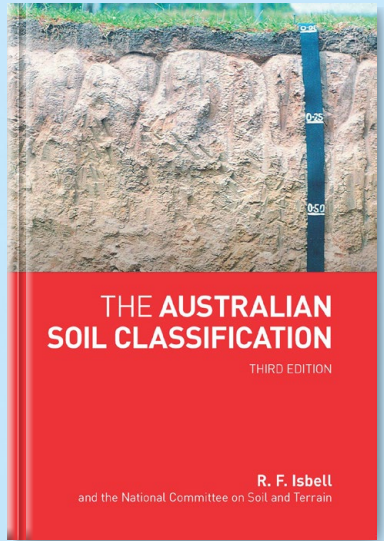


AUSTRALIAN SOILS

AUSTRALIA has a great diversity of soils.

Many are ancient, strongly weathered and infertile, but others are young and fertile.

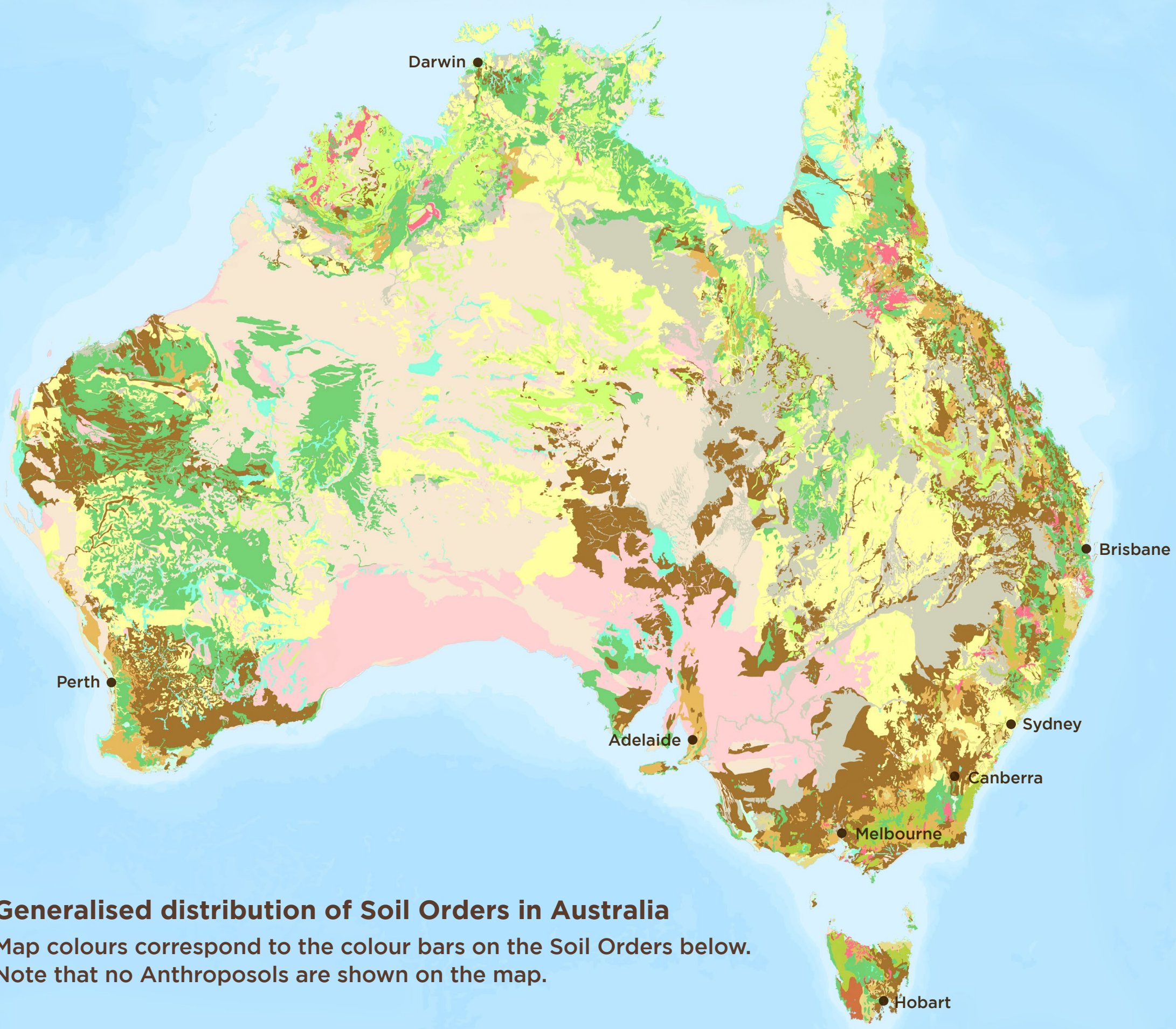


This 2024 poster highlights the key properties and great diversity of the 15 Soil Orders in the *Australian Soil Classification, Third Edition*.

Profile photographs show examples of some of the most common soils in each Order, and the map shows where they dominate in the landscapes of Australia.

Scan to access the online *Australian Soil Classification*.

NATIONAL COMMITTEE ON SOIL AND TERRAIN



Generalised distribution of Soil Orders in Australia
Map colours correspond to the colour bars on the Soil Orders below.
Note that no Anthroposols are shown on the map.

Anthroposols

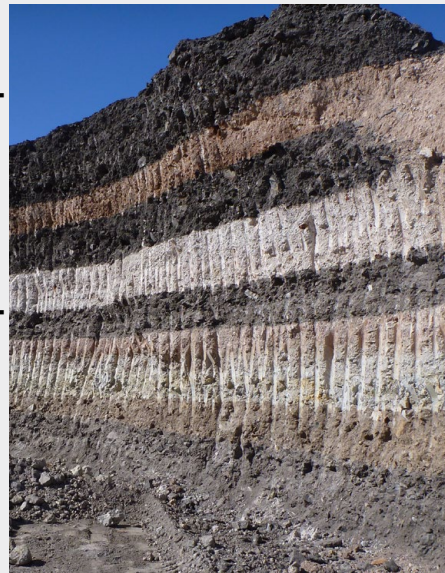
Soils resulting from human activity

- Dominant in <1% of Australia.
- Formed by the modification, mixing, truncation or burial of the original soil or creation of new soil parent materials as a result of human activities.
- Includes soils underlain by manufactured or organic landfill, formed by the application of human-made materials, and those formed by earthmoving operations.
- Identified by the presence of artefacts in the profile and/or evidence or knowledge that the soils or parent materials have been made or altered by human action.
- Excludes soils altered by common agricultural operations and soils that are artificially drained or flooded.

Cumulic Anthroposol



Spolic Anthroposol



Arenosols

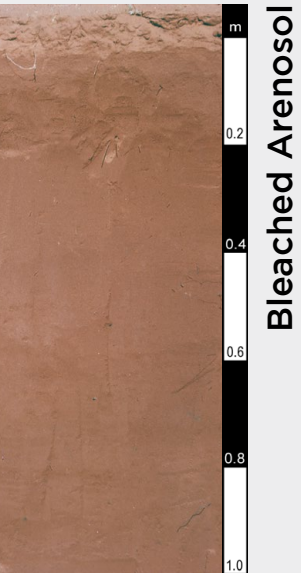
Deep sandy soils

- Dominant in about 22% of Australia.
- Soils with sandy textures to at least 1.0 m deep.
- Generally no observable peds apart from some structural development (often minimal) in the uppermost A horizon.
- Are the most widespread and abundant soils in Australia.
- Occur extensively in inland arid areas, in and adjacent to waterways and around the coast (especially in the west)
- Readily subject to wind erosion.
- Have low natural fertility but are used extensively for cereals and pastures in semi-arid SA and south-west WA.

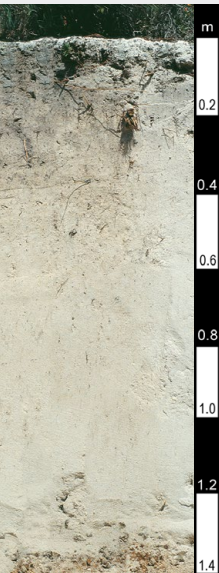
Yellow Arenosol



Red Arenosol



Bleached Arenosol

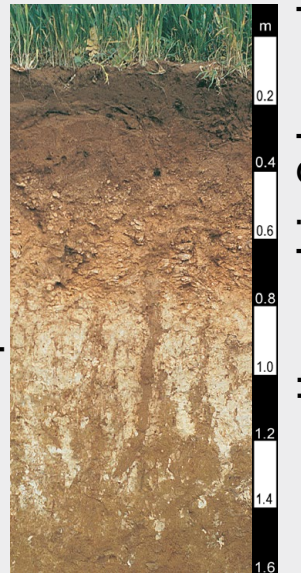


Calcarosols

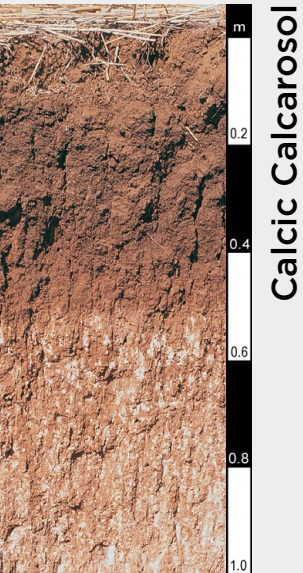
Highly calcareous soils, excluding deep sands

- Dominant in about 9% of Australia.
- Soils that contain calcium carbonate as soft or hard white fragments or as a solid layer. Some of the carbonate must be of secondary (pedogenic) origin.
- Extensive in the low rainfall, arid and semi-arid regions of SA, the NT and the Nullarbor Plain (WA/SA).
- Land uses include cereal growing, irrigated horticulture and sparse grazing in the north.
- Limitations include shallow depth, low water retention due to hard carbonate content and wind erosion on the sandier types.
- High salinity, alkalinity and/or sodicity may constrain plant growth. Soil fertility deficiencies are widespread.

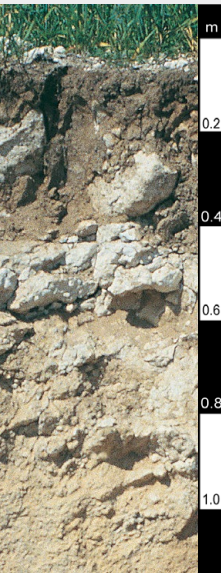
Supracalcic Calcarosol



Hypercalcic Calcarosol



Calcic Calcarosol



Chromosols

Soils with an abrupt increase in clay and non-sodic subsoil

- Dominant in about 3% of Australia.
- Soils with strong texture contrast between the A and B horizons and non-sodic and not strongly acid in the upper part of the B horizon.
- Common in the cereal belt of southern NSW, VIC and WA.
- Land use in the tropics is mainly cattle grazing of native pastures.
- Many have hardsetting surfaces with structural degradation caused by agriculture.

Red Chromosol



Brown Chromosol



Yellow Chromosol

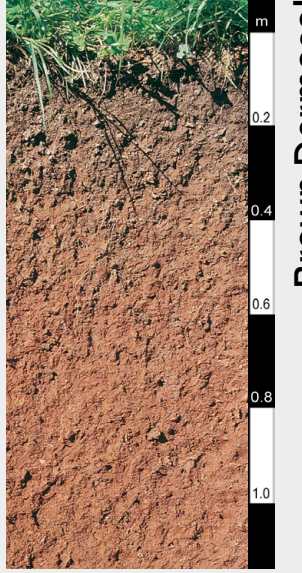


Dermosols

Structured soils without a texture contrast

- Dominant in about 2% of Australia.
- Moderately deep, well-drained and relatively fertile soils found in higher rainfall, and often mountainous, areas of eastern Australia.
- Often strongly acid in the high rainfall areas, but may be alkaline on calcareous parent materials.
- Support a wide range of land uses including cattle and sheep grazing of native pastures, forestry, horticulture and sugar cane. Cereal crops, especially wheat, are commonly grown on the more fertile Dermosols.

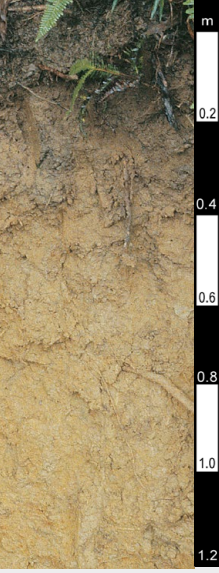
Red Dermosol



Brown Dermosol



Yellow Dermosol

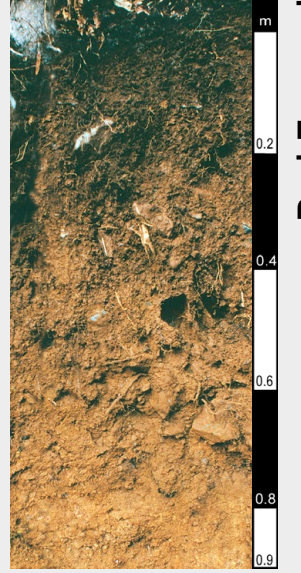


Ferrosols

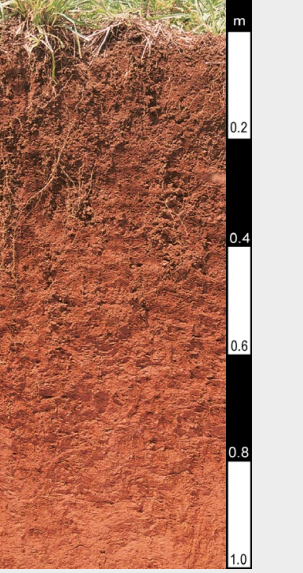
Iron rich soils

- Dominant in about 1% of Australia.
- Soils with high free iron oxide and clay contents, usually strongly red or brown in colour.
- Occur mainly on undulating landscapes of basalt along the eastern coastal hinterland, and in northern parts of TAS, WA and the NT.
- In high rainfall zones they may be strongly acid, very deep and well drained with high initial fertility.
- Land use includes dairying on improved pastures, horticulture, some plantation forestry, and sugar cane in coastal QLD. In northern Australia the shallow and stony variants support beef cattle grazing.
- Prone to compaction and structural degradation.

Brown Ferrosol



Red Ferrosol

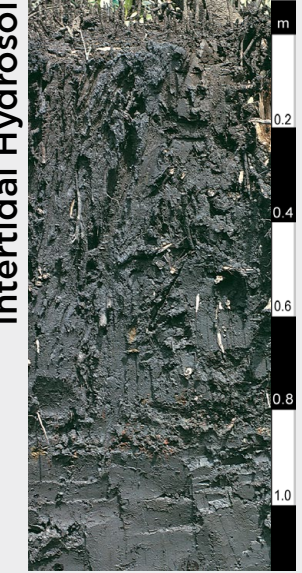


Hydrosols

Seasonally or permanently wet soils

- Dominant in <1% of Australia.
- Soils saturated for 2-3 months or more due to site or tidal influences and are diverse in nature.
- Distribution is mainly limited to wetlands, coastal floodplains (NT), seepages, waterways and lakes.
- Saline Hydrosols occur in tidally affected areas, inland ephemeral lakes and seepage areas, commonly human-induced.
- Elsewhere non-saline Hydrosols are widespread. Some are drained for sugarcane and dairying.
- Drainage of potential acid sulfate soils (sulfidic Hydrosols) can pose engineering and environmental problems and lead to extreme acidification.

Intertidal Hydrosol



Salic Hydrosol



Redoxic Hydrosol

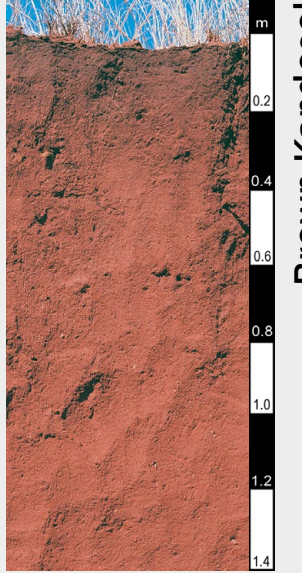


Kandosols

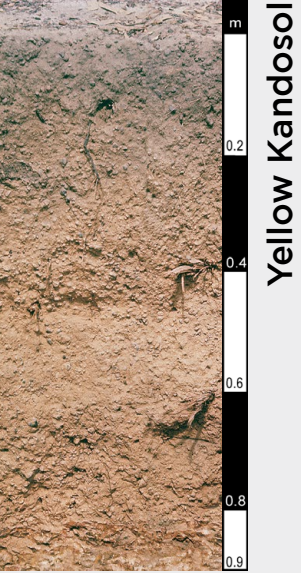
Structureless soils without a texture contrast, excluding deep sands

- Dominant in about 17% of Australia.
- Mostly well-drained, deep, permeable soils although some Yellow and most Grey Kandosols have impeded subsoil drainage.
- Widespread in the arid and semi-arid interior and northern Australia.
- Most have low fertility and land use is commonly restricted to grazing of native pastures.
- Used for agriculture in the wheatbelts of southern NSW and WA. With irrigation they are important agricultural soils used for a range of horticultural crops.
- Grazing lands are susceptible to surface soil degradation such as hardsetting and crusting even when grazing intensity is low.

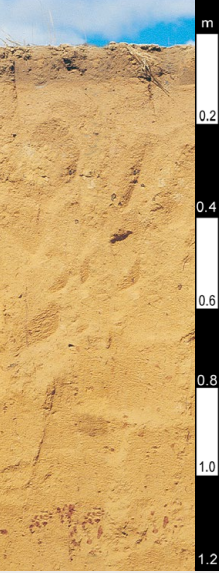
Red Kandosol



Brown Kandosol



Yellow Kandosol

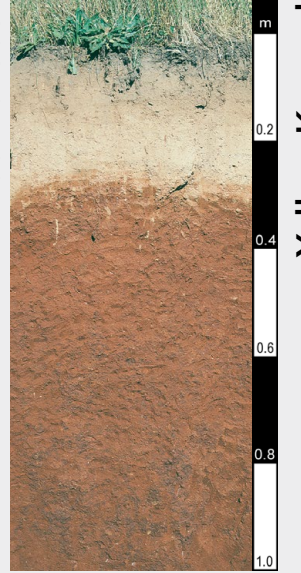


Kurosols

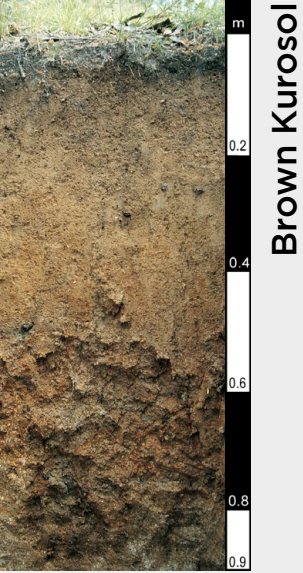
Soils with an abrupt increase in clay and strongly acid subsoil

- Dominant in about 1% of Australia.
- Soils with strong texture contrast between the A and B horizons and the strongly acid upper B horizon.
- Extend mainly from eastern QLD, through coastal and subcoastal NSW, to TAS. Also occur in southwest WA.
- Some areas are cleared and used for dairying on improved pastures.
- In the higher rainfall areas of NSW and TAS, Kurosols are used for forestry.
- Small areas in WA are used for cereal growing and lower rainfall woodlands support sparse cattle grazing.

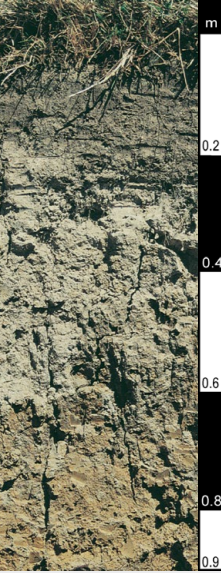
Red Kurosol



Yellow Kurosol



Brown Kurosol

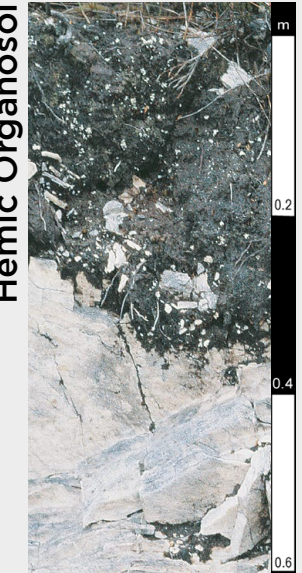


Organosols

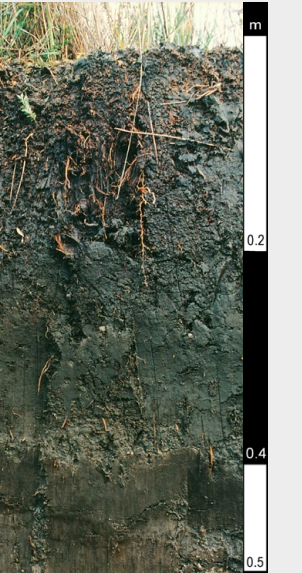
Soils dominated by organic materials

- Dominant in <1% of Australia.
- Soils dominated by organic materials.
- Common in alpine regions of TAS, NSW and VIC.
- Also occur in wet landscapes in the more humid parts of the eastern Australian coastal zone and SA.
- Fragile and prone to erosion if disturbed by fire, during droughts or grazing by hard-hooved animals.
- Less acidic forms in southern Australia have been drained and sown to pastures for dairying or used for intensive vegetable growing. Limited areas of sugarcane are grown on drained peats in north QLD.

Hemic Organosol



Hemic Organosol



Hemic Organosol



Podosols

Soils with subsoil accumulations of compounds of organic matter, aluminium and/or iron

- Dominant in <1% of Australia.
- Characterised by subsoil concentrations of organic matter and aluminium with or without iron (Bh, Bs or Bhs horizons).
- Soils have acidic sandy textures and can be greater than 20 m deep ("giant podzols").
- Most are very permeable unless indurated subsoil pans are present.
- Largely confined to coastal dunes and near-coastal sandplains.
- Soils have low fertility, poor water retention and some experience seasonal waterlogging.
- Some are drained for sugar cane (QLD) or used for irrigated vegetables or grazing on improved pastures (VIC, SA, WA).

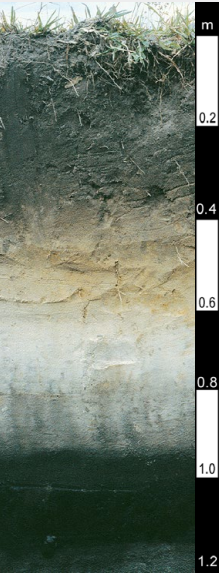
Aeric Podosol



Semiaquic Podosol



Aquic Podosol

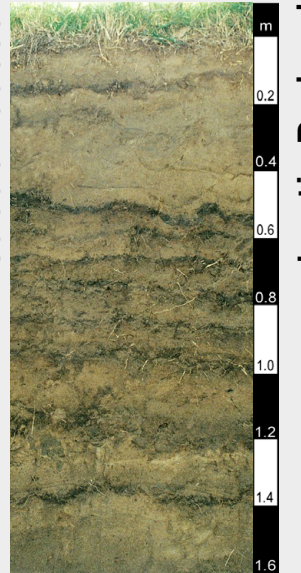


Rudosols

Minimal soil development, excluding deep sands

- Dominant in about 6% of Australia.
- The two most common types are stony soils that are very shallow and those formed in recently deposited alluvium (often stratified).
- Widespread throughout Australia. Most commonly found on recent alluvium in floodplains, and areas where soil formation is minimal such as steep rocky ranges.
- Most have few commercial land uses because of their properties or occurrence in arid regions, or both. Some alluvial forms may be used for cropping and improved pastures.
- Some Rudosol areas have spectacular scenery (e.g. Katherine Gorge NT and the Kimberley Region of WA).

Stratic Rudosol



Leptic Rudosol

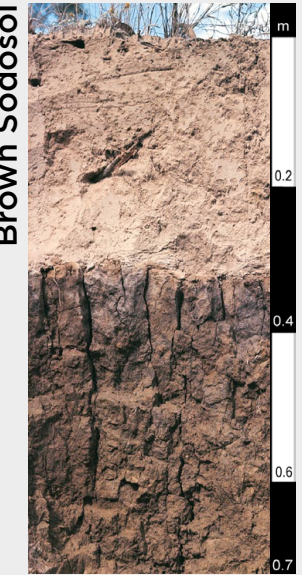


Sodosols

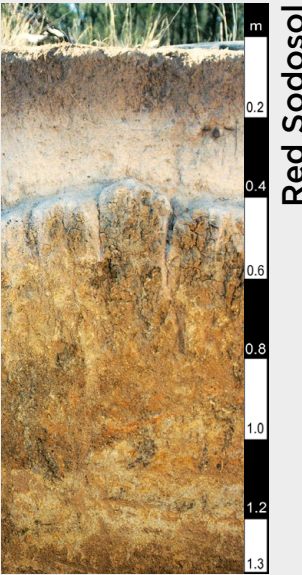
Soils with an abrupt increase in clay and sodic subsoil

- Dominant in about 13% of Australia.
- Soils with strong texture contrast between the A and B horizons and sodic upper B horizon.
- The high sodium content of the B horizon may lead to soil dispersion and tunnel and gully erosion. Arid-zone Sodosols may also be strongly saline.
- Seasonally perched water tables are common and B horizons usually have a striking prismatic or columnar appearance.
- Usually associated with a semi-arid or arid climate.
- Land uses include grazing of native or improved pastures and forestry and both dryland and irrigated agriculture in southern Australia.

Brown Sodosol



Grey Sodosol



Red Sodosol

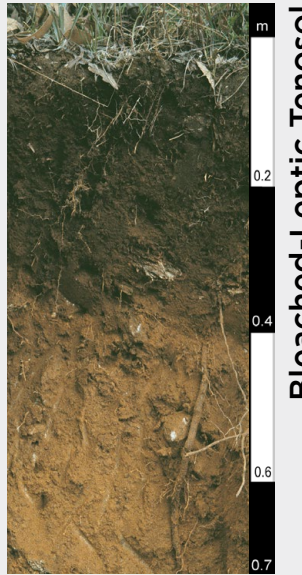


Tenosols

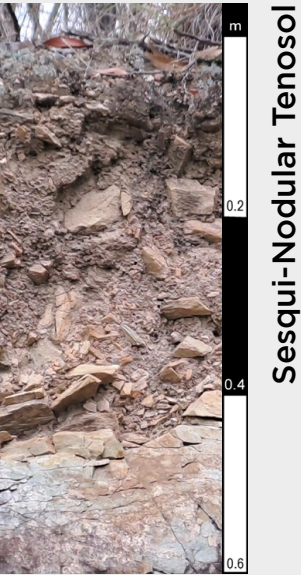
Weakly developed soils, excluding deep sands

- Dominant in about 13% of Australia.
- Soils with weak soil development, excluding deep sands.
- Diverse, commonly shallow loamy or sandy soils on slopes, plains and rises, with stony forms on steep slopes.
- Common in rangelands overlying rock or hardpans at shallow depth.
- Very common in south-west WA with abundant ferric or bauxitic gravels.
- Some are used for cropping and pastures in south-west WA.

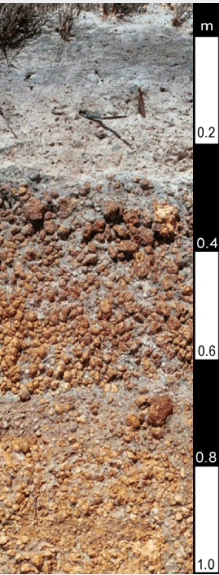
Chernic Tenosol



Bleached-Leptic Tenosol



Sesqui-Nodular Tenosol

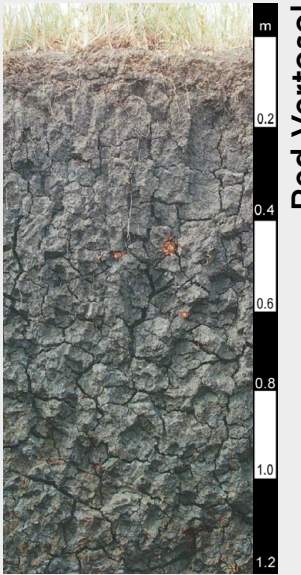


Vertosols

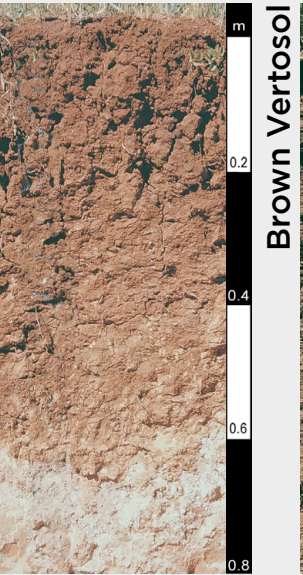
Shrink and swell clay soils

- Dominant in about 12% of Australia.
- Clay soils that shrink and crack when dry and swell when wet.
- Widespread in the inland plains of eastern Australia such as the Liverpool Plains (NSW), Darling Downs and Mitchell Grass Downs (QLD), and Barkly Tablelands (NT). Also extensive in the alluvial valleys of the Kimberley Region of WA.
- May be very deep (up to 6 m or more).
- Used for grazing of native and improved pastures, extensive dryland agriculture where rainfall is adequate, and irrigated agriculture.

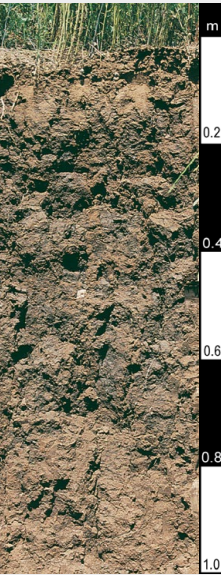
Black Vertosol



Red Vertosol



Brown Vertosol



ACKNOWLEDGEMENTS: Editors: Noel Schoknecht and Bernie Powell. **Design:** Noel Schoknecht. **Map:** Linda Gregory, CSIRO. Base map: ESRI, TomTom, Garmin, FAO, NOAA, USGS 2024. **Original poster:** K Brown, N McKenzie, R Isbell and D Jacquier (CSIRO Land & Water, 1996). **Soil map:** National Resource Information Centre, BRS (1991): *Atlas of Australian Soils* (digital) v3 CSIRO (2024). **Soil images:** All profile images from *Australian soils and landscapes: an illustrated compendium*. N McKenzie et al. CSIRO 2004

unless otherwise noted. Dominant soil % areas based on the revised (version 3) of the *Atlas of Australian Soils*. Other Images: Cumulic Anthropol; craftnhome.com | Spolic Anthropol; Anna Sheldon | Ferrosol landscape; TAS, Chris Grose | Organosol landscape; Central highlands, TAS, Rob Moreton | Rudosol landscape; Kimberley WA, Noel Schoknecht | Bleached-Leptic Tenosol, QLD, Bernie Powell | Sequi-Nodular Tenosol, WA, Noel Schoknecht.

REFERENCES: Isbell RF and the National Committee on Soil and Terrain (2022) *The Australian Soil Classification*, 3rd Edition. (CSIRO Publishing: Melbourne). Isbell RF, McDonald WS, Ashton LJ (1997) *Concepts and Rationale of the Australian Soil Classification*. (ACLEP, CSIRO Land and Water: Canberra). **ABBREVIATIONS:** NSW: New South Wales, NT: Northern Territory, QLD: Queensland, SA: South Australia, TAS: Tasmania, VIC: Victoria, WA: Western Australia.