Classifying Australia's Soil Resources 41

A major revision of the Australia Soil Classification

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INTRODUCTION

Soils are complex, highly variable, and a key natural resource that support life, provide food, as well as providing many other essential environmental services and product, such as being a storehouse of environmental carbon and biodiversity. Soils also require classification – just like other natural entities – especially as an aid to communication and understanding.

The Australian Soil Classification (ASC) is the nationally accepted scheme for Australia and is undergoing revision – as do all classification schemes – to incorporate new knowledge, understanding and uses.

The National Committee on Soil & Terrain (NCST) – part of the COAG inter-governmental committee system – oversees the ASC Working Group, an expert group of soil scientists providing guidance on improvements to the ASC.

The Working Group has recommended a major revision of the ASC to incorporate a new Soil Order – the highest level of organisation within the classification – of which there are currently 14. The new Order is the Arenosols, which will comprise deep sandy soils (more than one metre of sand) and take its place alongside existing Soil Orders such as the Calcarosols, Chromosols, Hydrosols, Podosols and Hydrosols. Arenosols are widespread across Australia, and present significant challenges to land use and management, as well as to broader environmental management.

Soil complexity needs to be rationalised via a classification system to aid communication; help describe and codify the characteristics of soil profiles as well as landscape mapping units; as an aid to understanding land use and management requirements, and as an input into environmental modelling for uses varying from strategic land use planning to climate change scenario modelling.

Figure 1 A proposed 'Yellow Arenosol' from the Western Australian North Coastal Plain, supporting a lupin crop – currently a Yellow-Orthic Tenosol. [Noel Schoknecht]

The Australian Soil Classification

The Australia Soil Classification (ASC) was developed to simplify and improve the classification of Australia's soil resources – with the first edition published in 1996, followed by a revised edition in 2002, and a second edition in 2016 (Isbell 1996, Isbell 2002, Isbell & NCST 2016).

Prior to the ASC, several soil classification schemes were in use in various parts of the country with no single nationally accepted system. Many will be familiar with earlier Australian systems: the 'Great Soil Groups' (Stace et al. 1968) and the 'Factual Key' (Northcote 1979). The ASC has both built-upon and improved-upon these older systems (as well as utilising parts of other systems of classification such as US Soil Taxonomy and the South African classification) and is now the nationally accepted soil classification scheme. It has proven to be a boon for soil scientists and others

for better understanding and communicating about soils within Australia.

The ASC was first established by Ray Isbell of CSIRO following an unprecedented level of consultation with State and Territory land and soil mapping programs – which were then active owing to funding arising from the 'Accelerated Program of Land Resource Assessment' in the 'Decade of Landcare' (1990–2000).

Those with experience of using the ASC – who also have experience of other systems of soil classification – appreciate its straightforwardness, ease of use, applicability to Australian soils and conditions, and usefulness for a range of purposes across a range of disciplines (e.g. hydrology, ecology, climate science, agricultural land management, land use planning, environmental carbon studies). It focuses on soil characteristics that can be observed in the field, with minimal requirement for laboratory testing. And where such testing is required but not available, estimates can be made to enable classification to proceed.

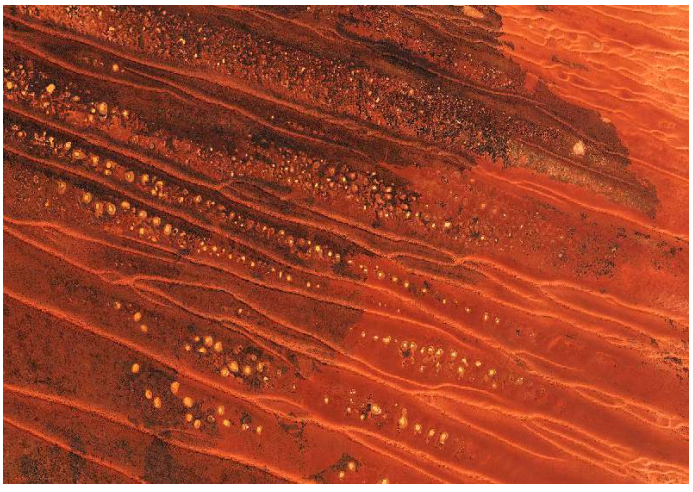

Figure 2 A aerial shot of red longitudinal sand dunes of the Great Sandy Desert – part of the vast sand dune network of Australia's arid interior – also showing circular soaks in the interdune swales. [Landgate WA]

Soil classification information is part of the National Data Infrastructure

Databases containing site and spatial descriptions utilising ASC classifications also form part of Australia's key data/information infrastructure – for example, within the Australian Soil Resource Information System (ASRIS), the Terrestrial Ecosystem Research Network (TERN), and the various state and territory-based data systems (such as the SALI database in Queensland, SALIS in NSW, and the State Land & Soil Information Framework in South Australia).

These site and spatial datasets can be utilised within agricultural, environmental, and climate change modelling to answer key management and policy questions, such as the prioritisation of issues for the allocation of limited available public and private resourcing.

The process to support change

As new knowledge is gained, new understanding achieved, and new uses discovered, corresponding changes to all classification schemes are required. Consequently, the National Committee on Soil & Terrain (NCST) oversees the dedicated expert working group that reports back on potential improvements to the ASC. The wider soil science community—through their professional body Soil Science Australia—are also able to have their say on potential changes.

The ASC Working Group relies on in-kind contributions from experts from around Australia, including Mark Imhof and David Rees (Victorian Department of Economic Development, Jobs, Transport & Resources), Ted Griffin (Western Australian Department of Primary Industries & Regional Development), Ben Harms (Queensland Department of Environment & Science), Brian Lynch (Northern Territory Department of Environment & Natural Resources), David Morand (NSW Office of Environment & Heritage), Dr Mark Thomas (CSIRO), and specialist soil consultants Noel Schoknecht (former Science Leader - Soils, Western Australian

Government) and James Hall (former Principal Soil Scientist, South Australian Government). The very able Chair of the group is Bernie Powell, formerly a Principal Scientist with the Queensland Government.

Figure 3 A proposed 'Bleached Arenosol' from South Australia's Upper South East, supporting a cereal crop and showing 'Argic' layers at depth – currently a Bleached-Orthic Tenosol. [SA Soil & Land Program SC Site MM099]

A proposed new Arenosol soil class at the highest level of classification

The Working Group has recommended a major revision of the ASC, which involves the creation of a new Soil Order – the highest level of organisation within the ASC – to be called the 'Arenosols'.

(The Latin word 'arena' means 'sand' or 'sand-strewn place of combat' – as the ancient Romans covered the floor of the Colosseum and other arenas with sand to absorb the blood produced by their human and animal spectacles. So, the modern English word 'arena' is derived from the Latin word for 'sand'.)

Arenosols are deep sandy soils that are more widespread and extensive than of any of the other Soil Orders and cover about 25% of Australia. Currently these soils are incorporated within the Rudosol, Calcarosol and Tenosol Soil Orders.

In Western Australia and South Australia, and to a lesser extent Victoria, Arenosols are widely used for dryland and irrigated agriculture, and across the whole of Australia they have distinct land use and management requirements and issues – such as poor water and nutrient retention, often high soil acidification risk, high wind erosion risk and often low agricultural productivity levels. However, they can present benefits as well, such as a deep potential rootzone, with most soil water being available for extraction by plant roots, and often high suitability for irrigation of deep-rooted crops. Significant agricultural industries depend on Arenosols.

Arenosols also support many diverse and important natural habitats – with some of Australia's most biodiversity-rich habitats supported by these deep sandy soils.

Figure 4 A proposed 'Calcareous Arenosol' from South Australia's Mid North agricultural region – currently a Calcic Calcarosol. [SA Soil & Land Program SC Site CU020]

Silica sand – a key, and often dominant, component of many Arenosols – is mined; for example, at Cape Flattery in Queensland, which is the largest silica sand mine in the world and has the highest proportion of indigenous workers of any Australian mine. Silica sand is put to many uses with the best-known being glass manufacture.

The revised ASC will also enable classification of mineral sands within the Arenosol Soil Order – helping to pinpoint and map potential mineral sand resources.

Shell sands – deep sandy soils dominantly composed of sand-size particles of calcium carbonate derived from shells and other aquatic skeletons – are mined at various sites across southern Australia as a source of lime for agricultural use to combat soil acidification.

While 'Little Sahara' – an extensive field of high, bare and mobile jumbled sand dunes, also dominantly composed of sand-size calcium carbonate grains – is a key tourist attraction of the southern coast of Kangaroo Island.

Moreover, the whitest beach in Australia, which is composed of highly reflective silica sand grains, can be found at Lucky Bay in Cape Le Grand National Park on Western Australia's south coast.

Figure 5 A severe 'dust storm' during the summer of 2011, Dalwallinu, NE Wheatbelt, Western Australia – wind erosion is a serious potential risk on deep sandy soils, especially in dry years when vegetative cover can be poor. [WA Dept of Agriculture & Food]

A workshop to be held at the National Soils Conference in Canberra

The ASC Working Group is still discussing – via vigorous but respectful scientific debate – the finer details of the Arenosol proposal, but the broad thrust of the changes has been agreed upon. A workshop is to be held at the Soil Science Australia 'National Soils Conference' in Canberra in November (soilscienceconference.org.au) to present the proposed changes and take on board additional suggestions from the soil science community. All are welcome to attend!

Following this, there will be a period of extensive field testing before a final proposal is presented to the NCST, with publication planned for late 2019.

What will this mean for Australia?

The National Soil Research, Development & Extension Strategy (https://soilstrategy.net.au) – 'Securing Australia's soil for profitable industries and healthy landscapes' – and its five priorities will benefit from an ASC (and corresponding site and spatial datasets) that has greater focus on key productive soils, such as the Arenosols, and the issues associated with their use and management. The continuing acidification, and corresponding degradation, of many agricultural sandy soils and adjacent water bodies, is a cause for concern, funding and action. Moreover, the ASC will align more closely with international classification systems that include a dedicated soil order for the deep sands.

For a range of complex reasons, the level of action and effectiveness in understanding, benchmarking and classifying Australia's soil resources has been limited since the Decade of Landcare (1990–2000). In order to improve the situation – as the soil management challenges facing Australia are large, and there is a clear need for much better information on soil condition and trends – the NCST has advocated for at least some renewal of the survey, monitoring and complementary RD&E activities, and believes they are essential. The NCST addressed this issue by preparing a report for the National Soil RD&E Strategy outlining the proposed Australian Soil Assessment Program.

The Australian Soil Assessment Plan proposal provides a comprehensive plan for re-engineering the national soil information infrastructure so that it can provide the required data and information to regularly assess the condition of soils and their responses to land management across Australia, as well as provide input data for a range of other environmental monitoring and modelling.

To underpin all these initiatives, a comprehensive understanding of our soil resources is paramount, and an improved ASC helps deliver this.

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