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The Role of Soil Surveys in Land Use Evaluation and Planning

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Abstract

Soil Surveys play an important role in both agriculture and forestry to apply best land practice, for farm planning, suitable crop choices, yield predictions and for control of erosion and compaction. Land evaluation includes assessing terrain, climate, geology, soil and vegetation cover. Soil information provides an essential facet for land assessment and suitability for a particular use or crop. A soil survey can be conducted at various levels from a detailed survey for irrigation at a scale of 1:5,000 to a reconnaissance level at scales of 1:20,000 to 1:50,000.

INTRODUCTION

Soil surveys are conducted on a portion of land, farm or estate for the purposes of gathering soil and terrain information that will enable the creation of a soil map. This map in turn should provide a spatial reference to different soil types each with their specific soil characteristics that can be used to make decisions about that unit of land in terms of its suitability for a specific use or crop, and its productivity potential.

Soil survey interpretation comprises the organization and presentation of knowledge about characteristics, qualities and behavior of soils as they are classified and outlined in maps. The purpose being to provide people with the best possible information for appropriate land use planning and decisions.

An overview deals with important soil characteristics, how they are described and the use of the South African soil classification system. The use of soil surveys for various agricultural crops, forestry and even estate landscaping projects is discussed.

SOIL DESCRIPTION

Field work entails the description of soil profiles using either soil pits or the use of a handheld auger. For the purposes of subsequent mapping these observations are conducted either in grid form or free mapping. The grid method provides better data, but is more expensive, whereas free form mapping conducted with the aid of aerial satellite photo imagery and contours can provide a satisfactory soil map especially for reconnaissance mapping. Table 1 lists the important soil characteristics to be described for assessing land use options.

Table 1. Important soil characteristics and related land qualities used in land evaluation (after McRae and Burnham 1981).

Soil characteristic	**Related land qualities**
Soil texture and stoniness	Ease of cultivation, moisture availability, drainage and aeration, fertility, water and wind erosion, soil permeability, irrigateability, rootability.
Visible boulders, rock	Ease of cultivation, moisture availability.
Soil depth	Moisture availability, ease of cultivation, rootability.
Soil structure	Wind and water erosion hazard, rootability, moisture availability.
Organic matter	Moisture availability, nutrient retention and availability, wind and water erosion.
Soil colour	Drainage and aeration.

Influence of soil structure on rooting

Soil structure refers to the degree, size and shape of peds or soil particles. An apedal soil is one without structure and provides a good medium for rooting but is more prone to compaction. A fine crumb structure, especially in the topsoil, provides a good medium for rooting due to greater surface area of small sized peds. In contrast a course firm blocky or prismatic structure reduces rooting surface area, as roots will only grow between the ped surfaces. Figures 1 and 2 illustrate two different structure types.

Figure 1. Strong blocky soil structure.

Figure 2. Crumb soil structure.

Figure 3. Eroded barren land.

The inset on figure 3 illustrates a duplex soil with a light textured topsoil overlying a strongly structured clay subsoil. This soil is also sodic and disperses easily once the cover crop has been removed. This has resulted in the extent of erosion on such a soil, which has been incorrectly managed and not suitable for irrigation. This land is now useless.

SOIL CLASSIFICATION

The classification and naming of soil types is very useful for communication, besides aiding with appropriate land preparation and crop choices. There are several soil classifications worldwide viz. USA, Australia, New Zealand, FAO (Rome) and South Africa to name but a few. The South African Classification has two levels, soil form and family (Soil Classification Working Group, 1991).

Each soil horizon has specific characteristics such as structure, colour, organic carbon content which is used to define what is referred to as a diagnostic horizon. The soil profile is classified depending on the vertical sequence of these horizons. In figure 3 there are three diagnostic horizons. An orthic A overlies an E or eluviated layer which abruptly overlies a firm gleyed clay. A Kroonstad form soil is poor in respect of the abrupt transition to a clay that perches water in the rainy season and has an E horizon that sets hard in the dry season.

Figure 3. Kroonstad soil form

SOIL MAPPING

Soil mapping requires adequate soil information gathered at each soil pit or auger drilling. This will be used as a data base for the delineation of like soil types. These take into account factors mentioned earlier such as soil depth, soil form, drainage, texture and structure.

Delineation of the units is normally done with the aid of aerial photography or satellite imagery and the use of contours, as soil normally changes with the slope shape and gradient. Vegetation and soil patterns are often quite distinct unless the vegetation is dense forest or plantation and provide a means to delineate these soil units.

The soil descriptions are now used to build a map legend, which can provide useful data for planning on each soil type.

SOIL SUITABILTY AND PRODUCTIVITY

Suitability is largely a matter of producing high yields with relatively low inputs. In order to establish this much research has gone into long term trial, and measurement of yield of numerous crops on various soil types and soil conditions.

Productivity ratings or yield predictions will be based on this research. Productivity ratings were developed for the main commercial tree species in the Cape regions. The end result was that the plantation soils were mapped on 150x150m and the productivity models were applied, using soil, terrain and climate data. The development of these models made use of long-term tree growth yield from all plantation compartments - see Table 2.

Table 2. Site Productivity models for the Cape regions (MAI20 is mean annual increment in m3/ha/annum at age of 20yrs)

MANAGEMENT PRACTICE & RECOMMENDED SPECIES	P.C.	PREDICTED MAI_{20}
Veneer or sawtimber:-*P.radiata, P.taeda* or furniture timber species	I	>20
Sawtimber:-*P.radiata* or *P.elliottii*	II	16-20
Sawtimber: *P.radiata*	III	10-15
Poles/short rotation: *P. radiata*	IV	5-9
P. pinaster	V	<5

Literature Cited

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