



*Understanding and Managing Soils in the  
Central Highlands*

**Field  
Manual**

*by G.F. Bourne  
and G.A. Tuck*

*edited by R.N. Thwaites  
and J.M. Maher*

*Land Management Manual Project*

## Queensland Government Technical Report

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Training Series QE93002

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by  
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# Introduction 1

The Land Management Manuals Project is a Department of Primary Industries 'self-help' initiative to aid decision making for sustainable land management and planning. The Land Management Manual provides a collation of currently available and up-to-date land resources data, combined with local experience and knowledge in the district.

They are designed for use by:

- extension staff dealing with land and water use issues
- farmers and farming groups eg. landcare for property management planning and catchment planning
- planners and consultants for regional and strategic planning and for the protection of good quality agricultural land
- other interest groups, such as land valuers, educators, rural banks, and prospective property buyers

Farmers and graziers will find the summary sheets that contain land use information and recommendations for each major soil in the district particularly useful. They aim to increase the awareness, and aid the understanding, of land resources information within the community to encourage its adoption through land management recommendations. Terminology is simplified and standardised to aid the communication of land resources information within and across districts. Manuals provide a handy tool for users to identify and evaluate their soils, or those under investigation, largely for themselves. We believe this is a big step towards the linking of soils information to the management of properties or districts, and to local planning; the ultimate aim always being to support optimising production whilst minimising land degradation.

The Land Management Manual package has three major parts contained within the folder.

- The **Field Manual**: the core and most important component of the package. It provides a summary of the region's soil and land characteristics appropriate to management and recommendations for their use. The manual provides guidelines on how best to identify the AMUs (soil groups), then use this information for decisions on appropriate land management. Various visual aids are provided for this purpose, including

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maps, keys, tables, summary cards and landscape and soil photographs.

- The ***Resource Information***: a reference document that emphasises the importance of soils in relation to land use and management. It provides a regional overview of climate, vegetation, geology and current land use. To support the information contained in the Field Manual, this document explains local land resource-related aspects in more detail. Information gathered from cropping areas is more reliable compared to grazing areas, because of the greater intensity of investigations in the cropping areas.
- ***The Land Resource Areas (LRA) map***: a full colour map showing the distribution of Land Resource Areas (**not** soils) within the district.

We are using the ring-binder format for these reasons:

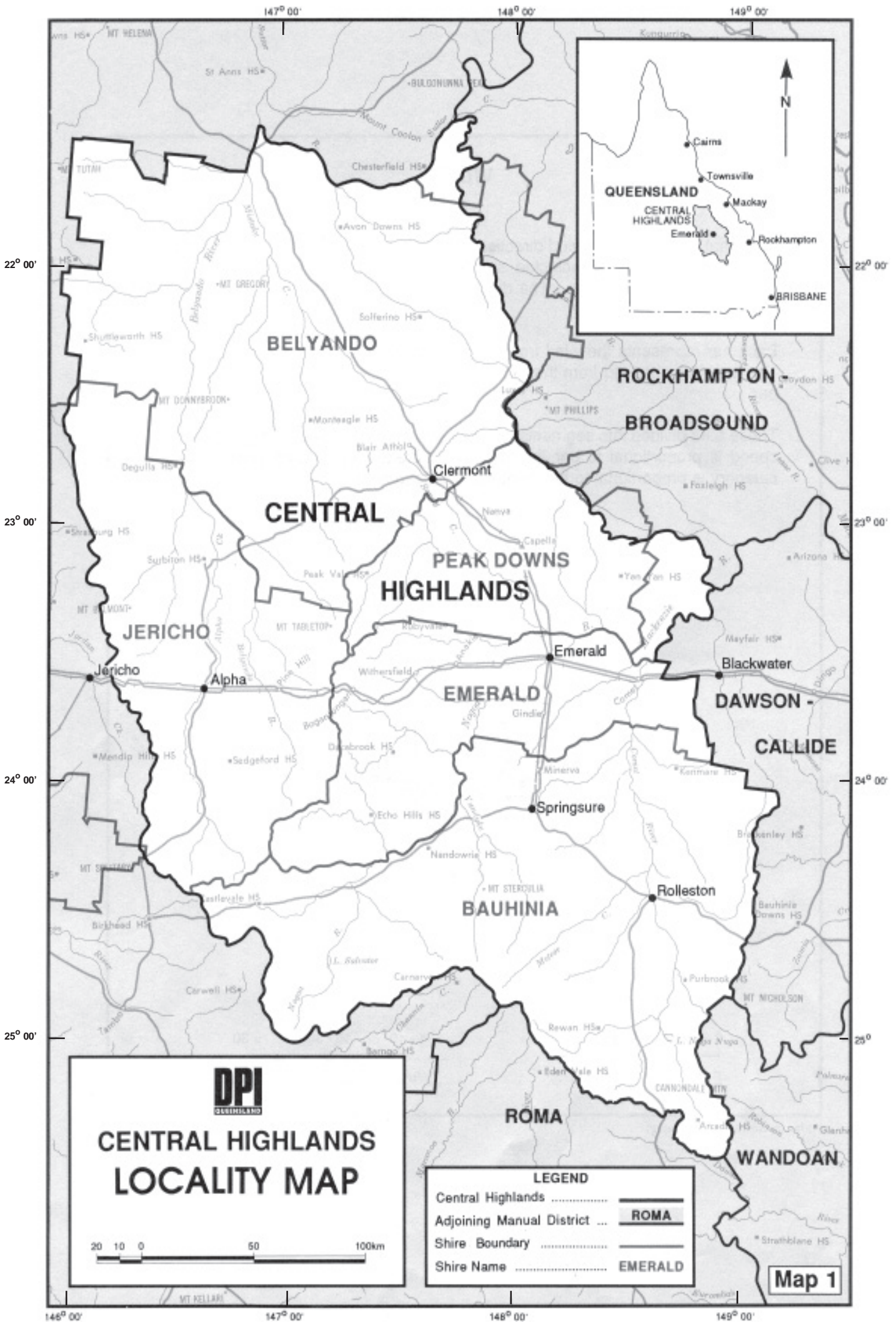
- to include updated information inexpensively and simply,
- to allow selective removal of the AMU summary sheets for convenient use in the field or at planning meetings, and
- the more relevant and important AMU summary sheets and related information can be repositioned in a place that is more easily accessible.

## Project Area

The Central Highlands covers 8 645 670 ha comprising the shires of Emerald, Bauhinia and the majority of Belyando and Peak Downs. It also encompasses the eastern half of Jericho Shire (up to the watershed of the main range) and small segments of the western parts of Nebo and Broadsound Shires. The north-eastern boundary of the manual district is dictated by the limit of land resource information at a satisfactory resolution. The western boundary coincides with the CSIRO Lands of the Nogoia - Belyando Area study (Gunn et al. 1967). The major towns in this area are Moranbah, Clermont, Capella, Emerald, Springsure and Rolleston.

The project area and its relationship to manuals in surrounding regions are shown in Map 1.



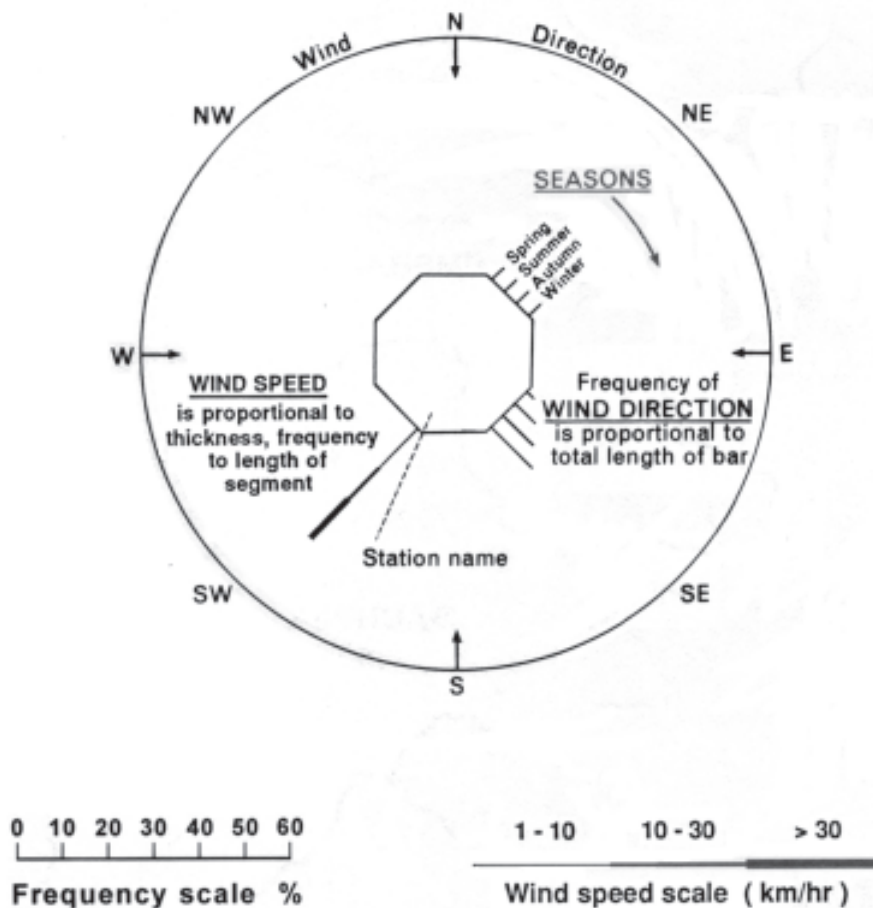


# WIND

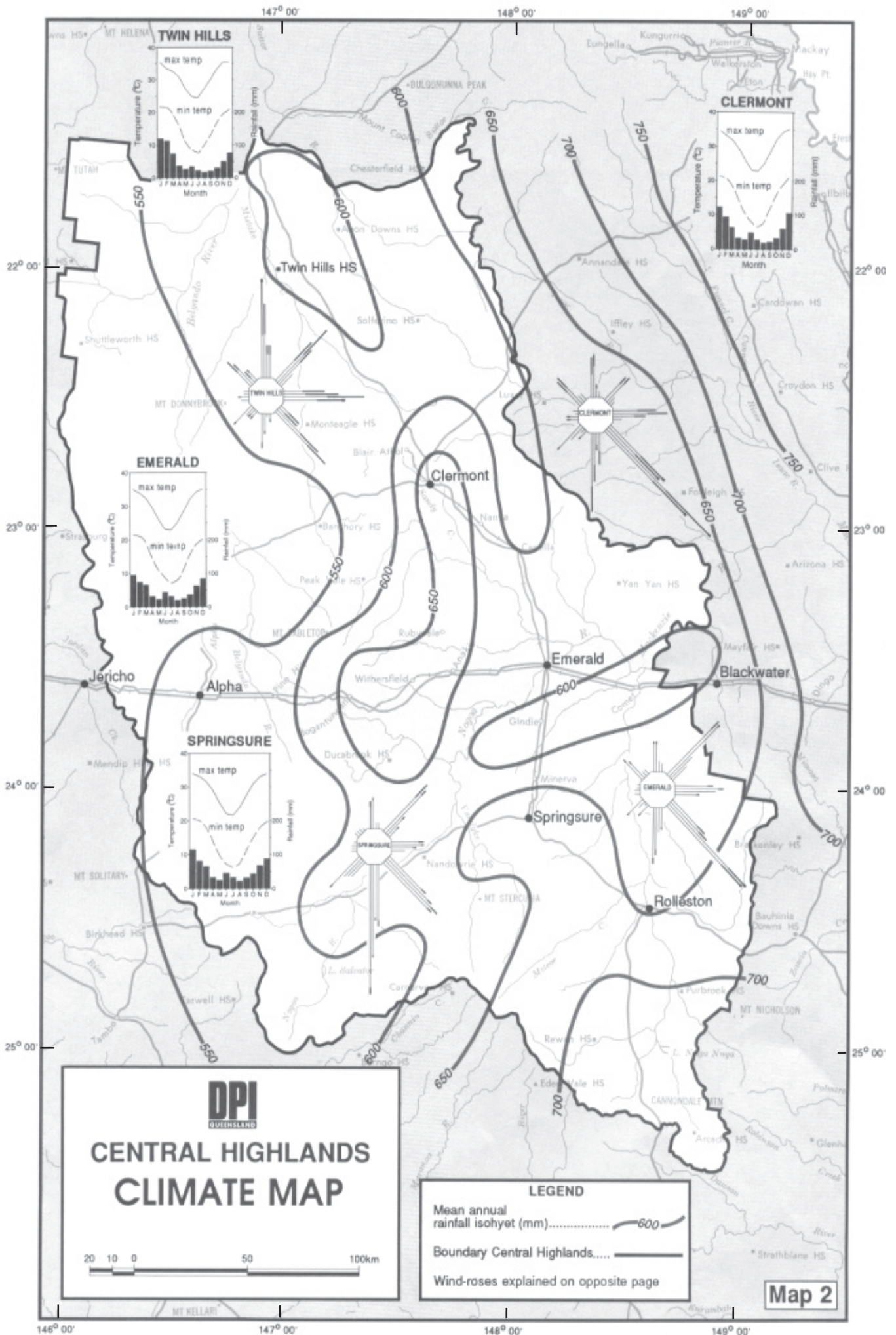
Seasonal frequencies of wind direction and speed, based on at least 21 years of records, are shown for selected stations by wind roses. Wind speeds were recorded at 9am each day. The diagram below shows how to interpret a wind rose.

Each bar represents the wind from a particular direction for a particular season. The frequency of wind from that direction is proportional to the total length of the bar.

Those bars divided into segments consider different wind speed categories. Wind speed is proportional to bar thickness. The frequency of wind speed in each category is proportional to the length of each segment.



Refer to Climate Map (Map 2)



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## The basis of the Manual

To make the best use of this manual it is essential to understand the two major notions that are the basis of the soils information. These are the 'Land Resource Area' (LRA) and the 'Agricultural Management Unit' (AMU). They are both defined in Section 5 of the Resource Information and Section 3 of the Field Manual, but it is as well to reiterate them here.

The whole landscape is divided into six Land Resource Areas (LRAs) which appear on the map in the back pocket. These are **landscape** units, not soils, and they help to reduce the complexity of what is a very complex landscape to easily-handled proportions. The AMUs are actually soil management groups, amalgamated on the basis of their similar characteristics for land management. They are not necessarily individual soil types and they are **not** mapped. It is because little mapping has been undertaken for the district that we are producing a manual such as this.

## Linking with 'land types'

A system of landscape classification exists for the management of grazing country. Like LRAs this other system, using 'land types', groups areas of land that are similar. But in this case, land types are grouped more by vegetation than by soil, geology and topography. These land types are regarded as indicators of production potential. This manual contains a reference to land types developed for the Central Highlands and links them, where possible, to the major AMUs (i.e. soil management groups) discussed in this manual.

# Using the Field Manual **2**

A summary of the land use potential and land management information for the Central Highlands is presented in this *Field Manual*. The primary aim of this manual is to provide land use and management recommendations that apply to soils which are readily identified by you.

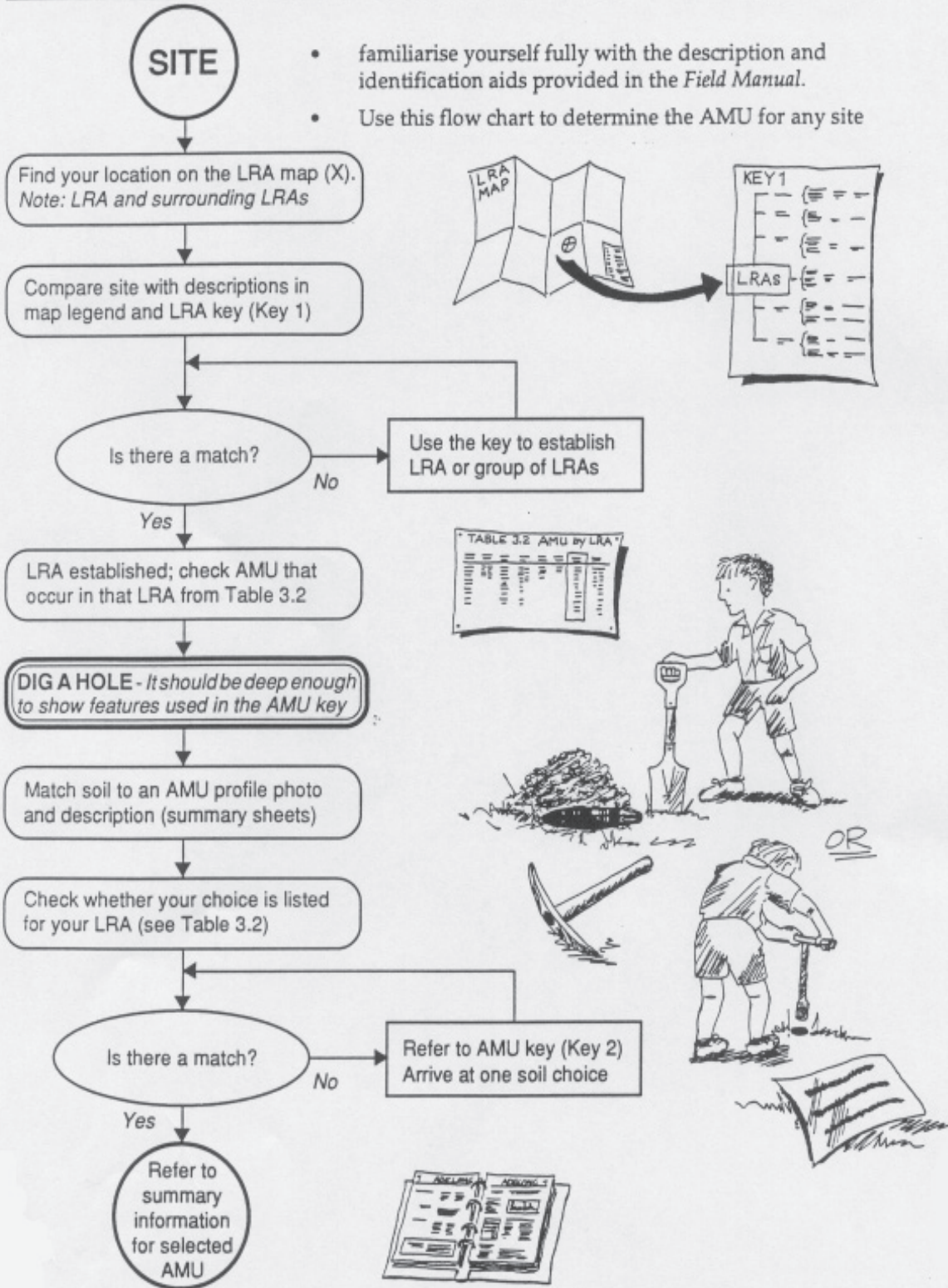
There are three major steps in using this manual - they are:

1. Establishing a specific Land Resource Area (LRA).
2. Determining the relevant Agricultural Management Unit (AMU).
3. Seeking the relevant land use and management information for the AMU.

The method of doing this is set out in more detail in the flow chart overleaf. To aid identification of both LRAs and AMUs, simple keys are provided (Key 1 for the LRAs; Key 2 for the AMUs). From working through the keys from left to right you can determine the LRA and AMU which relate to the site you are investigating. When using the flow chart or keys, matching descriptions does not imply they must be 'identical', but rather that they should be similar in most aspects.

As you gain knowledge of the land resources it will be possible to identify both the LRA and AMU using only the summary information from the *Field Manual*. This summary information includes the LRA map and LRA key, as well as the AMU key, representative soil photographs and a summary description of each soil. It must be stressed that the soil profile photo and accompanying description represent **one example** in the range of soils found within the AMU. However, this soil does dominate within the AMU, and as such, it is used to characterize that particular AMU.

# Determining the major soil for any site



# The land resources and land management **3**

## **Introduction**

The land resources of an area should first be documented in order to define their agronomic and land management requirements. Because of the broad scale and variable intensity of this information the land resources of the Central Highlands have been classified at two levels: the Land Resource Area (LRA) and the Agricultural Management Unit (AMU). The soils in the district have not been mapped in detail but their character and pattern of distribution can be determined by recognisable patterns of vegetation, landform and geology.

On a broad scale, Land Resource Areas can be identified by these landscape patterns. Geology is the dominant criterion for the Central Highlands. At the detailed scale, soil types are obviously more complex and varied. The main types have been amalgamated into management units (ie. AMUs) which are groups of similar soils with properties that allow similar land management and conservation requirements.

## **Land Resource Areas**

**Land Resource Area (LRA)** - a pattern of soils, vegetation and landform developed on common or related geological units. It is essentially a mapping unit.

Six LRAs were delineated in the Central Highlands. Their distribution is shown in Map 3. For more detailed information, the distinguishing features of the LRAs are given in Section 5 of the *Resource Information*. The key to the LRAs is presented in this *Field Manual* (see Key 1) along with the representative landscape photographs of the LRAs.

**Key 1. Key to identifying Land Resource Areas of the Central Highlands  
(refer to the LRA map)**

Landform	Vegetation/Soils	Land resources Area(LRA)
<ul style="list-style-type: none"> <li>• <b>Level alluvial plains</b></li> </ul>	<p>Eucalypt woodlands with poplar box and coolibah, includes brigalow and minor brigalow/gidgee scrub</p> <p>Mainly deep cracking clays, non-cracking clays, uniform sandy loams and duplex soils formed from alluvium</p>	<p><b>ALLUVIAL PLAINS</b></p>
<ul style="list-style-type: none"> <li>• <b>Gently undulating to undulating plains and rises</b></li> </ul>	<p>Scrub brigalow, gidgee, blackwood, bonewood, poplar box, belah, Dawson gum</p> <p>Cracking clays, solodic soils, red-brown earths, non-cracking clays and minor occurrence of earths</p> <hr/> <p>Woodland of poplar box, silver leaved ironbark, narrow leaved iron bark</p> <p>Mainly solodic soils with areas of red-brown earths; minor non-calcic brown soils and sands</p> <hr/> <p>Mainly grasses with scattered mountain coolibah, bloodwood, silver leaved ironbark</p> <p>Black, brown and grey cracking and non-cracking clays, shallow to moderately deep, frequently stony</p>	<p><b>UNDULATING SCRUB PLAINS</b></p> <p><b>EUCALYPT DUPLEX PLAINS</b></p> <p><b>UNDULATING DOWNS</b></p>
<ul style="list-style-type: none"> <li>• <b>Gently undulating plateaus, plains and fans</b></li> </ul>	<p>Woodlands of silver and narrow leaved ironbark, bloodwoods, Moreton Bay ash, ghost gum; minor yellowjack; midstory of wattles and desert oak</p> <p>Red and yellow earths; minor solodics and deep sands</p>	<p><b>PLATEAUS</b></p>
<ul style="list-style-type: none"> <li>• <b>Hills, mountains, dissected plateaus and mesas</b></li> </ul>	<p>Stony shallow soils, shallow sands and loams, minor red and yellow earths, red-brown earths, solodics and non-calcic brown soils</p>	<p><b>RANGES</b></p>



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## **Agricultural Management Units**

**Agricultural Management Units (AMU)** - a group of soils with similar agricultural and soil conservation management requirements within an LRA. An LRA may be composed of one or more AMUs. An AMU is essentially a management unit.

Eighteen AMUs were recognised in the Central Highlands (a summary of their distinguishing morphological features is given in Table 5.2 of the *Resource Information*) and a summarised description outlining the central concept for each is given in Table 3.1. Keys to these AMUs are presented below (see Key 2). Photographs of the soils together with descriptions are presented in Chapter 4 of the *Field Manual*. The AMUs likely to occur in each LRA are found in Table 3.2.

## Key 2. Keys to identifying Agricultural Management Units (AMU) of the Central Highlands

## 1. Alluvial Plains LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU	
Uniform Clays	Heavy cracking clay with a strong but thin (about 2 mm) mulch; may have thin sandy crust	Dark, uniform and deep (more than 90 cm) heavy clays on flat to gently undulating floodplains. Dense brigalow, coolibah scrub much of which now extensively cultivated. Shallow gilgai can occur.	ADELONG	
	Medium cracking clay with finer and deeper (2-5 mm) mulch than the above	Deep reddish brown to grey clay under open coolibah. Well drained. Commonly river deposited material associated with basaltic or shale downs. Shallow gilgai can occur.	MORAMANA	
	Cracking and non-cracking grey to brown clay with a sandy crust, a coarse mulch or hard setting surface	Severe surface and/or subsoil physical limitations indicated by prolonged water-logging, regularly water stressed plants, or bare areas. Very coarse surface mulch or crust.	Open woodlands of poplar box, brigalow and bauhinia with associated species. May have restricted depth due to gravel layering or high salinity below 50 cm depth. Differs from ROLLESTON AMU in severity of physical restrictions to plant growth.	COLLEGE
		Open grassland with isolated, severely stunted brigalow clumps. High salinity below 30 cm and acidic below 50 cm. Restricted occurrence to an area north of Kilcummin.	DOORUNA	
	Deep clays (more than 90 cm), with typical vegetation of whipstick or moderately stunted brigalow and eucalyptus (mainly Dawson gum). Subsoils are normally pale coloured and mottled below 60 cm. Drainage is restricted. Surface gravel can occur.	gilgai either absent or less than 40 cm deep.	ROLLESTON	
	gilgai more than 40 cm deep.	LONESOME		

<b>Duplex Soils</b>	<b>Sandy loam, hard setting</b>	<b>Pale grey to brown, moderately deep (20 to 45 cm to clay) sandy loam surface</b> overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark woodlands with associated brigalow, currant bush and others.	<b>LASCELLES</b>
		<b>Deep sandy loam surface soil</b> (more than 45 cm to clay)	<b>ISAAC</b>
		<b>A thin sandy surface layer</b> (less than 10 cm) overlies deep, moderately well drained grey or brown clay. Tall brigalow, belah and Dawson gum are typical. Forms a uniform clay with a sandy clay surface following cultivation.	<b>TURKEY CREEK</b>
	<b>Loose, coarse sandy, to firm</b>	Tall open blue gum, Moreton Bay ash or river red gum forest with associated species. <b>Deep sandy surface soil</b> (more than 45 cm to clay)	<b>ISAAC</b>
<b>Deep Uniform Sandy Soils</b>	<b>Loose, coarse sandy, to firm</b>	Tall open blue gum, Moreton Bay ash forest with associated species. <b>Deep sandy loams</b>	<b>ISAAC</b>

## 2. Undulating Scrub Plains LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU
	<b>Heavy cracking clay with a strong but thin</b> (about 2 mm) <b>mulch</b> ; may have thin sandy crust	<b>Dark, uniform and deep</b> (more than 90 cm) <b>heavy clays</b> on flat to gently undulating floodplains. Dense brigalow, coolibah scrub much of which now extensively cultivated. Shallow gilgai can occur.	<b>ADELONG</b>
	<b>Cracking</b> and forming a <b>fine, 'soft' mulch</b>	<b>Red, brown to dark grey soils under gidgee, brigalow and softwood scrub.</b> Extensively cultivated. Deep (more than 90 cm), well structured clays often with shallow gilgai less than 40 cm deep.	<b>PICARDY</b>
<b>Uniform clays</b>	<b>Cracking or non-cracking with sandy crust, coarse mulch or hard setting surface</b>	<b>Grey, brown heavy clays typically under whipstick or slightly stunted brigalow scrub with associated eucalyptus</b> (mainly Dawson gum) and a range of understorey species. Subsoils are pale coloured and often mottled below 60 cm depth. Drainage is restricted.	
		<sup>1</sup> <b>Gilgai absent or less than 40 cm deep</b>	<b>ROLLESTON</b>
		<sup>1</sup> <b>Gilgai more than 40 cm deep</b>	<b>LONESOME</b>
		<b>Mainly reddish brown to brown often non-cracking and gravelly clay.</b> Distinctive coarse-structured subsoil at 30 cm depth which is indicated by surface waterlogging and reduced water storage capacity (i.e. regularly water stressed plants). Soil depth is greater than 45 cm but often less than 90 cm to rock or gravel. Vegetation commonly brigalow, Dawson gum, bendee or gidgee scrub.	<b>SPRINGTON</b>

Duplex soils

Sandy loam, hard

**Pale grey to brown shallow sandy loam surface** (less than 20 cm to clay) overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark wodlands with associated brigalow, currant bush and others.

**GLENGALLAN**

**Reddish brown sandy loam to clay loam overlies moderately well drained** (i.e. few mottles) **clay subsoils**. Open ironbark, brigalow or box with associated species.

**GLENIDOL**

**A thin sandy duplex soil** under brigalow, belah, Dawson gum scrub. *After cultivation*, a sandy clay surface plough layer to 20 cm forms.

**TURKEY  
CREEK**

## 3. Eucalypt Duplex Plains LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU
Duplex soils	Sandy loam, hard setting	<p><b>Pale grey to brownish yellow sandy loam</b> over hard and coarse mottled clay which is poorly drained. <b>Soil immediately above the clay is often bleached and, or gravelly.</b> Poplar box, ironbark, brigalow are the dominant trees. Separated on basis of depth of surface horizon:</p> <ul style="list-style-type: none"> <li>• <b>Shallow sandy loam</b> (less than 20 cm to clay)</li> <li>• <b>Moderate depth sandy loam</b> (20 to 45cm to clay)</li> <li>• <b>Deep sandy loam</b> (more than 45 cm to clay)</li> </ul>	<p><b>GLENGALLAN</b></p> <p><b>LASCELLES</b></p> <p><b>DUCKPONDS</b></p>
		<p><b>Reddish brown sandy loam to clay loam</b> with ironbark, brigalow or box. <b>Usually no bleach or mottling.</b> Often a gravelly surface. Clay subsoils are moderately well drained although quite hard when dry.</p>	<p><b>GLEN IDOL</b></p>
		<p><b>A thin sandy surface layer</b> (less than 10 cm) <b>overlies deep, moderately well-drained grey to brown clay.</b> Forms a sandy clay topsoil following cultivation. Vegetation is tall brigalow, belah, Dawson gum and associated species.</p>	<p><b>TURKEY CREEK</b></p>
		<p>Deep sands or sandy loams of red, yellow to pale brown earths. Tall open bloodwoods, ironbark, cypress pine and a range of associated species</p>	<p><b>DUCKPONDS</b></p>
Deep, uniform, sandy	Loose to firm; very sandy		

#### 4. Undulating Downs LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU
	<b>Strong, often coarse self-mulching but thin</b> (about 2mm)	Dark to reddish brown heavy clay which is well structured and <b>greater than 45 cm deep to parent rock</b> (normally basalt). Open downs country with scattered ironbark, mountain coolibah, bloodwood. Areas of surface stone occur.	<b>ORION</b>
		As for ORION AMU but <b>less than 45 cm to parent rock</b> . Surface stone common.	<b>JIMBAROO</b>
<b>Uniform clays</b>	<b>Strong, finer and deeper self-mulch</b> (about 4 to 5 mm) than above; often forms a thin, fine sandy crust	<b>Moderately deep black heavy clay downs country. Greater than 45 cm depth</b> and commonly 1.0 to 1.4 metres to parent rock of shale or mudstone. Well structured subsoils. (Majority of these soils restricted to the south-west of Springsure).	<b>KIA-ORA</b>
	<b>Medium cracking clay with finer and deeper</b> (2 to 5 mm) <b>self-mulch</b> than the above	<b>Deep reddish brown to grey clay</b> under open coolibah. Well drained. Commonly river deposited material associated with basaltic or shale downs. Shallow gilgai can occur.	<b>MORAMANA</b>
<b>Shallow, uniform non-cracking clay or Duplex soils</b>	<b>Firm to hard setting, often stony</b>	<b>Shallow (less than 45 cm)</b> . Texture contrast or uniform clay soils associated with open downs. Commonly reddish brown colour.	<b>JIMBAROO</b>
<b>Duplex soils</b>	<b>Sandy, loam,hard setting</b>	<b>Reddish brown sandy loam to clay loam</b> with ironbark, brigalow or box. <b>Usually no bleach or mottling</b> . Often a gravelly surface. Clay subsoils are moderately well drained although quite hard when dry.	<b>GLEN IDOL</b>

## 5. Plateaus LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU
Duplex soils	Hard setting to firm	The depth of the sandy loam layer to clay is the distinguishing feature:	
		<sup>1</sup> greater than 45 cm to clay or gravel	DUCKPONDS
		<sup>1</sup> between 20 and 45 cm to clay or gravel	LASCALLES
		Reddish brown sandy loam to clay loam overlies moderately well-drained (i.e. few mottles) clay subsoils. Open ironbark, brigalow or box with associated species.	GLEN IDOL
Deep uniform sandy soils	Loose to firm	Sandy and uniform greater than 45 cm deep. Tall bloodwood, ironbark, cypress pine and a range of associated species.	DUCKPONDS
Shallow, rocky soils	Rocky, gravelly or sandy	Includes the range of shallow, rocky and infertile soils associated with dissected ranges and plateaus.	HIGHLANDS



## 6. Ranges LRA

SOIL TYPE	SOIL SURFACE	OTHER DISTINGUISHING FEATURES	AMU
Shallow, rocky duplex soils and earths	Rocky, gravelly or sandy	Includes the range of <b>shallow, rocky and infertile soils</b> associated with dissected ranges and plateaus.	HIGHLANDS
Duplex soils	Hard setting sandy loam	<p><b>Pale grey to brown, moderate depth sandy loam surface soil</b> (20 to 45 cm to clay) overlies very hard, coarse and mottled clay subsoils. Very poorly drained, and a bleached soil layer above the clay is common. Open box, ironbark woodlands with associated brigalow, currant bush and others:</p> <p><b>Reddish brown sandy loam to clay loam</b> with ironbark, brigalow or box. <b>Usually no bleach or mottling.</b> Often a gravelly surface. Clay subsoils are moderately well-drained although quite hard when dry.</p>	LASCELLES  GLEN IDOL

Table 3.1. *Summarised descriptions of Central Highlands AMUs*

<b>AMU</b>	<b>Concept</b>
<b>Adelong</b>	Self-mulching, dark or grey cracking clays of brigalow/coolibah scrub with yellowwood on alluvial plains.
<b>College</b>	Coarse self-mulching or crusting, grey and brown cracking and non-cracking clays on alluvial plains and levees.
<b>Dooruna</b>	Coarse cracking grey clays on level plains with tussock grasslands and clumps of stunted brigalow and coolibah.
<b>Duckponds</b>	Deep, red and yellow sandy earths and duplex soils with a deep A horizon of plateaus, rises and fans.
<b>Glengallan</b>	Thin, sandy-surfaced yellow-brown duplex soils; hard setting surface overlies coarse, impervious clay subsoils under brigalow/eucalypt scrub.
<b>Glen Idol</b>	Red to brown duplex soils which are moderately structured and well drained under brigalow scrub.
<b>Highlands</b>	Shallow, gravelly soils on rugged uplands and dissected ridges.
<b>Isaac</b>	Deep, coarse and medium textured soils associated with alluvial levees and interchannel areas.
<b>Jimbaroo</b>	Shallow cracking and non-cracking clays on undulating open downs formed on basalt.
<b>Kia-Ora</b>	Black cracking clays with a strong fine granular surface mulch on undulating open downs formed on shales.
<b>Lascelles</b>	Hard setting, yellow-brown sandy duplex soils with hard, impervious clay subsoils.
<b>Lonesome</b>	Melonholed grey and brown clays on brigalow scrub plains.
<b>Moramana</b>	Deep, red-brown to grey uniform clays on broad to narrow, occasionally deeply incised, alluvial plains draining basalt landscapes.
<b>Orion</b>	Deep, cracking dark clays on undulating downs on basalt.
<b>Picardy</b>	Deep, red, brown to grey cracking clays under brigalow, softwood scrub or gidgee scrub.
<b>Rolleston</b>	Deep, cracking grey to brown clays formed from highly weathered sediments under brigalow/eucalypt scrub.
<b>Springton</b>	Red to brown cracking and non-cracking clays usually on upper slopes of undulating scrub country.
<b>Turkey Creek</b>	Grey to brown duplex soils with thin sandy surfaces on undulating brigalow scrub country.

**Table 3.2 Relationship of AMUs to LRAs**

LRA	AMUs	
	Major Occurrence	Minor Occurrence
Alluvial Plains	Adelong, Moramana, College	Dooruna, Isaac, Lascelles, Lonesome, Rolleston, Turkey Creek
Undulating Scrub Plains	Springton, Turkey Creek, Glengallan, Glen Idol	Adelong, Lonesome
Eucalypt Duplex Plains	Lascelles, Duckponds	Glengallan, Turkey Creek, Glen Idol
Undulating Downs	Orion, Jimbaroo	Kia-Ora, Glen Idol, Moramana
Plateaus	Duckponds	Glen Idol, Highlands, Lascelles
Ranges	Highlands	Lascelles, Glen Idol

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## Potential agricultural uses and management recommendations

The major agricultural enterprises undertaken in the Central Highlands are dryland cropping, beef production and some irrigated cropping. The suitability of each AMU has been assessed in terms of their potential for these three enterprises.

The land management recommendations for all AMUs are presented in Tables 3.3 and 3.4 for irrigated and dryland cropping and in Table 3.5 for grazing land. Specific information for each AMU is given in the summary sheets in Section 4.

These recommendations are based on advice from producers and Department of Primary Industries district officers. In some cases the recommendations have been modified to take account of soil properties that affect long term land use and management. A more detailed description of these properties, their effect on land use, and the management practices recommended to minimise their impact are given in Section 6 of the *Resource Information*.

The recommendations are based on the optimum management practices which will ensure sustained land use without degradation of either soil or site properties. This does not mean that the soil cannot be used for other higher return purposes, but they would require more intensive management practices which lead to higher inputs and costs, and land degradation potential.

Table 3.3 *AMU suitability for dryland agriculture*

AMU	Summer Crop	Winter Crop	Winter Forage	Summer Crop	Cropping System
Adelong (1) Kia-Ora (10) Moramana (13) Picardy (14) Orion (15) Turkey Creek (18)	S				Long term dryland cropping
Rolleston (16)	LS			S	Suitable for forage cropping
Glengallan (5) Springton (17)	NS				
Glen Idol (6)	NS	LS		NS	Limited suitability for winter forage and crops
College (2) Duckponds (4)	NS			LS	Limited suitability for summer forage cropping only
Dooruna (3) Highlands (7) Isaac (8) Jimbaroo (9) Lascelles (11) Lonesome (12)	NS				Not suitable for development for cropping

**S** suitable; the benefits from the land use outweigh required inputs to initiate and maintain production

**LS** limited suitability; the benefits from the land use are cancelled out by the required inputs to initiate and maintain production; long-term suitability is doubtful

**NS** not suitable; the benefits from the land use do not justify the required inputs to initiate and maintain production; limitations are too severe

**Table 3.4** *AMU crop suitability for irrigated and dryland cropping*

AMU	Cotton	Soybeans	Sorghum	Sunflowers	Wheat	Chickpeas	Winter Forage	Summer Forage
Adelong (1)	I/D	lr	I/D	I/D	I/D	I/D	I/D	I/D
College (2)	lr	lr	lr	lr	lr	lr	lr	I/D
Dooruna (3)	-	-	-	-	-	-	-	-
Duckponds (4)	lr	lr	lr	lr	lr	lr	lr	I/D
Glengallan (5)	-	-	-	-	-	-	I/D	I/D
Glen Idol (6)	lr	lr	lr	lr	I/D	I/D	I/D	lr
Highlands (7)	-	-	-	-	-	-	-	-
Isaac (8)	-	-	-	-	-	-	-	-
Jimbaroo (9)	-	-	-	-	-	-	-	-
Kia-Ora (10)	I/D	lr	I/D	I/D	I/D	I/D	I/D	I/D
Lascelles (11)	-	-	-	-	-	-	-	-
Lonesome (12)	-	-	-	-	-	-	-	-
Moramana (13)	I/D	I/D	I/D	I/D	I/D	I/D	I/D	I/D
Orion (14)	I/D	lr	I/D	I/D	I/D	I/D	I/D	I/D
Picardy (15)	I/D	lr	I/D	I/D	I/D	I/D	I/D	I/D
Rolleston (16)	lr	lr	lr	lr	lr	lr	I/D	I/D
Springton (17)	lr	lr	lr	lr	lr	lr	I/D	I/D
Turkey Creek (18)	I/D	lr	I/D	I/D	I/D	I/D	I/D	I/D

lr = Suitable for irrigated cropping only

I/D = Suitable for both irrigated and dryland cropping

Table 3.5 *Grazing management recommendations for each AMU*

AMU	Carrying capacity (ha/AE) Cattle		
	Unimproved native pasture	Improved native pasture	Sown pasture
Adelong (1)	25-50	10-12	3-5
College (2)	15-20	5-10	5-6
Dooruna (3)	6-7	n.a.	n.a.
Duckponds (4)	12-15	8	8
Glengallan (5)	40	10-15	7-8
Glen Idol (6)	40	10-12	3-5
Highlands (7)	50	n.a.	n.a.
Isaac (8)	8-10	6-8	5-6
Jimbaroo (9)	7-15	6-10	6-10
Kia-Ora (10)	4-5	n.a.	5
Lascelles (11)	15-50	15	12-15
Lonesome (12)	40-50	15-20	6-10
Moramana (13)	12-15	4-6	3-5
Orion (14)	4-5	n.a.	5
Picardy (15)	25	13	3-4
Rolleston (16)	25	10-15	7-8
Springton (17)	30-40	10-12	4-5
Turkey Creek (18)	40	10-15	3-4

AE = Adult Equivalent (See Glossary)

n.a. = not applicable

Unimproved native pasture = the land in its virgin state (uncleared)

Improved native pasture = the land with the timber cleared or thinned, and only native grasses

Sown Pastures = the land developed by the replacement of native grasses with buffel grass or the addition of shrubby legumes (e.g. seca stylo)





# AMU summary sheets 4

***Read this in conjunction with a set of the green sheets***

The following sheets provide summary information about each AMU, and its associated land use suitability and management. Soil and site descriptions presented here are directly relevant to decisions on land use and management. A set of limitations to land use have been deduced from these descriptions. Recommendations are given for crop suitability, land conservation practices and stocking rates.

## **AMU information**

The sheets provide photographs of the landscape and a representative soil profile for each AMU. These are accompanied by summary information on the representative soil's characteristics and chemical and physical properties.

**Site description:** summarises the environmental characteristics that relate to the AMU. The landscape photograph shows a typical example of the AMU landscape in as close to its natural state as possible.

**Representative soil profile:** it must be stressed that this comprises a photograph and description of a *representative* soil within the range of soils of the named AMU. The representative soil is usually the most commonly occurring within the AMU.

The soil description is simplified from the profile descriptions contained in Appendix III of the *Resource Information*, but is detailed enough to identify the soil. Soil colour, structure and types of inclusions are defined in the Glossary.

**Distinguishing soil properties:** briefly summarises the chemical and physical attributes of the soil which are relevant to land use.

## Chemical properties

Statements are made on the natural availability of the three major nutrient elements (nitrogen - N, phosphorus - P and potassium - K) in the top 10 cm of the soil. The availability of micronutrients is also mentioned if they are significant. The general ratings used for the interpretation of soil chemical analyses are given in Table 4.1.

A measure of soil acidity or alkalinity is given as pH for the surface soil. pH7 is neutral, less than 7 is acid and greater than 7 is alkaline. The pH trend with an increase in depth is also given. Further explanation of pH is given in the Glossary.

Salinity and sodicity within the profile are based on the chemical analyses of the soil samples taken for each representative soil. Salinity is based on the electrical conductivity (EC) value and relates to inherent salinity (that is, presence of salts in the profile). Sodicity relates to the exchangeable sodium percentage (ESP) value. The terms are defined in the Glossary.

## Physical properties

Statements are made on the following if relevant:

- surface condition - the character of the topsoil in its natural, uncultivated state;
- workability - the ease or otherwise of working the soil with machinery;
- infiltration and permeability - how readily water enters the top soil and moves through the profile;
- effective rooting depth - depth to which most plant feeder roots will penetrate;
- PAWC - Plant Available Water Capacity, or the ability of the soil to retain moisture for use by the crop or pasture within the rooting zone.

- drainage
  - how freely water moves through and out of, the soil; the drainage categories are defined in the Glossary and are given as:
    - very poorly drained
    - poorly drained
    - imperfectly drained
    - moderately well drained
    - well drained
    - rapidly drained

Table 4.1. Ratings used for interpretation of soil analyses

Soil Test	Units	Ratings				
		Very low	Low	Medium	High	Very high
EC	(dS/m)	<0.1	0.15-0.45	0.45-0.90	0.90-2.0	>2.0
Cl	(%)	<0.01	0.01-0.03	0.03-0.06	0.06-0.20	>0.20
P	(mg/kg)	<10	10-20	20-40	40-100	>100
Extr. K	(m.eq%)	<0.1	0.1-0.2	0.2-0.5	0.5-1.0	>1.0
Total N	(%)	<0.05	0.05-0.15	0.15-0.25	0.25-0.50	>0.50
Total P	(%)	<0.005	0.005-0.02	0.02-0.05	0.05-0.10	>0.10
Total K	(%)	<0.1	0.1-0.5	0.5-1.0	1.0-3.0	>3.0
PAWC	(%)	<5	5.1-8.0	8.1-12	12.1-15	>15

Source: Bruce and Rayment, 1982 (chemical analyses) Reid et al, 1979 (physical analyses)

<sup>1</sup> See reference list in Resource Information

<b>Land use information</b>	<b>Land use suitability:</b>	suitability for irrigated or dryland cropping and sown pastures is presented; commonly recommended crops and pastures are listed.
	<b>Land use limitations:</b>	includes aspects important to soil management.
	<b>Land conservation:</b>	includes statements on water erosion hazard and surface runoff; this information is provided because of the erratic nature of the rainfall, its short duration and high intensity.

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Soils are identified as *suitable*, of *limited suitability*, or *unsuitable* for conservation structures, strip cropping and dams. Soil conservation structures are otherwise classed as not applicable (*n.a.*) where soils are not suitable for cropping. This information is for guidance only - local DPI Land Conservation Officers should be consulted for more detailed advice.

**Stocking rates:** recommendations are given for cattle in Adult Equivalents (AE) which represents a 450 kg live weight, non-lactating bovine, and are guidelines only, as rates will vary depending on such factors as the intensity of management, pasture type, browse availability and seasonal conditions.

Estimated stocking rates are given for native pastures in both cleared and uncleared states, as well as sown legume and grass pastures. These estimates are the best figures that can be provided as general recommendations given current knowledge. Graziers should seek advice concerning stocking in specific areas.

Where a grazing management system is not practised for the given AMU the stocking rate is stated as being not applicable (*n.a.*).

**Management recommendations:** lists important recommendations for responsible land management which allow optimal land use with minimum land degradation.

These recommendations are based on the known inherent properties of the soils and the limitations they present to any land use.

# AMU summary sheets



## AMU description:

Self-mulching, dark or grey cracking clay of brigalow / coolabah scrub with yellowwood on alluvial plains

## Site description

### Landform

Wide, level, alluvial plains of major drainage lines. Low lying clay plains and interchannel areas are prone to flooding. Characterised by low local relief and slopes below 1%.

### Vegetation

Extensively cleared for farming. Dense brigalow scrub with coolibah and yellowwood and associated wilga and belah.



## Representative soil profile

Depth (m)	Description
0 to 0.05	Brownish grey, heavy clay; self-mulching surface; strong, fine blocky structure; abrupt change to:
0.05 to 0.35	Greyish brown, heavy clay; strong blocky structure; a few carbonate nodules; gradual change to:
0.35 to 1.5	Greyish brown, heavy clay; strong lenticular structure; a few carbonate nodules.

## Distinguishing soil properties

### Chemical

- N: low to medium    K: very high
- P: low to very high
- surface pH 7.5, tending more alkaline with depth
- sodic below 1.2 m
- low salinity below 1.2 m

### Physical

- self-mulching to weak crusting surface; heavy clay difficult to work when wet
- effective rooting depth greater than 1.0 m
- high to very high PAWC
- imperfectly drained

**Land use suitability**

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland cropping</b>	: <i>sorghum, sunflower, mungbeans, wheat, cotton, chickpea, safflower</i>
<b>Forage cropping</b>	: <i>all forage sorghums, oats, dolichos, cowpea</i>
<b>Grazing native pastures</b>	: <i>low productivity of bluegrasses and annuals under scrub; reasonable productivity when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive purple pigeon</i>

**Land use limitations**

- flooding
- brigalow, yellowwood, coolibah regrowth
- waterlogging
- frost

**Land conservation**

<b>Water erosion hazard</b>	: medium
<b>Surface runoff</b>	: medium
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass or purple pigeon, angleton, creeping and native bluegrasses
<b>Strip cropping</b>	: suitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable (some sand lenses)

**Stocking rates**

Uncleared native pasture	: 25 to 50 ha / AE
Cleared native pasture	: 10 to 12 ha / AE
Sown pasture	: 3 to 5 ha / AE

**Management recommendations**

- When spelling cultivation, sown pastures are needed because native pastures won't regenerate
- Use minimum tillage techniques to retain stubble
- Rotate crops
- Use press-wheels to assist establishment
- Contour banks and waterways necessary on cultivation greater than 0.5% slope

**AMU description:**

Coarse self-mulching or crusting, grey and brown cracking and non-cracking clays on alluvial plains and levees

**Site description****Landform**

Elevated levees, terraces and relict alluvial plains often in small, localised occurrences.

**Vegetation**

Shrubby woodlands of brigalow, poplar box, silver leaved ironbark, sandalwood and Dawson gum.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; cracking surface; moderate, coarse blocky structure; abrupt change to:
0.05 to 0.25	Greyish brown, heavy clay; strong, coarse blocky structure; gradual change to:
0.25 to 0.8	Dull brown, heavy clay; strong blocky structure; some soft and nodular carbonate; gradual change to;
0.8 to 1.5	Dull brown, heavy clay; lenticular structure; a few carbonate nodules.

**Distinguishing soil properties****Chemical**

- N: low to very low P: very low K: medium
- surface pH 7.5, tending acid by 1.0 m depth
- high sodicity below 0.3 m to 0.5 m
- high salinity below 0.4 m

**Physical**

- either coarse mulching, crusting or hard setting surface; coarse cloddy surface with tillage, poor workability
- restricted infiltration and low permeability
- effective rooting depth 0.2 m to 0.4 m
- low PAWC
- poor drainage
- high dispersion below 0.2 m



## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops</i>
<b>Dryland cropping</b>	: <i>all types</i>
<b>Forage cropping (short term)</b>	: <i>all forage sorghums</i>
<b>Grazing native pastures</b>	: <i>reasonably productive bluegrasses and other natives in uncleared state; highly productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive buffel grass</i>

## Land use limitations

- crusting and sealing surface
- sodic and saline
- narrow moisture range for successful cultivation (poor workability)
- low PAWC
- restricted effective rooting depth
- very low P

## Land conservation

<b>Water erosion hazard</b>	: low
<b>Surface runoff</b>	: medium to high
<b>Contour banks</b>	: n.a.
<b>Waterways</b>	: n.a.
<b>Strip cropping</b>	: n.a.
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

## Stocking rates

Uncleared native pasture	: 15 to 20 ha / AE
Cleared native pasture	: 5 to 10 ha /AE
Sown pasture	: 5 to 6 ha / AE

## Management recommendations

- Largely unsuitable for dryland cropping
- Requires more frequent irrigation than other cracking clay soils
- Use minimum tillage techniques on irrigated land
- Sow pasture seed after clearing when using for grazing

## AMU description:

Coarse cracking grey clays on level plains with tussock grasslands and clumps of stunted brigalow and coolibah

### Site description

#### Landform

Level plains in the north-west.

#### Vegetation

Tussock grasslands with occasional clumps of stunted brigalow and coolibah.



### Representative soil profile

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; crusting and cracking surface; very coarse, blocky structure; abrupt change to:
0.05 to 0.3	Greyish brown, heavy clay; strong, coarse blocky structure; gradual change to:
0.3 to 1.3	Greyish brown, heavy clay; strong lenticular structure; some gypsum below 0.8 m; diffuse change to:
1.3 to 1.5	Greyish brown, heavy clay; distinct red and grey mottles.

### Distinguishing soil properties

#### Chemical

- N: very low      P: very low
- K: very low
- low zinc
- surface pH 7.0, acid below 0.5 m
- strongly sodic below 0.3 m
- high salinity below 0.3 m to 0.6 m

#### Physical

- coarse self-mulching surface; very cloddy if cultivated, poor workability
- restricted infiltration and low permeability
- effective rooting depth 0.3 m to 0.6 m
- low PAWC
- very poor drainage and high dispersion below 0.3 m

**Land use suitability**

**Grazing native pastures** : *highly productive bluegrasses, bull mitchell and others*

**Land use limitations**

- low fertility
- salinity
- very coarse surface
- low PAWC
- waterlogging
- frost

**Land conservation**

**Water erosion hazard** : low  
**Surface runoff** : medium to high  
**Contour banks** : n.a.  
**Waterways** : n.a.  
**Strip cropping** : n.a.  
**Diversion banks** : suitable  
**Dams** : unsuitable (saline and sodic soil)

**Stocking rates**

Native pasture : 6 to 7 ha / AE

**Management recommendations**

- Do not cultivate
- Do not overgraze

## AMU description:

Deep, red and yellow sandy earths and duplex soils with a deep A horizon of plateaus, rises and fans

## Site description

### Landform

Elevated plateaus, tablelands and rises of relict streams and old land surfaces. Slopes generally between 1% and 4%.

### Vegetation

Tall open woodlands comprising bloodwood, silver leaved ironbark, Moreton Bay ash, ghost gum and poplar box with areas of cypress pine, yellowjack and bonewood scrub. Wide range of understorey shrubs including desert oak and various wattles.



## Representative soil profile

Depth (m)	Description
0 to 0.25	Dull reddish brown, coarse sandy loam; firm to hard setting surface; massive structure; clear change to:
0.25 to 0.6	Dark reddish brown, coarse sandy clay loam; massive structure; gradual change to:
0.6 to 1.2	Red, coarse sandy clay; diffuse change to:
1.2 to 1.8	Red, coarse sandy clay, rounded quartz gravel common.

## Distinguishing soil properties

### Chemical

- N: very low      P: low  
K: medium to high
- surface pH 5.0, tending alkaline with depth
- non sodic and non saline

### Physical

- coarse sandy, firm to hard setting surface; quite abrasive on tillage implements
- effective rooting depth greater than 1.0 m
- very high infiltration and permeability
- low to medium PAWC
- well drained

## Land use suitability

**Irrigated (all types) cropping** : *peanuts, horticultural crops and pastures*

**Forage cropping (short term)** : *all forage sorghums*

**Grazing native pastures** : *reasonably productive speargrass, desert bluegrasses, other native grasses in uncleared state; highly productive when cleared*

**Grazing sown pastures** : *reasonable productive buffel grass, stylo*

## Land use limitations

- very low fertility
- excessive regrowth
- low to medium PAWC
- sensitive recharge area for groundwater
- weed infestation
- surface sealing

## Land conservation

**Water erosion hazard** : medium to low

**Surface runoff** : low to medium

**Contour banks** : narrow based

**Waterways** : suitable, grass with buffel grass and native grasses

**Strip cropping** : n.a.

**Diversion banks** : suitable

**Dams** : generally suitable

## Stocking rates

Uncleared native pasture : 12 to 15 ha / AE

Cleared native pasture : 8 ha / AE

Sown pasture : 8 ha / AE

## Management recommendations

- Not suitable for dryland cropping
- P supplementation usually required, particularly if using stylos for production gains
- Do not destroy trees if on groundwater intake area
- Do not clear if shrubby understorey present
- Marginally suitable for improved pasture grasses

## AMU description:

Thin, sandy-surfaced yellow-brown duplex soils; hard setting surface overlies coarse, impervious clay subsoils under brigalow/eucalypt scrub

## Site description

### Landform

Undulating plains of low local relief with most slopes below 1%.

### Vegetation

Brigalow scrub with emergent eucalypts (Dawson gum, poplar box, yapunyah) and understorey of currant bush and sandalwood.



## Representative soil profile

Depth (m)	Description
0 to 0.18	Dark brown, sandy clay loam; hard setting surface; weak, blocky to massive structure; abrupt change to:
0.18 to 0.2	Sandy clay loam; bleached A2 horizon; massive structure; abrupt change to:
0.2 to 0.5	Brown, sandy medium clay; strong, medium columnar structure; gradual change to:
0.5 to 1.25	Brown, sandy medium clay; strong, coarse prismatic structure; soft carbonate; a few orange mottles; clear change to:
1.25 to 1.5	Greyish red, sandy medium heavy clay.

## Distinguishing soil properties

### Chemical

- N: very low P: low to medium K: medium
- low zinc
- surface pH 6.5, tending alkaline with depth
- strongly sodic below 0.2 m
- low salinity

### Physical

- hard setting structureless surface, highly susceptible to plough pan development; poor workability; surface seals and sets hard after rain
- very low infiltration and permeability
- very poor drainage
- effective rooting depth less than 0.2 m
- very low PAWC
- highly dispersive below 0.2 m

**Land use suitability****Forage cropping (short term)**: *all forage sorghums, oats***Grazing native pastures**: *low producing bluegrasses, speargrass, wiregrasses and other native grasses in uncleared state; reasonably productive when cleared***Grazing sown pastures**: *reasonably productive buffel grass, stylo***Land use limitations**

- low fertility
- very low PAWC
- sodic subsoil
- poorly drained
- hard setting surface
- excessive regrowth

**Land conservation****Water erosion hazard**

: extremely high

**Surface runoff**

: high

**Contour banks**

: unsuitable

**Waterways**

: With buffel grass

**Strip cropping**

: unsuitable

**Diversion banks**

: suitable if subsoil not exposed

**Dams**

: generally suitable

**Stocking rates**

Uncleared native pasture

: 40 ha / AE

Cleared native pasture

: 10 to 15 ha / AE

Sown pasture

: 7 to 8 ha / AE

**Management recommendations**

- Cultivate only in short-term to control regrowth
- Do not expose subsoil because of erodibility hazard
- Topsoil dam walls to prevent piping and gully erosion

**AMU description:**

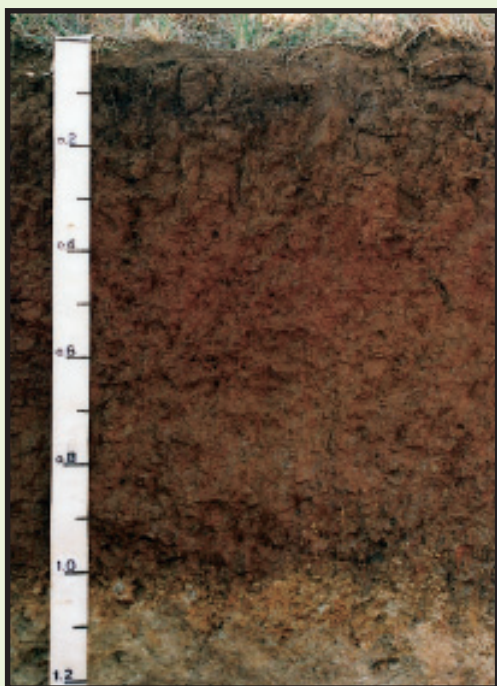
Red to brown duplex soils which are moderately structured and well drained under brigalow scrub

**Site description****Landform**

Undulating and gently undulating plains of low local relief with slopes generally less than 2% but can be greater than 20%.

**Vegetation**

A range including brigalow with associated bauhinia, ooline, Dawson gum, yapunyah; silver leaved ironbark, gidgee and bonewood scrub.

**Representative soil profile**

Depth (m)	Description
0 to 0.3	Dark reddish brown, clay loam; firm surface; weak, fine blocky structure; clear change to:
0.3 to 0.55	Dark reddish brown, medium clay; moderate prismatic structure; gradual change to:
0.55 to 1.0	Dull reddish brown, medium clay; strong prismatic structure; few yellow and grey mottles; clear change to:
1.0 +	Weathered basalt.

**Distinguishing soil properties****Chemical**

- N: low P: medium K: medium
- low zinc
- surface pH 7.0, tending alkaline with depth
- non sodic
- low salinity

**Physical**

- firm to hard setting surface; seals with rain after tillage
- infiltration and permeability restricted below 0.5 m
- effective rooting depth 0.5 m to 0.8 m
- medium PAWC
- moderate dispersion below 0.5 m



## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland farming (small areas only)</b>	: <i>winter crop only, wheat, chickpea, safflower</i>
<b>Forage cropping</b>	: <i>oats</i>
<b>Grazing native pastures</b>	: <i>very low producing wiregrasses and speargrasses in uncleared state; reasonably productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive buffel grass, rhodes grass, stylo, green panic</i>

## Land use limitations

- low N
- medium PAWC
- hard setting surface
- excessive regrowth

## Land conservation

<b>Water erosion hazard</b>	: medium
<b>Surface runoff</b>	: medium to high
<b>Contour banks</b>	: narrow based
<b>Waterways</b>	: suitable, grass with buffel grass, Katambora rhodes, native grasses
<b>Strip cropping</b>	: n.a.
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

## Stocking rates

Uncleared native pasture	: 40 ha / AE
Cleared native pasture	: 10 to 12 ha / AE
Sown pasture	: 3 to 5 ha / AE

## Management recommendations

- Do not overgraze because of susceptibility to wind erosion
- Control regrowth
- Do not clear bonewood scrub and slopes greater than 20%

## AMU description:

Shallow, gravelly soils on rugged uplands and dissected ridges

## Site description

### Landform

Mountains, hills and dissected plateaus.

### Vegetation

Eucalypt woodlands or open forest (narrow leaved ironbark, silver leaved ironbark, yapunyah, lemon scented gum) and a range of understorey vegetation including lancewood, bendee, rosewood and other wattles.



## Representative soil profile

Depth (m)	Description
0 to 0.35	Reddish brown, sandy clay loam; massive structure; large amount of rock and gravel; diffuse change to:
0.35+	Fresh rock (variable).

## Distinguishing soil properties

### Chemical

- N: very low P: very low K: very low
- neutral pH trend
- non sodic and non saline

### Physical

- firm to hard setting; often very gravelly
- high infiltration and permeability
- very shallow rooting depth less than 0.3 m
- very low PAWC

## Land use suitability

**Grazing native pastures** : *very low producing black speargrass, bluegrasses and other native grasses*

## Land use limitations

- very low PAWC
- restricted effective rooting depth
- shallow soil
- hard setting surface

## Land conservation

**Water erosion hazard** : medium  
**Surface runoff** : high  
**Contour banks** : n.a.  
**Waterways** : n.a.  
**Strip cropping** : n.a.  
**Diversion banks** : suitable  
**Dams** : unsuitable

## Stocking rates

Uncleared native pasture : 50 ha / AE  
 Cleared native pasture : n.a.  
 Sown pasture : n.a.

## Management recommendations

- Do not develop
- Maintain timber for property use, wildlife and catchment protection

**AMU description:**

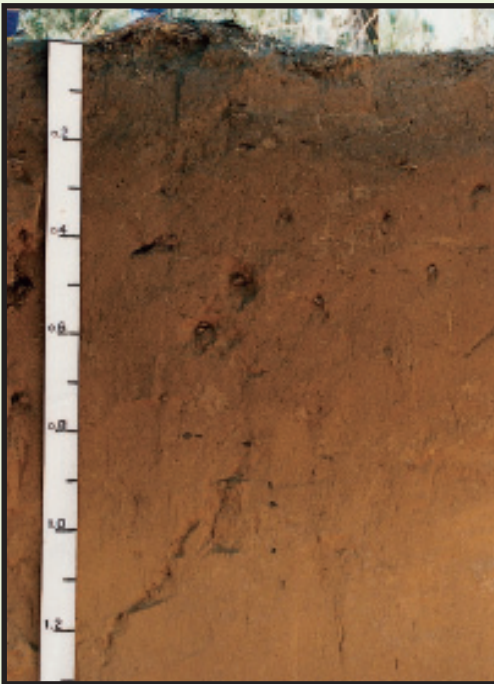
Deep, coarse and medium textured soils associated with alluvial levees and interchannel areas

**Site description****Landform**

Narrow levees and alluvial plains of low relief associated mainly with major streams.

**Vegetation**

Tall woodlands of blue gum and Moreton Bay ash.

**Representative soil profile**

Depth (m)	Description
0 to 0.1	Brownish grey, sandy clay loam; firm surface; weak blocky structure; clear change to:
0.1 to 0.6	Brownish black, sandy clay loam; weak blocky structure; gradual change to:
0.6 to 1.45	Brown, sandy loam; clear change to:
1.45+	Brownish grey, sandy light medium clay.

**Distinguishing soil properties****Chemical**

- N: very low                      P: high
- K: medium
- neutral pH trend
- non sodic and non saline

**Physical**

- loose to firm, deep sandy surface
- very high infiltration and permeability
- effective rooting depth greater than 1.0 m
- low to medium PAWC
- well drained

## Land use suitability

- Grazing native pastures** : *moderately productive native grasses in uncleared state; highly productive when cleared*
- Grazing sown pastures** : *highly productive green panic, buffel grass and stylo*

## Land use limitations

- flooding
- low to medium PAWC
- access because of wetness
- weed invasion
- frost

## Land conservation

- Water erosion hazard** : low
- Surface runoff** : low
- Contour banks** : n.a.
- Waterways** : n.a.
- Strip cropping** : n.a.
- Diversion banks** : n.a.
- Dams** : n.a.

## Stocking rates

- Uncleared native pasture : 8 to 10 ha / AE
- Cleared native pasture : 6 to 8 ha / AE
- Sown pasture : 5 to 6 ha / AE

## Management recommendations

- Do not develop for cropping
- Add stylos to native pasture
- Stock conservatively to prevent weed invasion, particularly by parthenium
- Observe clearing guidelines with respect to distances from creeks and rivers

## AMU description:

Shallow cracking and non-cracking clays on undulating open downs formed on basalt

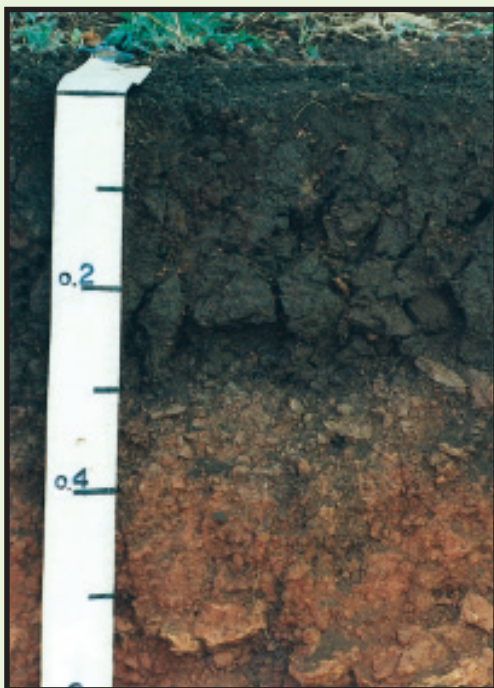
## Site description

### Landform

Often occurs within Orion or Kia-Ora AMUs on ridgelines and crests of gently undulating open downs.

### Vegetation

Open woodlands of mountain coolibah, silver leaved ironbark or bloodwood. Ground cover of bluegrass, mitchell grass, black speargrass and wiregrass.



## Representative soil profile

Depth (m)	Description
0 to 0.05	Brownish black, medium heavy clay; strong blocky structure; self-mulching and cracking; abrupt change to:
0.05 to 0.3	Brownish black, medium heavy clay; strong blocky structure; some carbonate concretions; clear change to:
0.3+	Weathered basalt.

## Distinguishing soil properties

### Chemical

- N: low to medium
- P: low to medium
- K: high
- low copper
- surface pH 7.5, tending slightly more alkaline with depth
- non sodic and non saline

### Physical

- self-mulching surface, often stony
- moderate infiltration and permeability
- effective rooting depth less than 0.45 m
- low to medium PAWC

**Land use suitability**

- Grazing native pastures** : *highly productive bluegrasses and others in uncleared state; highly productive when cleared*
- Grazing sown pastures** : *moderately productive purple pigeon*

**Land use limitations**

- shallow soil depth
- low to medium PAWC

**Land conservation**

- Water erosion hazard** : high
- Surface runoff** : medium to high
- Contour banks** : n.a.
- Waterways** : suitable, grass with African Star grass, purple pigeon, creeping bluegrass or angelton
- Strip cropping** : n.a.
- Diversion banks** : suitable
- Dams** : unsuitable

**Stocking rates**

- Uncleared native pasture : 7 to 15 ha / AE
- Cleared native pasture : 6 to 10 ha / AE
- Sown pasture : 6 to 10 ha / AE

**Management recommendations**

- Do not develop

**AMU description:**

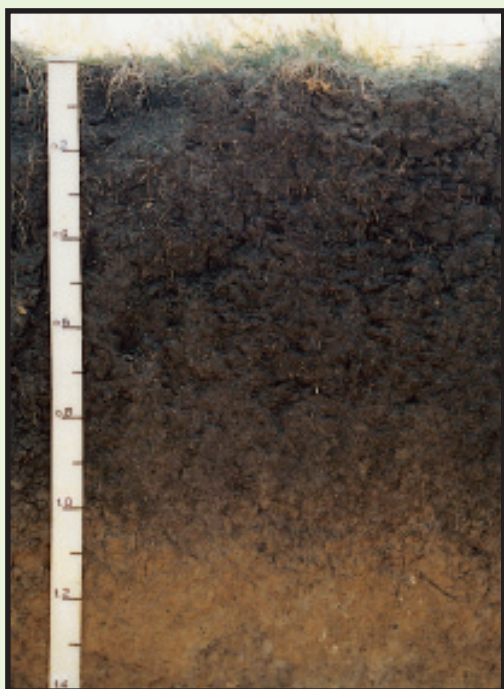
Black cracking clays with a strong fine granular surface mulch on undulating open downs formed on shales

**Site description****Landform**

Undulating plains in the south-west on generally higher slopes (>1.5%) than Orion AMU.

**Vegetation**

Bluegrass tussock grasslands.

**Representative soil profile**

Depth (m)	Description
0 to 0.2	Dark grey brown, medium heavy clay; strong, medium granular structure; self-mulching and cracking surface; abrupt change to:
0.2 to 0.8	Brownish black, heavy clay; strong blocky structure; gradual change to:
0.8 to 1.1	Brownish black, heavy clay; a few carbonate nodules; clear change to:
1.1 to 1.4	Brown, medium heavy clay; large amounts of soft carbonate (lime); abrupt change to:
1.4+	Weathered shale.

**Distinguishing soil properties****Chemical**

- N: medium    P: very high  
K: high
- low zinc
- surface pH 8.0, tending more alkaline with depth
- non sodic and non saline

**Physical**

- strong and fine mulching surface, sealing in places with moderate to good workability
- moderate infiltration and permeability
- effective rooting depth 0.45 m to 1.5 m
- high to very high PAWC



## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland cropping</b>	: <i>sorghum, sunflower, chickpea, mungbeans, wheat, safflower, cotton</i>
<b>Forage cropping</b>	: <i>all forage sorghums, oats, dolichos, cowpea</i>
<b>Grazing native pastures</b>	: <i>very highly productive bluegrasses, and other native grasses</i>
<b>Grazing sown pastures</b>	: <i>highly productive buffel grass, rhodes grass, purple pigeon</i>

## Land use limitations

- soil erosion
- surface sealing

## Land conservation

<b>Water erosion hazard</b>	: high
<b>Surface runoff</b>	: medium to high
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, Indian bluegrass, purple pigeon, buffel grass, Katambora rhodes, creeping bluegrass, angleton and native grasses
<b>Strip cropping</b>	: suitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

## Stocking rates

Uncleared native pasture	: 4 to 5 ha / AE
Cleared native pasture	: n.a
Sown pasture	: 5 ha / AE

## Management recommendations

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate crops
- Waterways stabilisation requires care
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate

## AMU description:

Hard setting, yellow-brown sandy duplex soils with hard, impervious clay subsoils

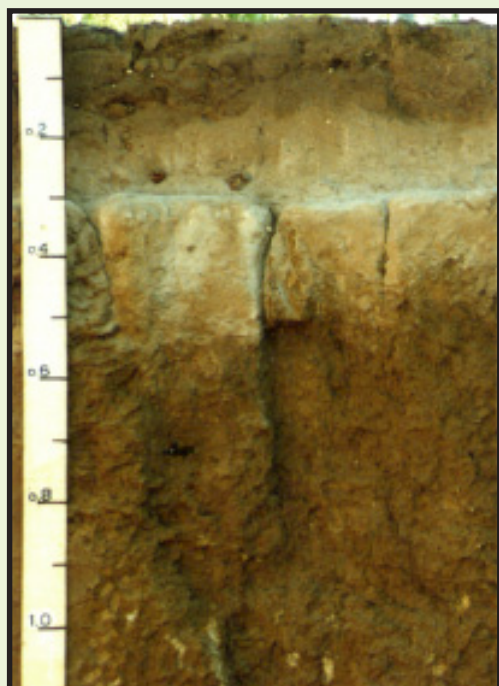
## Site description

### Landform

Undulating plains of low local relief with slopes generally less than 1%.

### Vegetation

Woodlands of poplar box, narrow leaved ironbark and silver leaved ironbark, with understorey of sandalwood, currant bush and wattles (occasionally without shrubby understorey).



## Representative soil profile

Depth (m)	Description
0 to 0.2	Yellowish brown, sandy loam; hard setting surface; very coarse, massive structure; clear change to:
0.2 to 0.3	Sandy loam; conspicuous bleach; massive structure; abrupt change to:
0.3 to 0.8	Yellowish brown, medium heavy clay; strong, coarse columnar structure; gradual change to:
0.8 to 1.5	Yellowish brown, medium clay; strong blocky structure; carbonate nodules common.

## Distinguishing soil properties

### Chemical

- N: very low    P: very low to medium  
K: medium
- low to medium copper and zinc
- surface pH 6.5, tending alkaline with depth
- strongly sodic below 0.4 m to 0.6 m
- low salinity below 0.5 m

### Physical

- hard setting sandy surface; seals and sets hard with rain following tillage
- initial high infiltration but tends to waterlog once wetting front encounters subsoil clay layer
- effective rooting depth 0.2 m to 0.5 m
- very low to low PAWC
- highly dispersive below 0.4 m to 0.6 m

**Land use suitability**

- Grazing native pastures** : *low to very low producing black speargrass, desert bluegrass and other native grasses uncleared; moderate grass production when cleared*
- Grazing sown pastures** : *low producing buffel grass and stylo*

**Land use limitations**

- very low to low PAWC
- low fertility
- sodic subsoil
- very high erodibility of subsoil
- excessive regrowth
- hard setting surface

**Land conservation**

- Water erosion hazard** : extremely high
- Surface runoff** : high
- Contour banks** : unsuitable
- Waterways** : suitable if topsoil intact, grass with buffel grass
- Strip cropping** : n.a.
- Diversion banks** : unsuitable
- Dams** : generally suitable

**Stocking rates**

- Uncleared native pasture : 15 to 20 ha / AE
- Cleared native pasture : 15 ha / AE
- Sown pasture : 12 to 15 ha / AE

**Management recommendations**

- Do not mechanically clear
- Use chemical treatment to selectively clear areas
- Do not expose sodic soils

**AMU description:**

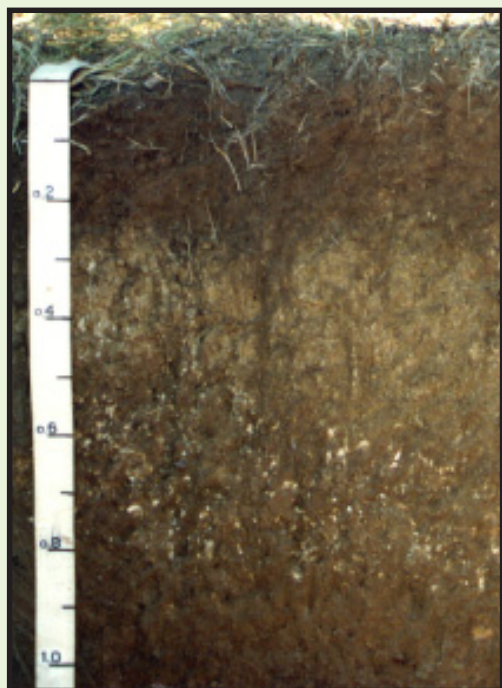
Melonholed grey and brown clays on brigalow scrub plains

**Site description****Landform**

Level or gently undulating plains with melonhole gilgai.

**Vegetation**

Brigalow scrub which may include yapunyah. Areas of blackwood and gidgee occur to the north of the area.

**Representative soil profile**

Depth (m)	Description (gilgai mound)
0 to 0.05	Brown, light clay; moderate granular structure; self-mulching and cracking surface; clear change to:
0.05 to 0.3	Brown, medium clay; moderate blocky structure; some soft carbonate; clear change to:
0.3 to 0.85	Yellow-brown, medium heavy clay; moderate prismatic structure; soft carbonate common; gradual change to:
0.85 to 1.5	Brown, heavy clay; strong blocky structure; grey and red mottles common.

**Distinguishing soil properties****Chemical**

- N: low P: low  
K: medium to high
- low zinc
- surface pH 8.0, tending acidic below 0.2 m
- strongly sodic below 0.2 m (mounds); 0.6 m (depressions)
- salinity below 0.3 m (mounds); 0.6 m (depressions)

**Physical**

- gilgais over 0.4 m deep; mounds are sandy crusting; depressions are coarse mulching, remaining waterlogged for extended periods
- very low infiltration and permeability
- very poorly drained
- effective rooting depth 0.2 m mounds; 0.6 m depressions
- medium PAWC (depressions); very low PAWC (mounds)
- highly dispersive below 0.2 m mounds; 0.6 m depressions

## Land use suitability

- Grazing native pastures** : *very low producing bluegrasses and other native grasses when uncleared; low producing when cleared*
- Grazing sown pastures** : *moderately productive purple pigeon, buffel grass, rhodes grass and para grass*

## Land use limitations

- gilgais
- coarse self-mulching surface
- high salinity and sodicity
- shallow effective rooting depth

## Land conservation

- Water erosion hazard** : low
- Surface runoff** : low to medium
- Contour banks** : n.a.
- Waterways** : n.a.
- Strip cropping** : n.a.
- Diversion banks** : suitable
- Dams** : suitable

## Stocking rates

- Uncleared native pasture : 40 to 50 ha / AE
- Cleared native pasture : 15 to 20 ha / AE
- Sown pasture : 6 to 10 ha / AE

## Management recommendations

- Develop only for sown pasture
- Gilgais may support para grass

## AMU description:

Deep red, brown to grey uniform clays on broad to narrow, occasionally deeply incised, alluvial plains draining basalt landscapes

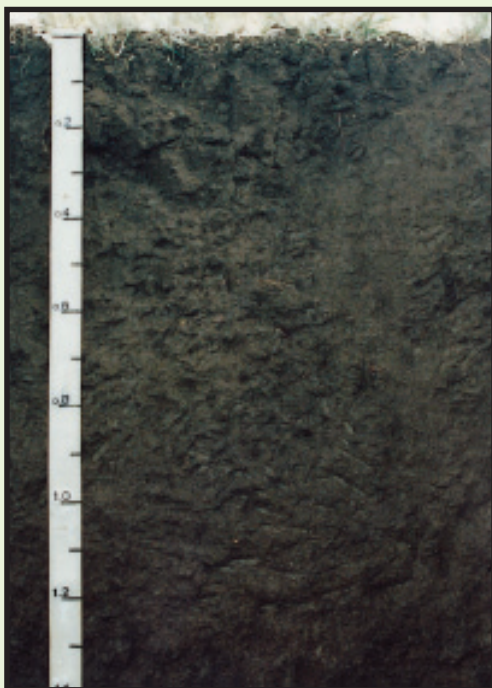
## Site description

### Landform

Alluvial plains along streams draining the basalt areas.

### Vegetation

Tall open woodlands of coolibah with associated black tea tree, brigalow and yellowwood.



## Representative soil profile

Depth (m)	Description
0 to 0.2	Grey brown, medium heavy clay; strong, fine granular structure; self-mulching surface; gradual change to:
0.2 to 0.4	Grey brown, medium heavy clay; strong, medium blocky structure; gradual change to:
0.4 to 1.5+	Grey brown, medium heavy clay; strong lenticular structure; a few carbonate nodules.

## Distinguishing soil properties

### Chemical

- N: low P: very low to low K: medium
- low zinc
- surface pH 7.5, tending more alkaline with depth
- non sodic
- occasional high salinity below 0.5m; otherwise very low salinity apart from seepage areas

### Physical

- fine self-mulching surface; good workability
- moderate infiltration and permeability;
- moderately well drained
- effective rooting depth greater than 1.0 m
- high PAWC

**Land use suitability**

<b>Irrigated (all types) cropping</b>	: <i>all crops</i>
<b>Dryland cropping</b>	: <i>sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton</i>
<b>Forage cropping</b>	: <i>all forage sorghums, oats, dolichos, cowpea</i>
<b>Grazing native pastures</b>	: <i>highly productive bluegrasses and other native grasses uncleared; highly productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive purple pigeon</i>

**Land use limitations**

- flooding
- salinity
- frost

**Land conservation**

<b>Water erosion hazard</b>	: medium
<b>Surface runoff</b>	: medium
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, purple pigeon, Indian bluegrass, creeping bluegrass, angleton or native grasses
<b>Strip cropping</b>	: suitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

**Stocking rates**

Uncleared native pasture	: 12 to 15 ha / AE
Cleared native pasture	: 4 to 6 ha / AE
Sown pasture	: 3 to 5 ha / AE

**Management recommendations**

- Do not clear black tea tree
- Use minimum tillage techniques to retain stubble
- Rotate crops
- Use press wheels to assist establishment
- Contour banks and waterways necessary on cultivated slopes over 0.5%
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate

**AMU description:**

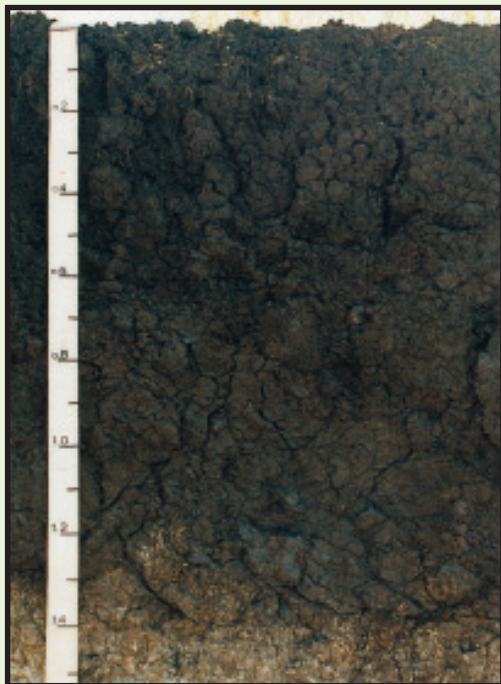
Deep, cracking dark clays on undulating downs on basalt

**Site description****Landform**

Undulating plains and rises on basalt.

**Vegetation**

Open grasslands of bluegrass, mitchell grass, black speargrass and wiregrass with scattered mountain coolibah, bloodwood, silver leaved ironbark and wattles.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Brownish black, medium clay; self mulching and cracking surface; strong blocky structure; clear change to:
0.05 to 0.35	Brownish black, heavy clay; strong blocky structure; gradual change to:
0.35 to 1.3	Brown, heavy clay; strong lenticular structure; a few carbonate nodules; gradual change to:
1.3+	Weathered basalt.

**Distinguishing soil properties****Chemical**

- N: low P: very low to low K: medium to high
- low zinc
- surface pH 7.5, tending more alkaline with depth
- non sodic and non saline

**Physical**

- strong self-mulching surface; surface stone can occur
- heavy clay difficult to work when wet
- low to moderate infiltration and permeability
- imperfect drainage
- effective rooting depth greater than 0.45 m (governed by depth to parent material)
- high PAWC



## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland cropping</b>	: <i>sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton</i>
<b>Forage cropping</b>	: <i>all forage sorghums, oats, dolichos, cowpea</i>
<b>Grazing native pastures</b>	: <i>very highly productive bluegrasses and other native grasses</i>
<b>Grazing sown pastures</b>	: <i>highly productive purple pigeon</i>

## Land use limitations

- soil erosion
- fertility
- coarse and thin surface mulch
- surface sealing
- surface stone
- variability of depth and PAWC

## Land conservation

<b>Water erosion hazard</b>	: high
<b>Surface runoff</b>	: medium to high
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, purple pigeon, Indian bluegrass, creeping bluegrass, and native grasses
<b>Strip cropping</b>	: suitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: unsuitable

## Stocking rates

Uncleared native pasture	: 4 to 5 ha / AE
Cleared native pasture	: n.a.
Sown pasture	: 5 ha / AE

## Management recommendations

- Contour banks on cultivation over 0.5% slope
- Use minimum tillage techniques
- Rotate crops
- Do not clear black tea tree
- Waterways stabilisation requires care
- Use press wheels to assist crop establishment

## AMU description:

Deep red, brown to grey cracking clays under brigalow, softwood scrub or gidgee scrub

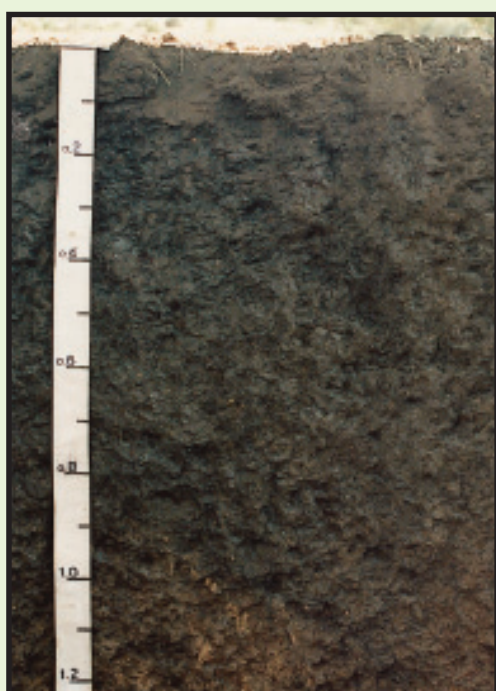
## Site description

### Landform

Level to undulating plains.

### Vegetation

Fairly dense scrub consisting of brigalow, yellowwood and associated softwood species or gidgee; mostly cleared for cultivation.



## Representative soil profile

Depth (m)	Description
0 to 0.1	Brown, medium clay; strong, fine granular structure; self-mulching and cracking surface; abrupt change to:
0.1 to 0.35	Brown, medium heavy clay; strong, medium blocky structure; gradual change to:
0.35 to 1.0	Greyish brown, medium heavy clay; strong lenticular structure; a few carbonate nodules; a gradual change to:
1.0 to 1.5+	Yellow-brown, medium heavy clay; soft carbonate common; basalt often encountered before 2 m.

## Distinguishing soil properties

### Chemical

- N: medium P: medium to high  
K: medium to high
- low zinc
- surface pH 8.0, tending more alkaline with depth
- possible medium sodicity below 1.2 m
- possible medium salinity below 1.2 m

### Physical

- strong granular self-mulching surface; easy workability; occasional tendency to seal following cultivation
- moderate infiltration and permeability
- imperfect drainage below 0.5 m
- effective rooting depth greater than 0.9 m
- high to very high PAWC

**Land use suitability**

- Irrigated (all types) cropping** : *all crops and pastures*
- Dryland cropping** : *sorghum, sunflower, wheat, mungbeans, chickpea, safflower, cotton*
- Forage cropping** : *all forage sorghums, oats, dolichos, cowpea*
- Grazing native pastures** : *low producing bluegrasses and scrub grasses when uncleared; moderately productive when cleared*
- Grazing sown pastures** : *highly productive buffel grass, rhodes grass and purple pigeon*

**Land use limitations**

- soil erosion
- surface sealing

**Land conservation**

- Water erosion hazard** : high
- Surface runoff** : medium to high
- Contour banks** : broad based
- Waterways** : suitable, grass with African Star grass, buffel grass, purple pigeon, Indian bluegrass, Katambora rhodes, creeping bluegrass, angleton and native grasses
- Strip cropping** : suitable
- Diversion banks** : suitable
- Dams** : suitable

**Stocking rates**

- Uncleared native pasture : 25 ha / AE
- Cleared native pasture : 13 ha / AE
- Sown pasture : 3 to 4 ha / AE

**Management recommendations**

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate crops

**AMU description:**

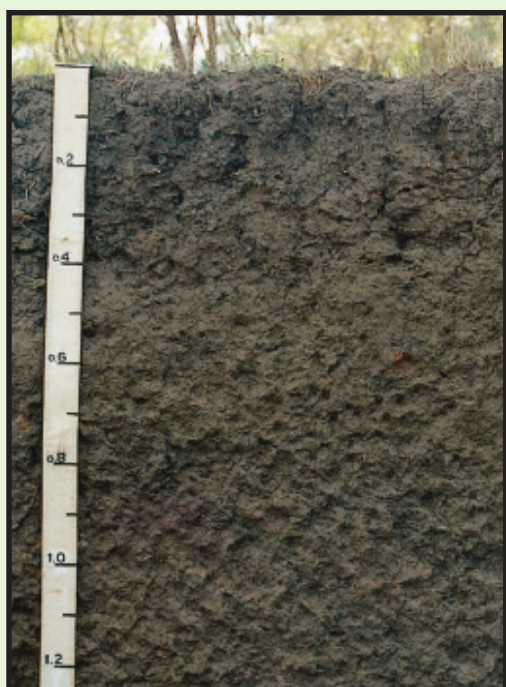
Deep, cracking grey to brown clays formed from highly weathered sediments under brigalow/eucalypt scrub

**Site description****Landform**

Level and lower sloping areas of undulating plains. Includes areas of normal gilgai with less than 0.4 m vertical interval.

**Vegetation**

Commonly brigalow and Dawson gum scrub with areas of gidgee and blackwood to the north.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Greyish brown, heavy clay; crusting and cracking surface; moderate, fine granular structure; clear change to:
0.05 to 0.3	Greyish brown, heavy clay; moderate blocky structure; some soft carbonate; gradual change to:
0.3 to 1.2	Dull brown, heavy clay; strong lenticular structure; a few carbonate nodules and manganese veins; gradual change to:
1.2 to 1.5	Dull brown, heavy clay.

**Distinguishing soil properties****Chemical**

- N: very low to medium
- P: very low to medium
- K: high
- surface pH 8.0, tending acid below 0.6 m
- sodic below 0.5 m
- very low to medium salinity below 0.5 m

**Physical**

- crusting to coarse mulching; often gilgais less than 0.4 m deep with depressions remaining wet for extended periods
- slow infiltration and permeability
- poorly drained
- effective rooting depth 0.5 m
- medium to high PAWC
- moderately dispersive below 0.5 m

## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland cropping (short term)</b>	: <i>sorghum, wheat, chickpea</i>
<b>Forage cropping</b>	: <i>forage sorghums, oats, dolichos, cowpea and millets</i>
<b>Grazing native pastures</b>	: <i>low producing bluegrasses, wire-grasses and other native grasses uncleared; moderately productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>moderately productive buffel grass, rhodes grass and purple pigeon</i>

## Land use limitations

- sodic and salinity
- gilgais
- coarse surface mulch
- regrowth

## Land conservation

<b>Water erosion hazard</b>	: low to medium
<b>Surface runoff</b>	: low to medium
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, buffel grass, Katambora rhodes, purple pigeon, Indian bluegrass, creeping bluegrass, angleton and native grasses
<b>Strip cropping</b>	: unsuitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

## Stocking rates

Uncleared native pasture	: 25 ha / AE
Cleared native pasture	: 10 to 15 ha / AE
Sown pasture	: 7 to 8 ha / AE

## Management recommendations

- Contour banks on cultivated land over 0.5%
- Rotate forage crops
- Use minimum tillage techniques
- Land levelling required insome areas

## AMU description:

Red to brown cracking and non-cracking clays usually on upper slopes of undulating scrub country

## Site description

### Landform

Mid and upper sloping areas of undulating landscapes in association with Turkey Creek AMU.

### Vegetation

Woodlands or scrub with a range of species including brigalow, bonewood, wilga, belah, bende, yellowwood, gidgee, silver leaved ironbark, Dawson gum and bottle tree.



## Representative soil profile

Depth (m)	Description
0 to 0.2	Dull reddish brown, medium clay; moderate, fine to medium blocky structure; abrupt change to:
0.2 to 0.4	Dull reddish brown, medium heavy clay; coarse blocky structure; a few carbonate nodules; clear change to:
0.4 to 1.4	Reddish brown, medium heavy clay; coarse blocky structure; a few carbonate nodules; clear change to:
1.4+	Weathered basalt.

## Distinguishing soil properties

### Chemical

- N: low to medium
- P: low to medium K: medium
- low zinc
- surface pH 8.0, tending more alkaline
- strongly sodic below 0.5 m
- low to medium salinity below 0.6 m

### Physical

- crusting to hard setting surface; cloddy after cultivation
- slow infiltration and permeability
- poorly drained below 0.5 m
- effective rooting depth 0.4 to 1.0 m (often quite variable)
- low to medium PAWC
- high dispersion below 0.5 m

**Land use suitability**

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Forage cropping</b>	: <i>all forage sorghums, oats, dolichos, cowpea, millets</i>
<b>Grazing native pastures</b>	: <i>very low producing bluegrass and scrub grasses when uncleared; moderately productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive buffel grass, green panic and rhodes grass</i>

**Land use limitations**

- restricted soil depth
- low to moderate PAWC
- sodic subsoil
- soil erosion
- workability; crusting and sometimes hard setting surface

**Land conservation**

<b>Water erosion hazard</b>	: medium
<b>Surface runoff</b>	: medium to high
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, buffel grass, Indian bluegrass, Katambora rhodes, creeping bluegrass, angleton and native grasses
<b>Strip cropping</b>	: unsuitable
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

**Stocking rates**

Uncleared native pasture	: 30 to 40 ha / AE
Cleared native pasture	: 10 to 12 ha / AE
Sown pasture	: 4 to 5 ha / AE

**Management recommendations**

- Contour banks on cultivated land over 0.5%
- Use minimum tillage techniques
- Rotate forage crops
- Retain all organic matter to reduce soil structural damage

**AMU description:**

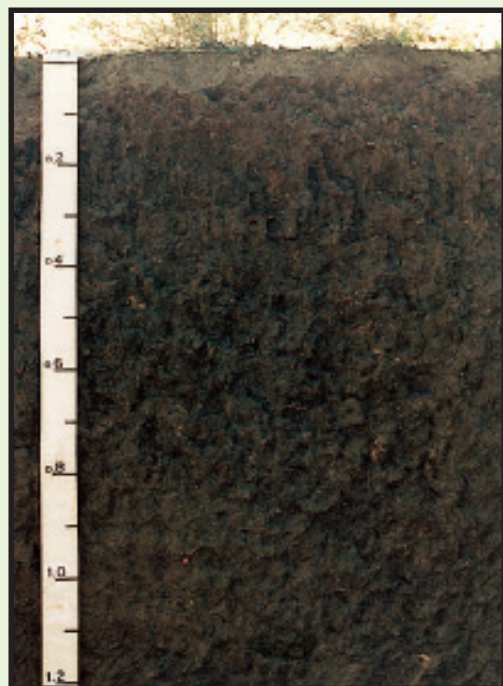
Grey to brown duplex soils with thin sandy surfaces on undulating brigalow scrub country

**Site description****Landform**

Midslope positions of undulating landscapes in association with Springton and Picardy AMUs.

**Vegetation**

Brigalow, belah, Dawson gum and yellow-wood scrub.

**Representative soil profile**

Depth (m)	Description
0 to 0.05	Brown, sandy clay loam; weak granular structure; clear change to:
0.05 to 0.25	Grey brown, medium clay; strong, medium blocky structure; gradual change to:
0.25 to 1.5+	Grey brown, heavy clay; strong lenticular structure; a few carbonate nodules.

**Distinguishing soil properties****Chemical**

- N: low to medium K: medium
- P: very low to medium
- low copper and zinc (in virgin state)
- surface pH 8.0, tending more alkaline with depth
- medium sodicity below 0.7 m
- low salinity below 0.7 m

**Physical**

- hard setting sandy surface becoming a sandy clay following tillage; vulnerable to plough pan formation
- moderate infiltration and permeability
- imperfect drainage
- effective rooting depth 0.6 m to 1.0 m
- medium to high PAWC
- slight tendency for clay dispersion below 0.6 m



## Land use suitability

<b>Irrigated (all types) cropping</b>	: <i>all crops and pastures</i>
<b>Dryland cropping</b>	: <i>sorghum, sunflower, cotton, mungbeans, wheat, chickpea, safflower</i>
<b>Forage cropping</b>	: <i>all sorghum forages, oats, dolichos,</i>
<b>Grazing native pastures</b>	: <i>very low producing bluegrass and other native grasses uncleared; moderately productive when cleared</i>
<b>Grazing sown pastures</b>	: <i>highly productive buffel grass, green panic, rhodes grass and purple pigeon</i>

## Land use limitations

- rapid nutrient decline
- plough pan development
- weed infestation

## Land conservation

<b>Water erosion hazard</b>	: high
<b>Surface runoff</b>	: medium
<b>Contour banks</b>	: broad based
<b>Waterways</b>	: suitable, grass with African Star grass, buffel grass, Katambora rhodes, purple pigeon and native grasses
<b>Strip cropping</b>	: n.a.
<b>Diversion banks</b>	: suitable
<b>Dams</b>	: suitable

## Stocking rates

Uncleared native pasture	: 40 ha / AE
Cleared native pasture	: 10 to 15 ha / AE
Sown pasture	: 3 to 4 ha / AE

## Management recommendations

- Contour banks on cultivated land over 0.5%
- Practice reduced tillage techniques on all cultivation
- Good weed control is vital (particularly parthenium)
- When spelling cultivation, sown pastures are needed because native pastures won't regenerate



# Glossary

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<b>A horizon</b>	See <i>Soil horizon</i> .
<b>A<sub>2</sub> horizon</b>	See <i>Subsurface soil; Bleach</i> .
<b>Acid clay</b>	Clay subsoils of low pH that occur under brigalow-belah vegetation
<b>Acid soil</b>	A soil giving an acid reaction throughout most or all of the soil profile (precisely, below a pH of 7.0; practically, below a pH of 6.5). Generally speaking, when the pH drops below 5.5 the following specific problems may occur - aluminium toxicity, manganese toxicity, calcium deficiency and/or molybdenum deficiency. Such problems adversely affect plant growth and root nodulation, which may result in a decline in plant cover and increase in erosion hazard. See <i>pH</i> .
<b>Acid volcanic rocks</b>	See <i>Volcanic rocks, acid</i> .
<b>AE</b>	Adult Equivalent - represents a 450 kg live weight, non-lactating bovine.
<b>Aeolian sediments</b>	See <i>sedimentary rocks</i> .
<b>Alkaline soil</b>	A soil giving an alkaline reaction throughout most or all of the soil profile (precisely, above a pH of 7.0; practically, above a pH of 8.0). Many alkaline soils have a high pH indicated by the presence of calcium carbonate, and are suitable for agriculture. However, others are problem soils because of salinity and/or sodicity. Soils with a pH above 9.5 are generally unsuitable for agriculture. See <i>pH</i> .
<b>Alluvial plain</b>	A plain formed by the accumulation of alluvium on a floodplain over a considerable period of time; this accumulation may be still occurring at present (recent alluvium) or may have ceased (relict alluvium).
<b>Alluvium (pl. alluvia)</b>	Deposits of gravel, sand, silt, clay or other debris, moved by streams from higher to lower ground.
<b>B horizon</b>	See <i>Soil horizon</i> .
<b>Backplain</b>	Large alluvial flat occurring some distance from the stream channel; often characterised by a high water table and the presence of swamps or lakes.
<b>Basalt</b>	See <i>Volcanic rocks</i> .

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<b>Bleach</b>	Subsurface soil (A <sub>2</sub> horizon) that is white, near white or much paler than adjacent soil layers. It occurs in varying proportions:
conspicuous bleach -	80% or more of the layer is white or almost so, when the soil is dry.
sporadic bleach -	the bleaching occurs irregularly through the subsurface layer, or as blotches or, as nests of bleached grains of soil material often at the interface of the surface and subsoil layers.
<b>C material</b>	Layer(s) below the B horizon which may be weathered parent material, not bedrock, little affected by soil-forming processes.
<b>Clays</b>	Soils with a uniform clay texture throughout the surface soil and subsoil.
• <i>cracking</i>	Clay soils that develop vertical cracks when dry.
• <i>non-cracking</i>	Clay soils that do not develop vertical cracks when dry.
<b>Colluvium</b> ( <i>pl. colluvia</i> )	Slope deposits of soil and rock material.
<b>Colour</b>	See <i>Soil colour</i>
<b>Concretion</b> ( <i>in soil</i> )	Rounded mineral aggregate.
<b>Consistence</b>	Refers to the degree of resistance to breaking or deformation when a force is applied.
<b>Cracking clays</b>	See <i>Clays, cracking</i> .
<b>Deep weathering</b>	The process by which earthy or rocky materials are slowly broken down into finer particles and soil by chemical and physical processes over a long period of time.
<b>Dispersion</b> ( <i>dispersivity</i> )	The process whereby soils break down and separate into their constituent particles (clay, silt, sand) in water.
<b>Dissection</b>	The process of streams or erosion cutting the land into hill, ridges and flat areas.

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**Drainage**  
(soil profile)

The rate of downward movement of water through the soil, governed by both soil and site characteristics. Categories are as follows:

Very poorly drained: free water remains at or near the surface for most of the year.

Poorly drained: all soil horizons remain wet for several months each year.

Imperfectly drained: some soil horizons remain wet for periods of several weeks.

Moderately well drained: some soil horizons remain wet for a week after water addition.

Well drained: no horizon remains wet for more than a few hours after water addition.

Rapidly drained: no horizon remains wet except shortly after water addition.

**Duplex soil**

A soil in which there is a sharp change in soil texture between the A and B horizons (surface and subsoil) over a distance of 10 cm or less. Also known as texture-contrast soil.

**Duricrust**

A cemented layer at or near the surface resulting from concentration of breakdown products of rock weathering.

**Earths**

Soils with a sandy to loamy (including clay loam) surface soil gradually increasing to a loamy to light clay subsoil.

- *massive*

Earths in which the subsoil is not arranged into natural soil aggregates and appears as a coherent, or solid mass.

- *structured*

Earths in which the subsoil is arranged into natural soil aggregates which can be clearly seen.

**Effective rooting depth (ERD)**

Depth to which most plant feeder roots will penetrate. This is taken here to be the depth either to which salts have been leached and have therefore accumulated, or to an impeding layer. This represents the long-term depth of wetting.

**Erodibility**  
(soil)

The susceptibility of a soil to the detachment and transportation of soil particles by erosive agents. It is a function of the mechanical,

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	chemical and physical characteristics of the soil, and is independent of the other factors influencing soil erosion such as topography, land use, rainfall intensity and plant cover. It may be changed by management.
<b>Erosion hazard</b>	The susceptibility of a parcel of land to the prevailing agents of erosion. It is dependent on a combination of climate, landform, soil, land use and land management factors.
<b>ESP</b>	Exchangeable sodium percentage. <i>See sodicity.</i>
<b>Gilgai</b>	Surface microrelief associated with soils containing shrink-swell clays. Characterised by the presence of mounds and depressions.
• <i>linear</i>	Long, narrow, parallel, elongate mounds and broader, elongate depressions more or less at right angles to the contour; usually in sloping lands.
• <i>melonhole</i>	Large depressions, usually greater than 3 m diameter and deeper than 0.4m, which have a sub-circular or irregular shape and are separated by elongate mounds or set in an almost level surface.
• <i>normal</i>	Small, irregularly distributed mounds and sub-circular depressions, usually with less than 0.4 m vertical interval between the mound tops and bottom of depressions.
<b>Gley</b>	Grey, blue and green coloured clay subsoil (B horizon). Caused by poor drainage which reduces iron and other elements.
<b>Granite/granitic rocks</b>	Coarse-grained, <i>igneous</i> rock formed well below the Earth's surface in which quartz constitutes up to 50% of the minerals. Other minerals included are feldspars and micas.
<b>Hard setting</b>	Surface soil that becomes hard and apparently structureless on the periodic drying of the soil.
<b>Horizon</b>	<i>See Soil horizon, also Soil horizon boundary.</i>
<b>Igneous rocks</b>	Rock crystallised from molten rock material (magma). It may be extruded to the Earth's surface ( <i>volcanic</i> ) or cool at variable depths below the surface (intrusive, and plutonic).

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<b><i>Intermediate volcanic rocks</i></b>	See <i>Volcanic rocks, intermediate</i> .
<b><i>Kaolinisation</i></b>	Breakdown of minerals (particularly feldspars) under intense weathering to form kaolinite clay (china clay). See also <b><i>Laterite</i></b> .
<b><i>Laterite</i></b>	A profile formed by intense weathering. Many deeply weathered profiles termed 'lateritic' exhibit a distinct series of layers including a surface duricrust, ironstone and mottled and pallid (kaolinised) zones. The word laterite is used for any profile in which ironstone is a major feature. See <i>Duricrust</i> .
<b><i>Lateritised rocks</i></b>	Rocks which have been partially or completely weathered to laterite
<b><i>Levee</i></b>	A very long, very low, nearly level ridge immediately adjacent to a stream channel, built up by over-bank flow.
<b><i>Lithology</i></b>	The character of a rock type, such as its colour, mineral composition and grain or crystal size.
<b><i>Loams</i></b>	Soils with a uniform loam (including clay loam) texture throughout the surface soil and subsoil. See also <i>Soil texture</i> .
<b><i>Local relief</i></b>	The altitude difference between the base and crest of slopes in undulating or hilly areas.
<b><i>Mangans</i></b>	Coatings of manganese oxides or hydroxides on surfaces of natural soil aggregates. The material may have a glazed appearance and is very dark brown or black.
<b><i>Massive earths</i></b>	See <i>Earths, massive</i> .
<b><i>Massive structure</i></b>	See <i>Soil structure, apedal</i> .
<b><i>Metamorphic rocks</i></b>	Rocks that were originally igneous or sedimentary that have been physically and/or chemically altered by high temperatures and/or pressures beneath the Earth's surface.
<b><i>Mottle</i></b>	Spots, blotches or streaks of subdominant colours different from the main soil colour.
<b><i>Nodules (in soil)</i></b>	Irregular rounded mineral aggregates.

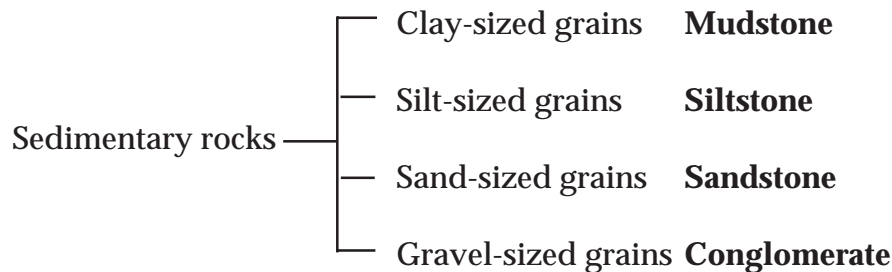
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<b><i>Non-calcic brown soil</i></b>	Soils with strong texture contrast between A horizons and B horizons which are not strongly acid and are non sodic. The dominant colour of the upper part of the B horizon is brown.
<b><i>Non-cracking clays</i></b>	See <i>Clays, non-cracking</i> .
<b><i>Permeability</i></b>	The capacity for transmission under gravity of water through soil or sediments.
<b><i>Plant available water capacity (PAWC)</i></b>	The quantity of water held in a soil that can be extracted by plant roots.
<b><i>pH</i></b>	<p>A measure of the acidity or alkalinity of a soil. A pH of 7.0 indicates neutrality, higher values indicate alkalinity and lower values indicate acidity. Each unit change in pH represents a 10-fold change in either the acidity or alkalinity of the soil. For example, a pH of 5.0 is 10 times more acid than a pH of 6.0.</p> <p>Soil pH affects the amount of different nutrients that are soluble in water and therefore the amount of nutrient available to plants.</p>
<b><i>Red-brown earth</i></b>	Soils with strong texture contrasts between A horizons and sodic or non sodic B horizons which are not strongly acid. The dominant colour of the upper part of the B horizon is red.
<b><i>Relict landform</i></b>	A land surface feature created by processes no longer operating in that place.
<b><i>Salinity</i></b>	The presence of sufficient soluble salts to adversely affect plant growth and/or land use. The main salt involved is sodium chloride, but sulphates, carbonates and magnesium salts occur in some soils. It is expressed as a level of electrical conductivity (EC).
<b><i>Sands</i></b>	Soils with a uniform sand (including sandy loam) texture throughout the surface soil and subsoil.
<b><i>Secondary salinity</i></b>	Salinity resulting from man's activities, largely through land development. See <i>Salinity</i> .
<b><i>Sedimentary rocks</i></b>	Rocks formed from the accumulation of material which has been weathered and eroded from pre-existing rocks, then transported and deposited as sediment by wind (aeolian) or water (fluvial, marine).

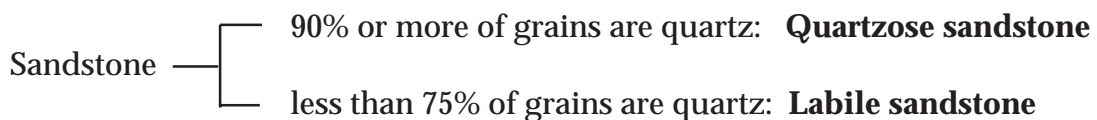


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Sedimentary rocks have been classified according to grain size and constituent minerals:



Sandstone is further subdivided on the basis of the dominant minerals making up the clasts (solid inclusions) or the matrix which cements the clasts together:



***Segregation***

Discrete accumulations in the soil because of the concentration of some constituent, usually by chemical or biological action.

***Self-mulching***

A condition of well-structured surface soil, notably of clays, in which the aggregates fall apart naturally as the soil dries to form a loose mulch of soil aggregates.

In cultivated soils, ploughing when wet may appear to destroy the surface mulch which, however, will re-form upon drying.

***Snuffy (surface soil)***

Soils with a surface having a very fine granular structure and a dry consistence strength that is weak to very weak. The soil may be water repellent and becomes powdery when cultivated.

***Sodicity***

A characteristic of soils (usually subsoils) containing exchangeable sodium to the extent of adversely affecting soil stability, plant growth and / or land use. It is measured as a percentage of the cation exchange capacity of the soil.

The classes are defined as follows:

- non-sodic - less than 6%
- sodic - between 6% and 15%
- strongly sodic - more than 15%

Sodic or strongly sodic soils would be dispersible and may be improved by the addition of gypsum.

**Soft segregations**  
(in soil)

Soft, finely divided mineral compounds accumulated in the soil through chemical action with water. They are not easily separated as discrete bodies (compare with *Nodules*)

**Soil colour**

The colour of soil material is determined by comparison with a standard Munsell soil colour chart. The colour classes used for soil description in this manual are as follows:

Value/Chroma rating*					
Hue	1	2a	2b	4	5
10R	dark	red-grey	red-brown	red	red
2.5YR	dark	grey-brown	red-brown	red	red
5YR	dark	grey-brown	brown	red-brown	red-brown
7.5YR	dark	grey-brown	brown	yellow-brown	brown
10YR	dark	grey	yellow-brown	yellow	brown
2.5YR	dark	grey	yellow-grey	yellow	olive-brown
5Y	dark	grey	yellow-grey	yellow	olive

\*Value/Chroma rating is that defined by Northcote (1979)

Value/Chroma 2a = 4/1, 4/2 to 6/1, 6/2

Value/Chroma 2b = 5/3, 5/4 to 6/3, 6/4

Actual Munsell names were used for colours with a value/chroma rating of 3.

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<b>Soil horizon</b>	A layer of soil material within the <i>soil profile</i> with distinct characteristics and properties produced by soil-forming processes, and which are different from those of the layers above and/or below. The three main horizons are: A (topsoil); B (subsoil); C (see C material).
<b>Soil horizon boundary</b>	Boundaries between horizons take many forms. The terms used are:  <b>Sharp</b> - less than 5 mm wide; <b>Abrupt</b> - 5 to 20 mm wide; <b>Clear</b> - 20 to 50 mm wide; <b>Gradual</b> - 50 to 100 mm wide; <b>Diffuse</b> - more than 100 mm wide.
<b>Soil profile</b>	A vertical cross-sectional exposure of a soil, from the surface to the parent material or <i>substrate</i> .
<b>Soil reaction trend</b>	The general direction of the change in pH with depth.
<b>Soil structure</b>	The arrangement of natural soil aggregates that occur in soil; structure includes the distinctness, size and shape of these aggregates.
• <i>strong</i>	The natural soil aggregates are quite distinct in undisplaced soil; when displaced more than two-thirds of the soil material consists of aggregates (ie. well structured).
• <i>moderate</i>	Natural soil aggregates are well formed and evident but not distinct in undisplaced soil; when displaced more than one-third of the soil material consists of aggregates (ie. moderately structured).
• <i>weak</i>	The natural soil aggregates are indistinct and barely observable in undisplaced soil; when displaced more than one-third of the soil material consists of aggregates (ie. moderately structured)
• <i>coarse</i>	The natural soil aggregates are relatively large; an average size of 20 mm or more is coarse for the purpose of this manual.
• <i>medium</i>	The average size of the natural soil aggregates is between fine and coarse.
• <i>fine</i>	The natural soil aggregates are relatively small; an average size of 5 mm or less is fine for the purposes of this manual.

- *apedal* There are no observable natural soil aggregates (structureless); the soil may be either a coherent mass (massive) or a loose, incoherent mass of individual particles such as sand grains (single grain).
- *blocky* The natural soil aggregates have the approximate shape of cubes with flat and slightly rounded sides.
- *prismatic* The natural soil aggregates have the approximate shape of elongated blocks.
- *columnar* The natural soil aggregates are like those of prismatic but have domed tops.
- *polyhedral* The natural soil aggregates are irregular, many sided and multi-angled.
- *lenticular* The natural soil aggregates are like large vertical lens shapes with curved cracks between the aggregates.

### **Soil texture**

The coarseness or fineness of soil material as it affects the behaviour of a moist ball of soil when pressed between the thumb and forefinger. It is generally related to the proportion of clay, silt and sand within a soil. Texture classes used in this manual are defined primarily by the total clay content:

	<b>Group</b>	<b>Clay content (%)</b>
Coarse	Sand Loamy sand Sandy loam	less than 5 5 to 10 10 to 20
Medium	Loam Sandy clay loam Clay loam	~ 25 20 to 30 + sand 20 to 35
Fine	Sandy clay Light clay Medium clay Heavy clay	35 to 40 + sand 35 to 40 40 to 50 more than 50

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<b><i>Solodic Soils</i></b>	Soils with strong texture contrast between A horizons and sodic B horizons which are not strongly acid.
<b><i>Structured earths</i></b>	See <i>Earths, structured</i> .
<b><i>Subsoil</i></b>	Soil layers below the surface with one of the following attributes: <ul style="list-style-type: none"> <li>• a larger content of clay, iron, aluminium, organic material (or several of these) than the surface and subsurface soil;</li> <li>• stronger colours than those of the surface and subsurface soil above, or the <i>substrate</i> below. The B horizon.</li> </ul>
<b><i>Substrate</i></b>	The material below the soil profile which may be the parent material or may be unlike the material from which the soil has formed; substrate which is not parent material for the soil above may be layers of older alluvium, rock strata unrelated to the soil or the buried surface of a former landscape.
<b><i>Subsurface soil</i></b>	Soil layers immediately under the surface soil which usually have less organic matter, paler colours and may have less clay than the surface soil. The A <sub>2</sub> horizon.
<b><i>Surface soil</i></b>	The soil layer extending from the soil surface down which has some organic matter accumulation and is darker in colour than the underlying soil layers. The A horizon.
<b><i>Terrace</i></b>	Any long, relatively level or gently sloping surface, generally narrower than a plain and bounded by a steeper ascending slope on one edge and a steeper descending slope on the other. Often associated along the margin and above the level of a body of water eg. stream or lagoon.
<b><i>Texture</i></b>	See <i>Soil texture</i> .
<b><i>Texture-contrast soil</i></b>	See <i>Duplex soil</i> .
<b><i>Uniform clays</i></b>	See <i>Clays</i> .
<b><i>Uniform loams</i></b>	See <i>Loams</i> .
<b><i>Uniform sands and sandy loams</i></b>	See <i>Sands</i> .

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**Volcanic rocks**

Igneous rocks which have cooled from magma extruded to the Earth's surface. The size of the rock crystals depends on its duration of cooling - rapid cooling forms very fine crystals or even volcanic glass.

- *acid*                      Contain 10% or more quartz and proportions of magnesium, iron and calcium. Usually light coloured.
- *basic*                      Basalt or basaltic rocks containing minimal or no quartz. Usually dark coloured because of a high proportion of iron and manganese minerals.
- *intermediate*            Contain less than 10% quartz and mixed amounts of other minerals that are intermediate between the typical acid and basic igneous rocks.

**Waterlogged**

An area in which water stands near, at or above the land surface, so that the roots of all plants except those with extreme water tolerance are drowned and the plants die.

**Workability**

The ease or otherwise of working the soil with machinery.