

UND Undalya Land System

Undulating to moderately steep land between Auburn and Rhynie

Area: 76.3 km²

Annual rainfall: 475 – 575 mm average

Geology: The land system is formed on a complex area of folding and includes a series of interbedded rock types. The characteristic rocks are dolomites and calc-siltstones of the Auburn and Skilloogalee Dolomite Formations, siltstones and shales of the Woolshed Flat Formation, and Undalya Quartzites. Folding and tilting of these formations has produced two conspicuous horseshoe shaped quartzite ridges and corresponding shapes in other less prominent rock layers. There are only limited accumulations of outwash sediments - these are mostly fine grained. Rocks and sediments are generally mantled by fine carbonates of aeolian origin, although these are difficult to distinguish from reworked carbonates derived from calcareous parent rocks.

Topography: The Undalya Land System has a complex topography resulting from interactions between a range of rock types with differential weathering characteristics, intense folding of the rock layers, and extensive dissection by three major watercourses which flow through the system. Dominating the topography are quartzite hills and ridges with slopes as steep as 50% in places. These are associated with narrow beds of quartzite which are highly resistant to weathering compared with the surrounding softer rock types. Although there are also some lower ridges formed on dolomites, the softer rocks generally give rise to a more subdued landscape of undulating to gently rolling rises. The River Wakefield enters the system from the north and bends westwards at Undalya. It is joined by Pine Creek from the north east, Woolshed Flat Creek from the south east and Skilloogalee Creek from the north east. Alluvial flats are generally associated with these streams except where they pass through quartzites.

Elevation: 384 m west of Undalya to 210 m where the Wakefield River leaves the system.

Relief: Maximum relief is 110 m

Soils: Most soils are moderately deep to shallow over weathering basement rock. They are mostly loamy. Some have red clayey subsoils; others are formed directly on rock or soft to hard carbonate layers. Deeper soils occur on highly weathered rocks or alluvium on lower slopes. These include silty loam over red clay soils, gradational clay loams, cracking clays and deep black loams.

Main soils: *Soils formed over basement rocks on hillslopes*

D7 Hard clay loam over dispersive red clay on rock

B4 Gradational loam on limestone

D1 Hard loam over red clay on rock

C2 Gradational loam on rock

L1 Shallow stony loam



Minor soils:*Soils on hillslopes*

- B2** Shallow calcareous loam on calcrete
A2 Shallow calcareous loam - on calcareous rock
C3 Gradational clay loam - on deeply weathered rock
E2 Red cracking clay - on deeply weathered rock

Soils formed on alluvial sediments

- D3** Hard silty loam over dispersive red clay
D2 Hard silty loam over well structured red clay
M2 Deep black loam
M4 Gradational fine sandy loam
C5 Dark gradational loam

Variable thicknesses of recent silty deposits may overlies the soils formed on alluvium

Main features:

The Undalya Land System is characterized by moderately steep to steep non arable quartzite hills and ridges, and by mostly arable undulating rises with shallow soils on basement rocks capped by either hard or soft carbonates. The soils of the rises, although often shallow, are generally inherently fertile and well structured. They have high productive potential although are they are prone to moisture deficit in dry finishes. They are resistant to erosion, although a significant area is only marginally arable due to moderate slopes. There is minor watercourse erosion throughout. There is sporadic saline seepage in drainage depressions, particularly in the Woolshed Flat catchment.

Soil Landscape Unit summary: 13 Soil Landscape Units (SLUs) mapped in the Undalya Land System

SLU	% of area	Main features #
ACC	3.5	Strip of low hills to 60 m high with slopes of 15-30% formed on Skillogalee Dolomite. There is extensive surface calcrete, as loose stones or sheet rock. Main soils: <u>shallow calcareous loam</u> - A2 (E) and <u>gradational loam (on rock or limestone)</u> - C2/B4 (E), with <u>shallow stony loam</u> - L1 (L) and <u>shallow calcareous loam on calcrete</u> - B2 (L). This land is moderately steep with shallow stony soils. It is non arable, but the soils are fertile and well structured. Pasture productivity potential is good, but moisture stress is a problem in dry springs.
AFC	1.8	Moderately steep low hills formed on siltstones, calc-siltstones and dolomites. Slopes are 10-25% and relief is up to 70 m. There is variable surface stone and rock outcrop, often enough to prevent machinery access. Main soils: <u>shallow stony loam</u> - L1 (V) with <u>gradational loam on rock</u> - C2 (L) and <u>shallow calcareous loam</u> - A2 (L). This land is generally too steep (and too rocky in places) for cropping, but has good grazing potential.
ARC	14.9	Ridges and low hills formed on Undalya Quartzite. Slopes range from 15-50% and relief from 20 to 110 m. Linear quartzite outcrops occupy up to 20% of the land surface, and there is an extensive surface cover of quartzite stones. Main soils: stony <u>hard clay loam over dispersive red clay on rock</u> - D7 (E) and <u>shallow stony loam</u> - L1 (E). Although most of the soils are moderately deep, they are very stony, often poorly structured and infertile. Moderately steep to steep slopes and extensive surface stone further restrict agricultural use. Most of the land is uncleared, or used for grazing, generally of native pastures.
DEC DED	11.0 9.2	Rises formed on interbedded Woolshed Flat shales, Auburn dolomites and minor quartzites. There are minor quartzite ridges, up to 10% surface stone and some watercourse erosion. DEC Undulating rises with slopes of 3-12%. DED Rolling rises with slopes of 10-20%. Main soils: <u>hard loam over red clay on rock</u> - D1 (V), with <u>gradational loam on rock</u> - C2 (L), <u>shallow stony loam</u> - L1 (L), <u>gradational loam on limestone</u> - B4 (M) and <u>shallow calcareous loam on calcrete</u> - B2 (M). These soils are moderately shallow but generally well structured and fertile. Hard setting surfaces tend to increase runoff and likelihood of erosion, and may affect seedling establishment, but use of gypsum and modified surface management practices can overcome this problem. The steeper slopes of DED are marginal for cropping because of the potential for erosion.



DOH	16.3	Undulating rises formed on interbedded siltstones, quartzitic shales, dolomites and minor quartzites. Slopes are 3-12% with some steeper slopes on minor low quartzite ridges. Watercourse erosion is common in places. There is up to 10% surface stone. Main soils: <u>hard clay loam over dispersive red clay on rock</u> - D7 (E) and <u>gradational clay loam</u> - C3 (E), with <u>hard loam over red clay on rock</u> - D1 (L), <u>gradational loam on limestone</u> - B4 (L) and <u>red cracking clay</u> - E2 (L). These soils are generally fertile and moderately deep, but have poorly structured hard setting surfaces. These conditions lead to excessive runoff and associated erosion, poor workability and restricted emergence and early growth. The D7 soils are also likely to suffer from subsurface waterlogging due to perched water tables. The clay soils, although not widespread, are usually intimately interspersed with the texture contrast soils, making management difficult. They are slower to respond to opening rains, have different fertility characteristics, are usually alkaline, and difficult to traverse in winter.
EMC EMD	16.2 11.7	Rises formed on dolomites and calc-siltstones of the Auburn and Skillogalee Dolomite Formations. EMC Undulating rises with slopes of 3-12%. EMD Rolling rises with slopes of 10-20% and about 10% rocky outcrop. Main soils: <u>gradational loam on limestone</u> - B4 (E) and <u>shallow calcareous loam on calcrete</u> - B2 (E), with <u>gradational loam on rock</u> - C2 (L), <u>shallow calcareous loam</u> - A2 (L) and <u>hard loam over red clay on rock</u> - D1 (M). The soils are generally shallow but well structured and inherently fertile. The mixture of calcareous and non calcareous soils may cause some problems with regard to nutrient availability, fertilizer and chemical usage. The other limitation is moisture deficit during dry finishes. Although well structured and resistant to erosion, the moderate and often stony slopes of EMD are marginal for cropping.
JAB JAJ JAO	1.5 2.8 5.2	Drainage depressions and outwash fans formed on clayey alluvium. JAB Gently inclined fans with slopes of 2-3%. JAJ Drainage depressions with eroded watercourses. JAO Drainage depressions with up to 10% of the land affected by saline seepage. Main soils: <u>hard silty loam over dispersive red clay</u> - D3 (E) and <u>hard silty loam over well structured red clay</u> - D2 (E), with <u>red cracking clay</u> - E2 (L) and <u>dark gradational loam</u> - C5 (L). These soils are deep and inherently fertile, but most are prone to hard setting sealing surfaces. They are difficult to work and are prone to waterlogging and emergence / early growth problems. Watercourse erosion is common in some drainage depressions, and saline seepage in others (mainly Woolshed Creek catchment). Salt levels should be monitored throughout.
JSE	2.2	Narrow creek flats with waterlogged areas and minor saline seepage. Main soils: <u>deep black loam</u> - M2 (V) with <u>hard silty loam over dispersive red clay</u> - D3 (L). The M2 soils are deep and fertile with high productive potential, although prone to waterlogging. Poorly structured surface soils may require some amelioration. The D3 soils have lower fertility and are more prone to waterlogging. Soil salinity levels should be monitored, as there is some evidence of saline seepage.
JUE	3.7	Flats associated with major watercourses including the River Wakefield. Main soils: <u>hard silty loam over dispersive red clay</u> - D3 (E), <u>gradational fine sandy loam</u> - M4 (E) and <u>dark gradational loam</u> - C5 (E). These soils are mostly poorly structured and erodible. Natural fertility is moderate, and salinity may be a problem in places, associated with shallow water tables. Watercourse protection should be a major component of management.

PROPORTION codes assigned to soils within Soil Landscape Units (SLU):

- (D) Dominant in extent (>90% of SLU)
- (V) Very extensive in extent (60–90% of SLU)
- (E) Extensive in extent (30–60% of SLU)
- (C) Common in extent (20–30% of SLU)
- (L) Limited in extent (10–20% of SLU)
- (M) Minor in extent (<10% of SLU)



Detailed soil profile descriptions:

- A2** Shallow calcareous loam (Paralithic, Hypercalcic Calcarosol)
10-25 cm calcareous loam over a very highly calcareous brown clay loam with soft to rubbly carbonate at about 25 cm, grading to weathering siltstone at about 60 cm.
- B2** Shallow calcareous loam on calcrete (Petrocalcic, Calcic Calcarosol)
25-40 cm calcareous loam to clay loam, usually more calcareous and clayey with depth, abruptly overlying a calcrete pan, grading to dolomite or calc-siltstone.
- B4** Gradational loam on limestone (Petrocalcic, Red Dermosol)
15-40 cm loam to clay loam grading to a well structured red clay loam to clay abruptly overlying a calcrete pan at about 30 cm, merging with dolomite or calc-siltstone.
- C2** Gradational loam on rock (Hypercalcic, Red Dermosol)
10-20 cm loam grading to a well structured red clay loam with soft carbonate from about 40 cm merging with weathering siltstone at about 60 cm.
- C3** Gradational clay loam (Hypercalcic, Red Dermosol)
15-40 cm friable clay loam grading to a well structured red clay with soft carbonate at about 75 cm, grading to deeply weathered rock.
- C5** Dark gradational loam (Hypercalcic, Black Dermosol) *
Dark loam grading to a well structured dark grey to black clay, highly calcareous with depth, over alluvium.
- D1** Hard loam over red clay on rock (Hypercalcic, Red Chromosol)
15-40 cm siltstone gravelly loam abruptly overlying a well structured red clay, with soft carbonate from about 50 cm grading to weathering siltstone at about 75 cm.
- D2** Hard silty loam over well structured red clay (Calcic, Red Chromosol) *
40-60 cm silty loam to clay loam, often with a paler A2 layer, abruptly overlying a red well structured clay with soft carbonate from about 80 cm over alluvium.
- D3** Hard silty loam over dispersive red clay (Calcic, Red Sodosol) *
40-60 cm silty loam to clay loam, often with a paler A2 layer, abruptly overlying a red (sometimes with brown mottles) poorly structured and dispersive clay with soft carbonate from about 80 cm over alluvium.
- D7** Hard clay loam over dispersive red clay on rock (Calcic, Red Sodosol)
10-30 cm hard quartz gravelly clay loam abruptly overlying a coarsely structured dispersive red heavy clay with soft carbonate at about 45 cm grading to quartzite or quartzitic shale usually deeper than 100 cm.
- E2** Red cracking clay (Epipedal, Red Vertosol)
Dark well structured seasonally cracking clay becoming more clayey, calcareous and coarser structured with depth, continuing below 100 cm.
- L1** Shallow stony loam (Lithic, Leptic Tenosol / Rudosol)
Up to 50 cm stony loam directly overlying basement rock, with or without carbonate in fissures.
- M2** Deep black loam (Calcic, Black Dermosol / Chromosol) *
25-50 cm black loam to light clay grading to (Dermosols), or abruptly overlying (Chromosols) a black well structured heavy clay, usually calcareous from about 60 cm.
- M4** Gradational fine sandy loam (Brown Kandosol) *
Thick brown silty loam to sandy loam grading to a brown or black, weakly structured silty clay loam or clay subsoil formed in alluvium.

* Variable thicknesses of recent silty deposits may overlie the soils formed on alluvium.

Further information: [DEWNR Soil and Land Program](#)

