Soil Science

Handout 1

Short Guide to the Soils of South African

CIN: 205 Version: 001 Date: 2022/02/09

A short guide to the soils of South Africa, their distribution and correlation with World Reference Base soil groups

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Abstract
The 73 soil forms of the South African classification can be placed into 14 groups (organic, humic, vertic, melanic, silicic, calcic, duplex, podzolic, plinthic, oxidic, gleyic, cumulic, lithic and anthropic) which are identified by means of an eliminative key based on the presence of defined diagnostic horizons or materials. This allows generalizations more readily to be made about properties, genesis, distribution and environmental significance. Correlation with the World Reference Base (WRB) classification reveals that 25 reference soil groups are represented and with the aid of new distribution maps the regional abundance of WRB groups in South Africa can approximately be assessed.

Key Words
Soil classification, soil maps, diagnostic horizon, soil resources

Introduction

The only comprehensive account of the soils of South Africa is that by Van der Merwe (1940). The classification of South African soils has nevertheless evolved, with the publication of numerous regional studies, through various approximations and is currently well established, with 73 soil forms constituting the highest level grouping (Soil Classification Working Group 1991). A new account is now available (Fey 2010) which covers geographic distribution, properties (including selected profile descriptions and analytical data), classification (including correlation with major international systems), genesis, and environmental significance. The objectives of this paper are to present a synopsis of the soil groups that were created as the basis for this general account, to show their distribution and frequency of occurrence, and to broadly indicate how they relate to the groups of the World Reference Base (IUSS Working Group WRB 2006).

The soil groups

Fourteen soil groups have been created (Fey 2010) with the guiding principle being the identification of a diagnostic horizon, as defined by the Soil Classification Working Group (1991), so as to construct an eliminative key (Table 1) which is similar in operation to those employed by a number of international classifications. A representative illustration of each group is provided in Figure 1. If one of four special kinds of topsoil horizons is not present (i.e. the topsoil is orthic) then the direction and degree of development of the subsoil are considered. If none of the seven categories of subsoil development is sufficiently expressed then the soil is placed in one of the remaining, immature soil groups which are differentiated on the basis of three broad categories of parent material (Table 1).

Distribution maps

The maps in Figure 2, which exclude the organic and anthropic soil groups since these are infrequent and sporadic, were constructed from data contained in the land type survey of the Institute for Soil, Climate and Water. The map units are based on frequency of occurrence of soil groups within each land type.

World Reference Base correlation

The correlation with WRB soil groups is shown in Table 2. The cross-cutting of the two classifications, whereby some WRB groups appear in several of the South African soil groups, is not unexpected in view of the different priority given to criteria on which the respective identification keys are based. Despite this, the correlation, in conjunction with the maps in Figure 2, provides those unfamiliar with South African classification an opportunity to quickly assess the regional distribution of soil types using familiar terminology. Conversely it allows South African scientists more readily to look beyond their borders and consider local knowledge in a global context.

Acknowledgements
The E J Lombardi Trust funded this project. Support for MVF is currently provided by Alcoa World Alumina Australia and BHP Billiton Worsley Alumina (Pty) Ltd. Theo Dohse, Jeff Hughes, Jan Lambrechts, Antoni Milewski and Anthony Mills contributed to the monograph on which this paper is based. Illustrations in Figures 1 and 2 are reproduced with the permission of Cambridge University Press.

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Table 1. Key to the soil groups.

Differentiating principle	Soil group		Concept	Diagnostic horizon or material for identification
Soils with special topsoil characteristics	1	Organic	Wetland or montane peat	Organic O
	2	Humic	Humus enrichment; free drainage; low base status; humid climate	Humic A
	3	Vertic	Swelling, cracking clay; basic parent material; semi-arid to sub-humid climate	Vertic A
	4	Melanic	Dark, structured clay; high base status; semi-arid to sub-humid climate	Melanic A
Soils with special subsoil characteristics relating to pedogenic accumulation and having an orthic topsoil	5	Silicic	Cementation by amorphous silica or sepiolite; arid climate	Dorbank (duripan) or sepiocrete
	6	Calcic	Carbonate or gypsum enrichment; arid climate	Soft or hardpan carbonate or gypsic B
	7	Duplex	Marked textural contrast through clay enrichment	Pedocutanic or prismacutanic B
	8	Podzolic	Metal humate enrichment; siliceous parent material	Podzol B
	9	Plinthic	Absolute iron enrichment; localised, hydromorphic segregation with mottling or cementation	Soft or hard plinthic B
	10	Oxidic	Residual iron enrichment through weathering; uniform colour	Red apedal, yellow-brown apedal or red structured B
	11	Gleyic	Protracted reduction in an aquic subsoil or wetland	G horizon
Young soils with an orthic topsoil but weakly developed subsoil	12	Cumulic	Incipient soil formation in colluvial, alluvial or aeolian sediment	Neocutanic or neocarbonate B, regic sand, thick E horizon or stratified alluvium
	13	Lithic	Incipient soil formation on weathering rock or saprolite	Lithocutanic B or hard rock
	14	Anthropic	Human disturbance	Disturbed material

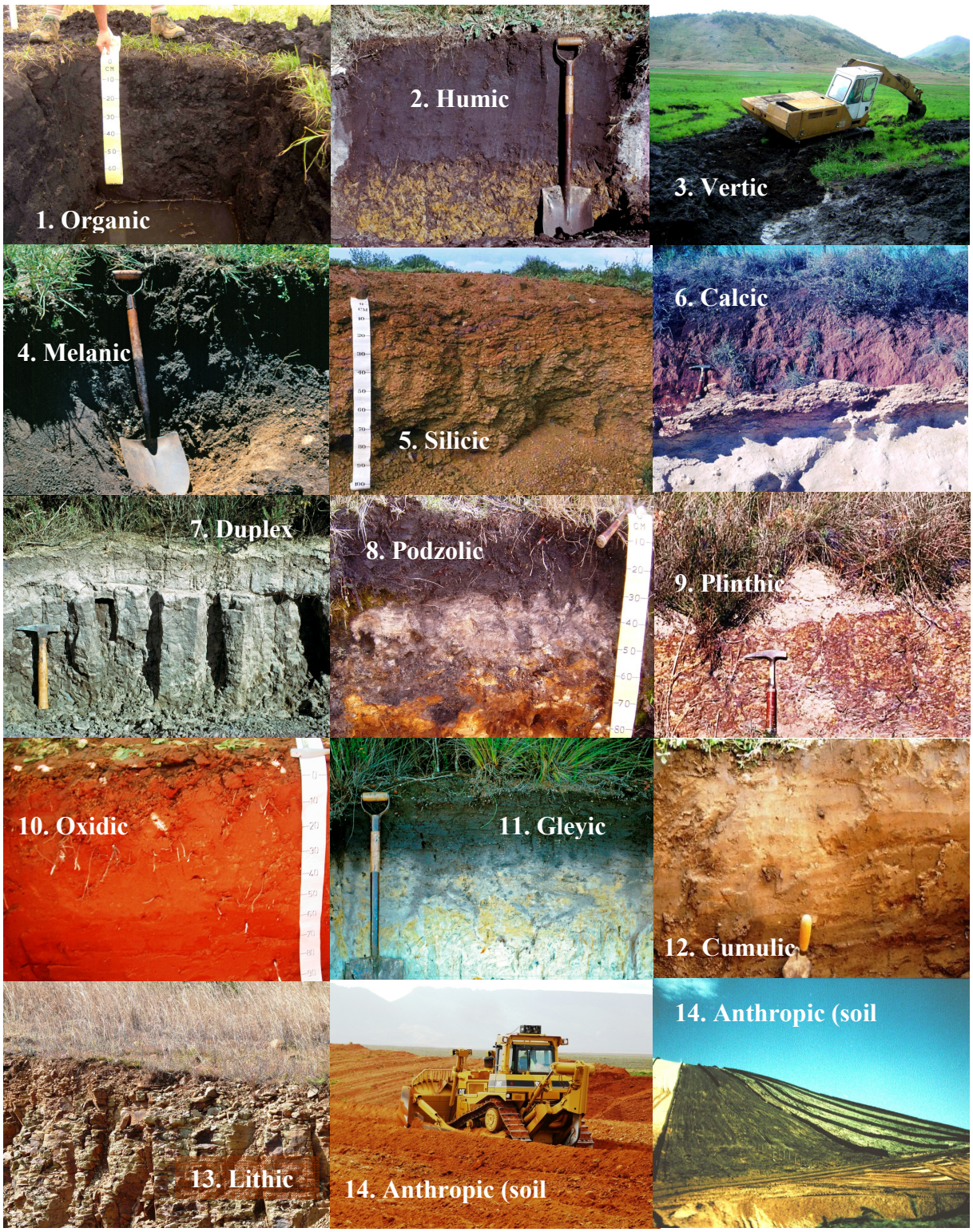

Figure 1. Illustration of the fourteen soil groups (Compiled from Fey 2010, with the publisher's permission).

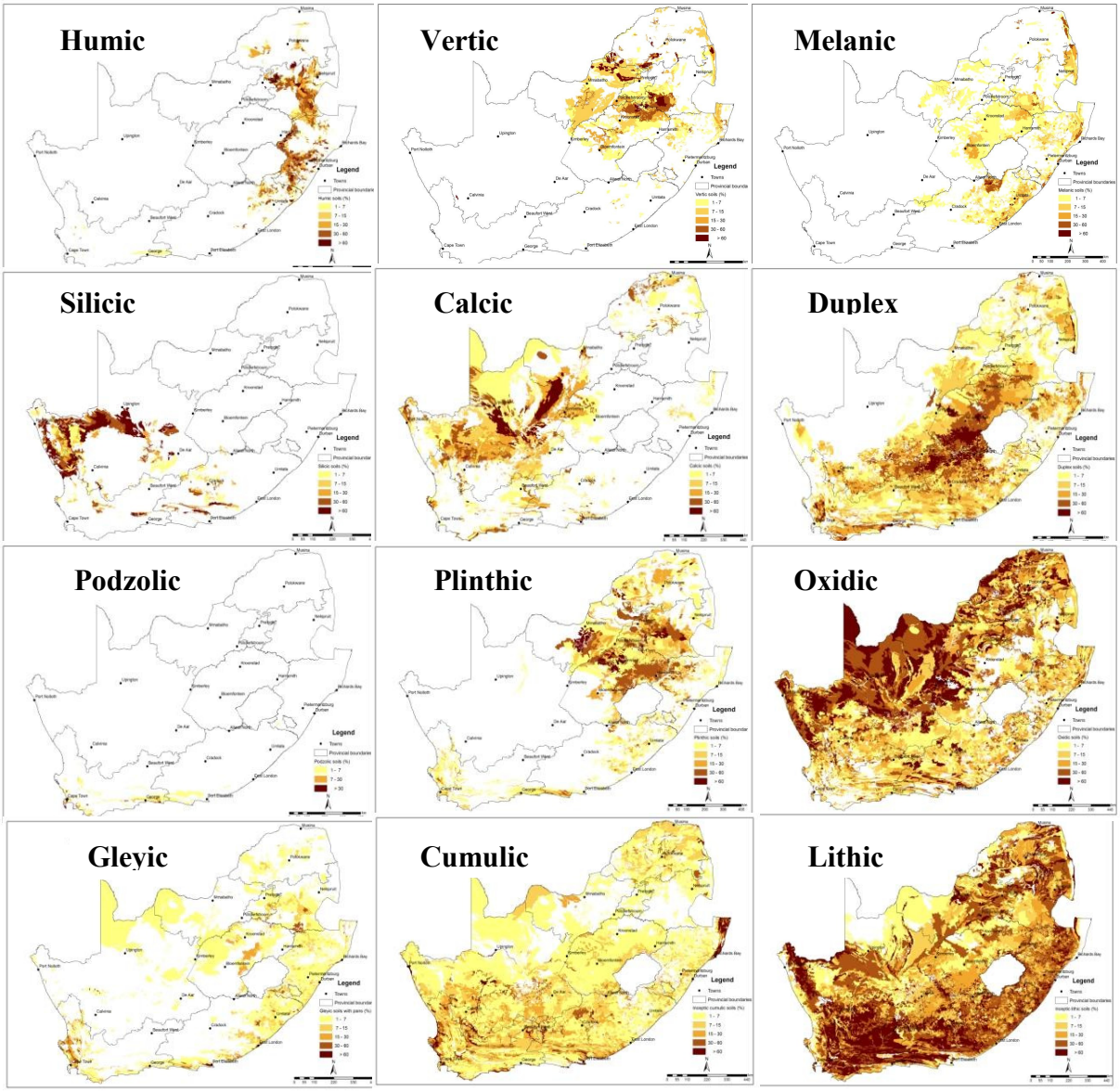

Figure 2. Distribution of the soil groups. The darkest colour indicates > 60 percent of soils in the mapping unit and the lightest yellow colour between 1 and 7 percent (From Fey 2010, with the publisher's permission).

Table 2. Correlation of South African soil groups with World Reference Base soil groups.

Soil group	WRB correlation (IUSS Working Group 2006)
1. Organic	Histosols Gleysols
2. Humic	Umbrisols Ferralsols Acrisols Luvisols Lixisols Cambisols
3. Vertic	Vertisols Gleysols Phaeozems
4. Melanic	Chernozems Umbrisols Gleysols Phaeozems Kastanozems Luvisols Calcisols Leptosols Fluvisols
5. Silicic	Durisols
6. Calcic	Calcisols Gypsisols Luvisols Lixisols
7. Duplex	Planosols Solonetz Luvisols Albeluvisols Lixisols
8. Podzolic	Podzols
9. Plinthic	Plinthosols Ferralsols Acrisols Stagnosols Lixisols Arenosols
10. Oxidic	Acrisols Alisols Ferralsols Luvisols Lixisols Arenosols Cambisols Nitisols
11. Gleyic	Gleysols Stagnosols Planosols
12. Cumulic	Cambisols Arenosols Fluvisols Luvisols Acrisols Lixisols
13. Lithic	Leptosols Cambisols Acrisols Lixisols
14. Anthropic	Anthrosols Technosols