An introduction to the soils of the Narrogin advisory district

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National Soil Conservation Program (Australia)
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AN INTRODUCTION TO THE

SOILS

OF THE

NARROGIN

ADVISORY DISTRICT

-descriptions, illustrations and notes on eight common soils

COMPILED BY T.C. STONE MAN

WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE
This publication is one of a series dealing with soils either commonly occurring or of particular significance, in the wheatbelt advisory districts of the Department of Agriculture. The districts regarded as ‘wheatbelt’ are Geraldton, Three Springs, Moora, Northam, Merredin, Narrogin, Katanning, Lake Grace, Jerramungup, Albany and Esperance (see Map below). Most of the publications will be in this format, but those for Merredin and Northam will be rather more comprehensive in coverage of the soils, landscapes and agriculture of their respective districts.

The publications have the objective of encouraging and aiding recognition by advisory staff and farmers of different wheatbelt soils and the development of a greater appreciation of the influence that soil characteristics have on land capability.

Particular points to note with respect to the terminology and descriptions used in this publication follow.

Australian great soil groups - the names used follow the identification discussed by Stace et al. (1968) ‘A handbook of Australian soils’.


Soil profile sketches - these line drawings interpret the profiles presented in the matching colour photographs.

Colour photographs - many of the colour photographs show a darker coloured vertical band of soil on either side of the depth tape. This strip has been moistened and is intended to indicate moist and dry soil colour.

Soil colours - the common names used in soil descriptions are standard names derived from Munsell soil colour codes.

pH values - all pH values recorded in the text are from a 1:5 soil water extract. Values in 0.01 M calcium chloride (CaCl₂) are also given in the soil profile descriptions.

Soil maps - the maps indicating where each soil most commonly occurs are derived from interpretations of Sheet 5 of the Atlas of Australian soils (Northcote et al. 1967).

Particular acknowledgement is made for funds provided by the National Soil Conservation Program to assist the Department of Agriculture to undertake this project.
The Narrogin advisory district

The Narrogin office of the Department of Agriculture services an advisory district embracing the shires of Boddington, Brookton, Corrigin, Cuballing, Narrogin, Pingelly, Wagin, Wandering, West Arthur, Wickepin and Williams. The district is approximately 2.15 million hectares and has about 1,400 farms.

Geologically the district is located on the Yilgarn Block and is composed of Archaean granites and gneisses. The eastern portion of the district (east of the Meckering Line†) has a mature landscape with little relief between the valleys and hilltops. External drainage consists of a system of very low gradient salt lake channels which only flow in periods of above average rainfall. West of the Meckering Line the natural drainage system has been rejuvenated by uplift of the Old Plateau in past geological time. The Dale and Avon Rivers drain northwards, eventually into the Swan River, the Hotham and the Williams Rivers drain to the west into the Murray River and the Hillman, Arthur and Beaufort Rivers drain to the south-west into the Blackwood River.

The rejuvenated drainage landscapes west of the Meckering Line are mainly hard and sandy, neutral and acidic soils with yellow mottled subsoils (e.g. Soils 1, 2 and 3). The eastern part of the advisory district has soils associated with extensive lateritic uplands (Soils 5 and 7) and with the major drainage systems and subsidiary valleys (Soils 4, 6 and 8).

Agricultural land use is mainly wheat and sheep farming, with cattle raising of some importance.

† The Meckering Line separates the zone of rejuvenated drainage from the poorly drained inland areas. Within the Narrogin Advisory District, the line lies in an approximately north-south direction west of Wickepin.

References to soils in the Narrogin district


Classification
Australian Great Soil Group: Yellow podzolic
Northcote: Dy 5.41
Local name: None

Soil profile description
(See Figure 1, colour photograph inside back cover)

- 0-20 cm dark brown loamy sand, with very few coarse quartz fragments, pH 5.9 (4.7 CaCl₂)
- 20-35 cm yellowish brown coarse sand with very few coarse quartz and granite fragments, pH 6.6 (5.4 CaCl₂)
- 35-80 cm brownish yellow with red mottles common, medium clay, pH 6.3 (5.3 CaCl₂)
- 80+ cm weathered granite.

Distinguishing features
- The profile consists of coarse sandy material overlying a mottled medium clay at about 35 cm. Weathering granite is present below about 80 cm.
- The profile is slightly acidic in reaction throughout.
- The soil occurs on valley slopes with granite outcrops common. It is similar to Soil 3 and small areas of Soil 2 often occur in association with Soils 1 and 3.
- The native vegetation is a wandoo woodland (Eucalyptus wandoo).
- Map 1 provides an indication of the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

**Soil characteristics**

*Favourable attributes*
- Water entry - good
- Soil workability - good
- Nutrient status - reasonable, apart from phosphorus

*Limitations*
- Drainage - through-drainage is impeded by the relatively shallow clay resulting in waterlogging in wet periods.

*Agronomic considerations*
- Crops - given appropriate fertilizer and rotation practices, cereal crops can be grown very satisfactorily.
- Pastures - subterranean clovers are the appropriate pasture legume.

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**Soil conservation**

Water erosion of sloping lands is a common problem. Contour earthworks are frequently necessary, including the use of seepage interceptors where waterlogging is a problem.

**Water conservation**

The soil is moderately successful as surface water catchments but dam sites are difficult to locate because of shallow rock.

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Map 1
ISOil

2. Narrogin advisory district

Classification
Australian Great Soil Group: Solodic Northcote: Dr 3.42 Local name: York gum/jam soils

Soil profile description
(See Figure 2, colour photograph inside back cover)

0-15 cm dark reddish brown sandy loam,
pH 6.1 (4.9 CaCl₂)
15-30 cm yellowish red sandy loam,
pH 6.6 (5.2 CaCl₂)
30-35 cm brown sandy loam, pH 7.0
35-75 cm reddish brown with light reddish brown
mottles common, heavy clay, pH 7.9 (6.3 CaCl₂)

75-115 cm olive, with many red and grey mottles,
medium clay, pH 7.8 (6.3 CaCl₂)

115+ cm weathering gneiss

Distinguishing features
- The soil profile is sandy loam over heavy clay at 35 cm. Red colouration dominates down to about 75 cm, below which depth the clay is olive coloured, onto gneissic rock at a little over a metre depth. The upper part of the horizon is strongly influenced by proximity to a dolerite dyke about 50 m upslope.
- The soil is acidic in reaction at the surface, passing to alkaline in the subsoil.
- The soil occurs on valley slopes in the vicinity of basic dykes. It commonly occurs on relatively small areas within more extensive areas of Soils 1 and 3.
- The native vegetation is dominated by wandoo (Eucalyptus wandoo), York gum (E. loxophleba) and jam (Acacia acuminata).

Map 2 provides an indication of the area within which this soil occurs most commonly in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry - good
Soil workability - good
Water availability - good, except where heavy clay subsoil occurs at shallow depth (less than 30 cm)
Nutrient status - good, apart from phosphorus

Limitations
Drainage - through-drainage can be impeded by the relatively shallow subsoil clay resulting in waterlogging in wet periods.

Agronomic considerations

Crops - given appropriate fertilizer and rotation practices, cereal crops grow well.
Pastures - subterranean clovers are the appropriate pasture legumes.

Soil conservation
Water erosion of sloping lands and waterlogging can be problems in particularly wet years.

Water conservation
The soil is good water catchment country but dam sites require careful selection to avoid shallow rock.
**Classification**  
Australian Great Soil Group: Yellow podzolic  
Northcote: Dy 5.41  
Local name: None

**Soil profile description**  
(See Figure 3, colour photograph inside back cover)

- 0-15 cm dark brown loamy sand, pH 5.6 (4.4 CaCl₂)
- 15-55 cm pale brown loamy sand with very few ferruginous nodules, pH 6.3 (5.2 CaCl₂)
- 55-75 cm brownish yellow with many red mottles, sandy clay with very few ferruginous nodules, pH 6.2 (5.6 CaCl₂)
- 75-110 cm red with many grey mottles, light medium clay
- 110-125 cm dark red with many grey mottles, medium clay, pH 5.7 (4.3 CaCl₂)
- 125+ cm weathering granite

**Distinguishing features**
- The profile is a loamy sand over sandy clay at about 50 cm onto weathering granite at about 125 cm depth.
- The soil is acidic in reaction throughout the profile.
- The soil occurs on valley slopes with granite outcrops common. It is similar to Soil 1 and small areas of Soil 2 often occur in association with Soils 1 and 3.
- The native vegetation is dominated by wandoo (*Eucalyptus wandoo*) and jam (*Acacia acuminata*).
- Map 3 provides an indication of the area within which this soil occurs most commonly in the Narrogin advisory district.
Agricultural use and management

Soil characteristics
Favourable attributes
Water entry - good
Soil workability - good
Water availability - reasonable
Nutrient status - reasonable, apart from phosphorus

Limitations
Drainage - through-drainage is impeded by the clay subsoil and waterlogging can be a problem in wet periods in areas where the subsoil is shallow or the slopes very gentle.

Agronomic consideration
Crops - given appropriate fertilizer and rotation practices, cereal crops grow well.
Pastures - subterranean clovers are the appropriate pasture legumes.

Soil conservation
Water erosion of sloping lands is a common problem. Contour earthworks are frequently necessary.

Water conservation
The soil is reasonably successful as a surface water catchment, but dam sites require careful selection to avoid shallow rock.

Map 3
**Soil profile description**
(See Figure 4, colour photograph inside back cover)

0-10 cm dark greyish brown loamy sand with ferruginous nodules common, pH 6.3 (5.2 CaCl₂)

10-40 cm pale brown coarse sand, with many ferruginous nodules, pH 7.1 (5.9 CaCl₂)

40-75 cm yellow with orange mottles common, sandy clay with very few ferruginous nodules, pH 6.1 (5.7 CaCl₂)

75-125 cm yellowish red medium clay, with distinct tongues of light grey with pale yellow mottles, medium clay with few ferruginous nodules, pH 7.0 (6.1 CaCl₂)

125-150 cm brownish yellow coarse sandy clay loam, with distinct tongues as above, with few ferruginous nodules and occasional flecks of calcium carbonate, pH 6.8

150-190 cm light grey with orange mottles common, medium clay with very few ferruginous nodules and occasional flecks of calcium carbonate, pH 8.0

**Distinguishing features**
- The surface material is a coarse loamy sand to sand, overlying a sandy clay at about 40 cm. There are small amounts of ferruginous nodules throughout the profile and calcium carbonate appears as small flecks and spots below 125 cm. Mottled light grey clay is present as tongues below 75 cm.
- The profile is slightly acidic in the upper horizons but becomes alkaline below 125 cm.
- The soil occurs on broad valley floors.
- The native vegetation is dominated by wandoo (Eucalyptus wandoo).
- Map 4 provides an indication of the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry - good
Soil workability - good
Water availability - moderately good
Nutrient status - moderate, apart from phosphorus

Limitations
Drainage - through-drainage is impeded by the subsoil clay, resulting in waterlogging in wet periods. Surface drainage (W-drains) can be used to remove excess water to main creeks.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, cereal crops grow reasonably well.

Pastures - subterranean clovers are the appropriate pasture legumes.

Soil conservation
Waterlogging of these flat and very gently sloping soils is a common problem in wet periods.

Soil salinity can be a serious problem when shallow groundwaters develop.

Water conservation
The sandy surfaced soil is not satisfactory for natural water catchments. Roaded catchments can be constructed if the depth to clay is not greater than about 45 cm. The soil is suitable for excavated dams, except where shallow saline groundwaters are present.

Map 4
**Classification**  Australian Great Soil Group: Siliceous sand overlying a truncated lateritic profile

Northcote: Uc 2.32  Local name: None

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**Soil profile description**

(See Figure 5, colour photograph inside back cover)

0-10 cm grey sand, pH 6.0 (4.6 CaCl₂)

10-50 cm very pale brown sand, pH 5.9 (4.7 CaCl₂)

50-75 cm pale yellow with few faint orange mottles, sand, pH 6.7 (5.7 CaCl₂)

75-100 cm red sandy clay loam with tongues of pale yellow with few faint orange mottles, sandy clay, pH 6.5

100-150+ cm brownish yellow with many grey mottles, massive continuous cemented material pH 7.7 (6.3 CaCl₂)

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**Distinguishing features**

- The profile is a deep pale coloured sand overlying a truncated lateritic profile.
- The profile is slightly acidic in reaction, apart from the cemented horizon below 100 cm depth.
- The soil occurs on valley sides below areas of lateritic soils or remnant laterite outcrops.
- The native vegetation is commonly wandoo (Eucalyptus wandoo) and sheoak (Casuarina heugeliana).
- Map 5 presents an indication of the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
- Water entry and drainage - good
- Soil workability - good

Limitations
- Water availability - low
- Nutrient status - low

Agronomic considerations

Crops - given appropriate fertilizer and rotation practices, cereals can be grown, but are marginal. Lupins grow well on this soil.

Pastures - lupins are the most suitable fodder plant for this soil.

Soil conservation

Wind erosion from summer grazing and during crop establishment can occur. Minimum cultivation systems with good stubble management are required. Water erosion also occurs, particularly where the soil is situated below rock or laterite outcrops.

Water conservation

The soil is unsuitable for water catchments or farm dams.

Map 5
Classification
Australian Great Soil Group: Solonetz
Northcote: Dy 5.43
Local name: Salmon gum

Soil profile description
(See Figure 6, colour photograph inside back cover)

0-3 cm dark greyish brown sand, pH 5.9 (4.6 CaCl₂)
3-5 cm light brownish grey clayey sand, pH 6.2
5-30 cm light brownish grey with many distinct brown mottles, sandy clay, columnar structure, pH 7.4 (6.0 CaCl₂)
30-60 cm light grey with few faint orange mottles, sandy clay, pH 9.3 (8.0 CaCl₂)

60-90 cm yellow with many distinct grey mottles, light medium clay with few calcium carbonate nodules, pH 9.3 (8.2 CaCl₂)

90-125 cm yellowish brown with grey mottles common, clayey sand with very few quartz fragments, pH 9.1 (7.9 CaCl₂)

125-175+ cm brownish yellow with many grey mottles, medium clay, with few manganiferous segregations, pH 8.3 (7.6 CaCl₂)

Note: Saline groundwater present at 170 cm.

Distinguishing features
- The profile is a very shallow sand over a dense, darkly mottled sandy clay subsoil which has a distinctly domed surface. The deeper subsoil is mainly yellow clay with a few calcium carbonate segregations between 60 and 90 cm depth.
- The shallow sandy surface is slightly acidic in reaction, but the subsoil is strongly alkaline.
- The soil occurs on flat valley floors.
- The native vegetation is dominated by salmon gum (*Eucalyptus salmonophloia*).
- Map 6 indicates the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Soil workability - good, if subsoil is below depth of cultivation; very shallow surface horizon produces an admixture of subsoil clay and results in a very hardsetting surface.

Limitations
Water entry - usually limited by shallow dense subsoil clay.
Nutrient status - poor due to shallow surface sand and highly alkaline and sodic subsoil.
Water availability - limited due to restricted root penetration of dense clay subsoil.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, oats is the most suitable crop for this soil. Crops should be sown early to avoid waterlogging and germination failure. Direct-drilling should be used. Lupins do not do well due to restricted root penetration and highly alkaline subsoils.
Pastures - medics are the appropriate pasture legumes.

Soil conservation
Salinity, due to shallow saline groundwater, can occur, particularly in areas close to major drainage problems. Shallow drains can be used to remove excess surface water, and flood control levees employed to prevent the spread of upper catchment runoff water.

Water conservation
The soil sheds well for water catchments if slope is adequate. Dams excavated in this soil hold water satisfactorily but care is needed to ensure shallow saline groundwaters are not present. Dam walls can collapse during sudden wetting due to the sodicity of the subsoil.

Map 6
**Classification**  Australian Great Soil Group: Lithosol  
Northcote: Uc 1.22  
(probably truncated Uc 3.32)  
Local name: Sandy ironstone

**Soil profile description**  
(See Figure 7, colour photograph inside back cover)

<table>
<thead>
<tr>
<th>Depth Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 cm</td>
<td>Greyish brown loamy sand with few ferruginous nodules, pH 6.7 (5.5 CaCl₂)</td>
</tr>
<tr>
<td>10-50 cm</td>
<td>Weakly cemented continuous sesquioxide pan, massive and pisolithic</td>
</tr>
<tr>
<td>50-175+ cm</td>
<td>Strongly cemented continuous massive sesquioxide pan</td>
</tr>
</tbody>
</table>

**Distinguishing features**
- The soil is a very shallow loamy sand over an indurated laterite.
- The surface soil is slightly acidic in reaction.
- The soil occurs on upper slopes and ridges.
- The native vegetation is a mixture of wandoo (*Eucalyptus wandoo*), morrel (*E. oleosa* var. *longicornis*) and sheoak (*Casuarina heugeliana*).
- Map 7 provides an indication of the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Soil workability - good, except where the indurated material occurs within the depth of cultivation.

Limitations
Water entry and drainage - restricted by shallow indurated material.
Water availability - very low.
Nutrient status - very low.

Agronomic considerations
Crops - yields of all cereals limited by shallow soil. Oats and peas for grazing are the most successful. Lupins are not suitable for this soil.
Pasture - subterranean clover is the appropriate pasture legume.

Soil conservation
Water erosion can occur, particularly when there is runoff from upslope. Contour working is possible, but contour earthworks can not be constructed because of the nature of the subsurface material. Removal of the surface soil by water and wind exposes a completely unproductive surface.

Water conservation
The soil is only moderately suitable for water catchments, but is unsuitable for dams.
Classification
Australian Great Soil Group: Solonized brown soil  Northcote: Gc 2.22  Local name: Morrel

Soil profile description
(See Figure 8, colour photograph inside back cover)

- 0-10 cm dark brown loam, pH 6.8 (5.8 CaCl₂)
- 10-30 cm brown clay loam with very few ferruginous nodules, pH 8.1 (6.7 CaCl₂)
- 30-80 cm very pale brown light clay, calcareous, pH 8.9 (7.8 CaCl₂)
- 80-150+ cm yellowish red with grey mottles common, medium clay, with very few manganiferous nodules, highly calcareous, pH 9.4 (8.1 CaCl₂)

Distinguishing features
- The profile increases in texture from loam at the surface through clay loam and light clay to medium clay by 80 cm. Colours are generally brown to 80 cm, then yellowish red.
- Large amounts of finely divided calcium carbonate are present in the subsoil, particularly below 80 cm. This soil type frequently has large quantities of calcareous nodules present in the profile and is often highly calcareous to the soil surface.
- The soil surface is near neutral in reaction becoming highly alkaline by 30 cm depth.
- The soil commonly occurs on gently sloping land surfaces, frequently to the east and south-east of salt lakes.
- The native vegetation is morrel (*Eucalyptus oleosa* var. *longicornis*) and salmon gum (*E. salmonophloia*) woodland.
- Map 8 provides an indication of the area within which this soil most commonly occurs in the Narrogin advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Soil workability - good

Nutrient status - reasonably good, particularly for potassium

Water entry and drainage - good

Limitations
Water availability - limited by osmotic effects of high concentrations of soluble salts in the soil solution.

Salinity - subsoils are always saline and removal of surface soil by erosion results in serious salinity problems.

Agronomic considerations
Crops - soil salinity and alkalinity limit productivity of cereals; cereal rye is the most adapted to these conditions. Barley and oats are more tolerant than wheat. Lupins usually cannot be grown satisfactorily on this soil.

Pastures - medics are the pasture legume of choice for this soil, because of the alkaline conditions. Salt tolerant shrubs (saltbush and bluebush) can provide a viable alternative in many areas, particularly those where salinity problems have been aggravated by wind erosion.

Soil conservation
Wind erosion and salinity problems are closely associated on this soil. Adoption of farming practices to minimize wind erosion of the fine and loose surface soil is essential if serious loss of production resulting from soil salinity in the exposed subsoil is to be avoided. Soil salinity due to shallow groundwater does not usually occur on the soil.

Water conservation
Dams excavated in this soil usually do not hold water satisfactorily. Natural catchments are not very efficient and roaded catchments do not perform well.
FIGURE 1. Yellow podzolic

FIGURE 2. Solodic (York gum/jam soils).

FIGURE 3. Yellow podzolic

FIGURE 4. Solodized alluvial soil. (Wandoo flats)

FIGURE 5. Siliceous sand

FIGURE 6. Solonetz (Salmon gum)

FIGURE 7. Lithosol (Sandy ironstone)

FIGURE 8. Solonized brown soils (Morrel)