sediments. Collectively they may be described as gilgaied calcareous cracking grey and brown clays with different degrees of friability. Gravels, deep sands, red-brown earths, solonetz and various solodised solonetz and solodic soils occur throughout the area.

Land use

Some areas are agriculturally unused. Other areas provide sparse grazing and some cropping for fodder.

Wheat and improved pastures are produced on alluvial plains near the eastern edge of the surveyed area and in some other areas of the unit.

2.2.8 Association unit H.8

This association described the soils of the *dissected plains* landscape unit which is bordered by the Wimmera river to the north and Nortons Creek to the east. Similar soils occupy smaller areas of low ridges, low rises and ironstone outcrops throughout the southern half of the survey and a few localities to the north east.

The soils of this unit are mainly solodised solonetz, solodic and solonetzic. They have various concentrations of ferruginous ironstone and sandstone gravels throughout the profile. Surface range from 6 to 50 cm of brownish grey to reddish brown loamy sand to sandy clay loam. Different degrees of bleach occur in the lower parts of the surface soils. The surface soils are sharply separated from the variously mottled tough heavy clay subsoils which have moderate to coarse solumnar or prismatic structures. Various amounts of carbonates occur in the deeper subsoils.

Similar soils, with either deep (40 to 80 cm) sand to sandy loam surfaces or a very high concentration of gravels, occupy most of the gully floors and foot slopes.

Non-friable calcareous grey and brown clays, as well as red-brown earths, are present in smaller amounts.

Land use

The soils of this unit are used mainly for wool growing with cropping for fodder production. Gravels in some areas have been used for roadmaking.

2.2.9 Association unit H.9

The soils of this association occupy the *lower outwash slopes* landscape unit on the Grampians plains. The association unit is mapped in the south-east corner of the survey area.

Solodised solonetz and solodic soils are the main soils. They are distinguished by having moderate surface depths (20 to 60 cm) of brownish grey to reddish brown sandy loam to sandy clay loam. The lower parts of the surface soils are strongly bleached and usually massive. They appear either as a flat continuous compacted layer or as a cemented capping for the domed columns of the subsoils below. Subsoils are distinctly mottled tough heavy clays with strong medium and coarse blocky to columnar structures.

The sub-dominant soil components of this unit are siliceous deep sands, brown clays, relatively shallow surfaced (10 to 30 cm) red-brown earths and solonetzic soils.

Land use

The main land use is sheep grazing with some cropping for fodder.

2.2.10 Association unit H.10

This association represents the soils on the *upper outwash slopes* landscape unit in the mountainous areas. The unit is found near the Grampians ranges in the south-east corner of the surveyed area.

The soils, which support a dense cover of native vegetation, are mainly solodised solonetz, solodic, soloth and podzolic. Varying amounts of loose decomposed organic matter and vegetative litter occur on the surface. The mineral surface soils are deep (30 to more than 150 cm) brownish grey to greyish brown sand to sandy loam. These are sharply separated by variously bleached soil layers from strongly mottled, tough sandy clay to heavy clay subsoils. The dominant soils are siliceous deep sands. Sub-dominant soils include shallow surfaced (10 to 30 cm) solodised solonetz and solodic soils.

Land use

Most of the area is classified as reserve forest. There is a small timber milling industry and an olive plantation near Mt. Zero is in production and proving successful. There have been attempts to grow pastures in some areas of this unit.

2.2.11 Association unit H.11

This soil association occupies rugged rocky outcrops and partly forested *cuestas* in the *mountains* landscape unit of the Grampians. A small part of the Black Ranges is included in the survey and occurs within the unit.

The dominant soils are lithosols. Sub-dominant soils include podzols.

Land use

Most of the area is classified as reserved forest. Some timber is extracted for milling.

2.2.12 Association unit H.12

This soil association occupies relatively small areas of both level ground and low rises scattered throughout the *gently undulating plains* landscape unit which occurs mainly in the northern half of the survey. The association also occurs on some of the upper and mid slopes in the *ridges and low rises* landscape unit as well as on some lunettes in the *lakes and lunettes* unit.

The soils of this unit are cracking calcareous brown clays, with different degrees of friability. Surface soils are mainly tough blocky greyish brown to reddish brown medium or heavy clay with depths varying from 5 to 30 cm. Subsoils are brown to red-brown heavy clays with strong blocky or prismatic structures. Consistence is hard when dry, slightly to moderately friable when moist, plastic and very sticky when wet. Trace to slight amounts of carbonates occur at different levels in the subsoils.

Friable cracking calcareous grey clays and red-brown earths occur rarely.

Land use

Wheat production is the main use of the soils of this unit. In this regard the management system used involves a rotation which includes a period under medic pasture. Higher yields have been obtained by applying gypsum at the recommended rates to the brown clays and their associated red-brown earths.

2.2.13 Association unit H.13

This association occurs in the *lakes and lunettes* landscape unit on the undulating plains in the south-western corner of the survey. The soils of this association occupy most of the swamps and their corresponding lunettes and sand sheets. Small areas of the association occur in the north west adjacent to the flood plain of the Wimmera river.

The lake bed soils are mainly non-friable cracking calcareous grey clays. Surface soils range from 4 to 25 cm in depth and are dark grey to yellowish grey, tough coarse, blocky, heavy clays. Carbonates are present in different amounts at different depths in the soil profile. Non-friable cracking calcareous brown clays and solonetzic soils are present occasionally in the lake beds.

The soils on the lunettes and the sand sheets are commonly solodised solonetz, solodic and solonetz. Their 5 to 30 cm loamy sand to sandy clay loam surfaces are sharply separated from very tough, prismatic to columnar structured heavy clay subsoils. Typically, there is a sub-surface (A₂) soil horizon, with different degrees of bleaching and of varying depths, over the main subsoil horizon. Similar soils with deeper surfaces (up to 400 cm) are found on some lunettes. Red-brown earths are rarely found.

Land use

The area is used mainly for wool production. Cereal cropping, mainly for fodder production, also occurs.

2.2.14 Association unit H.14

Soils of this association occupy areas of level ground in the *flood plains* landscape units. There are single occurrences of similar soils on parts of the *gently undulating plains* and *lakes and lunettes* landscape units.

The main soil of this is a cracking calcareous grey clay characterised by a uniform, slightly yellowish grey profile to a depth of about 100 cm. The friable, blocky, light to medium clay 10 cm surface lies on a less friable, strongly structured coarse prismatic medium to heavy clay subsoil. Clay colour becomes more yellow or diffusely mottled, at depth, and carbonates are found almost throughout the profile in amounts up to 10%.

Other clay soils of different characteristics and red-brown earths occur in the association and are intermingled with the main soil in different degrees of complexity.

Land use

The main soil type of this unit is considered to be suitable for irrigated perennial pasture. It is also used for wheat growing under dryland farming. Sunflower is recommended as an alternative crop on the Wimmera grey clays.

2.2.15 Association unit H.15

This association represents the *undulating sand plain* landscape unit, which covers the easternmost fringe of the Little Desert. It is mapped in the north-west corner of the survey area.

The main soils are solodised solonetz and solodic. Surface litter is common. These soils consist of deep grey-brown to greyish brown sands which often occur as dunes and sheets. Surface soils are sands to sandy loams with depths varying from 30 to more than 200 cm. Often there is a sub-surface horizon of varying thickness which is usually conspicuously bleached. Typically, the subsoil is a strongly mottled, brownish grey and/or yellowish grey with red-brown and brown, medium or heavy clay. The subsoil structure is either blocky, prismatic or columnar. A cemented bleached layer often caps the columns.

Soils with shallower surfaces, heavier textures, or lacking the sub-surface bleached horizon, also occur in the association. They may be found in the swales and foot slopes of the dunes.

Land use

Much of the native vegetation of this unit still remains. The Victorian Forests Commission has established a forest nursery at Wail, which is included in this unit. The nursery provides trees and shrubs suitable for all purposes including commercial tree planting. There have been attempts to grow pastures in a few localities in the Little Desert.