SOIL

REFERENCE SOILS OF SOUTH-WESTERN AUSTRALIA

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In 1986 the WA Branch of the Australian Society of Soil Science received a grant from the Australian Bicentennial Authority to establish a system of Reference Soils in the south-west province of WA. I applied for and was awarded the contract for the project and began site selection in mid 1987. My brief was to select and document sites on reserved land (eg Nature Reserves, National Parks) where the soil surface and native vegetation were undisturbed and where the soil type was representative of important agricultural, horticultural or forestry land.

Sandplain site at Coorow.

To ensure an even spread of sites the area was divided into natural regions (eg Swan Coastal Plain, Wheatbelt etc) and these formed the basis for selection of sites and for discussion of the Reference Soils.

What's in the book?

Each natural region is treated in a separate chapter beginning with a brief history of European settlement and leading to a discussion of the relationships between past and present land use and the attributes of the Reference Soils. There are soil maps and diagrams to indicate the spatial and stratigraphic relationships between soil types of each region. The book may be used at a general level, or in as much detail as is required.

The properties of a Reference Soil and associated site data are generally set out on a single page. There is an accurate location, a record of site properties (geology, landform, drainage status and native vegetation) and a detailed description of the soil profile usually to a depth of one metre but sometimes deeper; chemical and physical analysis data are also included.

The assembled descriptions and discussions together with explanatory data and a comprehensive bibliography were published in book form in 1991 and reprinted in 2004.

"Reference Soils of South-western Australia" W.M. McArthur. 2004 reprint. Dept of Agriculture and Food, Perth. $11.00 Obtainable from DAFWA, Jarrah Rd, South Perth, but only to personal callers, no postal sales.

Using the book

While the prime objective of the project was to preserve sites for demonstration and comparison purposes, the assembled data will be useful to agriculturalists, foresters and biologists. By reference to descriptions, maps and diagrams, those with interest in the land will have little difficulty in identifying the different elements of the landscape as exemplified by the Reference Soils.

The morphological descriptions, using defined terminology, show the minimum depth of the soil profile and the thickness of the various horizons. It is also clear that there are orderly changes in the colour, texture, structure, consistence and the incidence of gravels with depth. These changes have implications for productivity through permeability, water-holding capacity, root penetration and ease of cultivation.

The chemical attributes, which also show orderly changes with depth, combine with water to supply nutrients to plant roots. However they do not act independently but rather through complex interactions both between attributes and with clay minerals, iron and aluminium oxides, and organic matter. Thus acidity or alkalinity (pH values) can affect nutrient uptake with extreme values causing deficiency for some elements. The effects of surface salinity are obvious but, in some soils, salts are confined to deeper subsoils and crops are not affected. Phosphorous levels in most WA soils are very low. In the Reference Soils most surface horizons contain <10mg/kg of available phosphorous, indicating that they would respond to P applications. Potassium levels are generally adequate for crop production in

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all except the sandy profiles where potassium is readily leached. Those soils derived from wind-blown lake deposits (eg KELL 9; q.v.) have very high levels of potassium.

The exchangeable cations – calcium, magnesium, sodium and potassium – react in a very complex manner with clay particles and affect soil structure. It is sufficient here to state that, in clay soils, where calcium is the dominant ion soil structure is stable but, where magnesium and/or sodium are dominant, the soil disperses when wet and sets very hard when dry.

The description of Reference Soils and the associated analytical data may also be used to make comparisons between sites from different regions. Thus there are several samples from yellow sandplain soils stretching from Geraldton south and east through the wheatbelt; their morphology and chemistry are remarkably similar. There are also several diverse sites that support karri forest and it is clear that, in this instance anyway, soil morphology does not determine distribution.

Discussion

The project has raised some interesting ideas and questions especially in relation to rehabilitation of abandoned farmland. It is relatively simple to replace some of the original above-ground components but the soil, particularly the surface, has been subject to significant alteration. Cultivation, herbicides, insecticides, fertilizers, animal trampling and introduced bacteria have produced an entirely different growth medium. How long would it take for the soil to return to a condition with original microflora and microfauna? Would the low pH values (acid soils) revert to normal values and would hardpans caused by compaction disappear over time? The high nutrient status under farming may not favour establishment of some native plants (eg Proteaceae) in soils other than deep sandy profiles.

What of the future? It is clear that 150 sites to represent the SW of WA is a pitifully small sample but the result was worthwhile – a published record of descriptions of those 150 undisturbed soils together with detailed analyses. It provides a baseline for future comparisons. The project has limitations and reservations but it could be seen as a reminder that protection of natural phenomena will never be easier than now!

Bill McArthur worked in CSIRO (Divisions of Soils and Land Resources Management) for 30 years, then as a Consultant in land resource assessment – and he hasn't given up yet!