By R. H. M van de Graaff

LAND INVENTORY

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1.1 Introduction

It is widely accepted that a plan for the development of a region should be based not only the needs of the community, but also on the physical characteristics of the land.

This principle applies to such a region as the study area, with its rapidly developing land use problems. Some few years ago, it was still predominantly rural both in character and activities and the uses to which its several land types were directed were orientated accordingly. Today, the land resources of the study area have already felt severe ill-effects from the burgeoning expansion pressures generated by the abutting metropolis. The needs for new suburbs, increased intensive farming development, greater water supplies and adequate recreational amenities have all resulted in a rapidly growing competition for the direct or indirect use of large areas. To determine the compatibility or otherwise of the land to meet these demands is the objective of this land resources study.

The term land comprises not only the solid surface on which one can walk, to be measured in acres or hectares, but includes the attributes of slope, soil type, vegetation, bedrock and climate in all their peculiarities. These physical and biological attributes determine to a large degree the possible kinds of land uses on a given parcel of land, and the desirable land use options in a regional context. The land inventory which has been made for this planning project distinguishes different kinds of land. Each kind of land, possessing a distinct combination of physical and biological attributes, will also have its own set of limitations and suitabilities for any kind of land use under consideration, as discussed in another chapter. Here we are concerned with the method in which a rather complex geographical area is broken up into smaller parts of grater homogeneity – distinct kinds of land – which therefore can be more easily understood and interpreted by the planner. These distinct kinds of land can be defined in terms of their attributes, e.g. range and configuration of slopes, common soil types, and typical vegetation communities. It is the aim of this inventory to define these kinds of land in such a way that they can be mapped conveniently and can be easily recognised in the field.

1.2 The nature of the Mapping Units

A mapping unit is one of the various areas shown on the map and identified by its own symbol, colour or hachuring. It is usually listed in the map legend with a brief description. A mapping unit is a synthetic and mental image which represents a distinct and real kind of land in the field. Obviously, a given kind of land may occur in one or several areas within the boundaries of the four Shires. However, at any one of these locations, the characteristics of the land may vary somewhat from the average condition which is described for the mapping unit in question. It is most important to make this point.

The area of the four shires is approximately 3 000 km^2 and land systems have been mapped at a scale of 1 : 50 000. The mapping scale determines the size of the smallest area that can still be portrayed on the map. The limited time available for field work and the scale of the map precluded the mapping of elementary land forms, e.g. a ridge crest, a levee or a back swamp, having a high degree of uniformity of topography, soil type, vegetation, climate, etc. Moreover, such detailed mapping is not warranted by the intensity of land use at the present time. The elementary and simple land forms are called land components. Land components do not occur haphazardly throughout the landscape, but in natural associations. River levees, for example, will occur side by side with back-swamps and cut-off meanders, while hill crests can only exist if there are slopes and swales. The mapping units therefore, are representative of natural associations of certain elementary land forms. These associations have been called land systems, the mapping units usually used in semi-detailed and reconnaissance level surveys. Although the land system is generally a complex mapping unit because it is an association of several land components, it retains a high degree of predictive value for overall planning. This is so because the limitations and suitabilities of a land system are equal to the sum plus the interactions of the limitations and suitabilities of the constituent land components.

At times, should two different land systems adjoin each other, some components of the first land system can occur as components in the second land system and vice versa, but in most cases they make up a completely different proportion of the other land system. The same will be found to be true for two or more land systems which are related, for example through similar bedrock and climate, even if they are not adjoining. Alluvial flats

forming a component in hilly country on Silurian or Devonian mudstones also occur as a component with quite similar attributes in rolling and undulating country or in mountainous country on the same rock. However, they tend to be wider and more important constituents in the rolling and undulating country than in the more steeply dissected terrain.
It may also happen that at a given locality in the field the full association of land components described for the land system does not occur. Land systems “x” may be described as having components, x1, x2, x3 and x4 but in a small occurrence of “x” one, but rarely more, of the components may be absent.

The land systems and their components are defined and described in Figures 1-32 so that planners can recognise them in the field, and can make interpretations from these data and from a site inspection. If necessary, additional field detail or corrections can be inserted at a later date in the land system and land component descriptions without necessarily affecting the boundaries on the map.

1.3 The Mapping Programme and its Consequences

The information presented here is based to a large extent on a prior and ongoing study of the land, by the Soil Conservation Authority, within the catchment of the Yarra River. Two *ad hoc* reports on the lands of the Shires of Lilydale and Upper Yarra were completed previously. The information contained in these reports has been modified somewhat for the study of the lands in the four shires, and additional field work and air photo interpretation was required for parts of Healesville and Sherbrooke Shires.

The mapping of land systems places great reliance on air photo interpretation. The characterisation of land attributes however, and the accurate positioning of land system boundaries, require much field work. Air photos on a scale of 1 : 29 000 and 1 : 44 000 – both practical scales for this study – were available only for about half the area, although photography at a scale of 1 : 80 000 (a smaller scale than the published map and hence less useful) was available for the whole area. In addition, large parts of the area are mountainous, forested and of poor accessibility. As a result the information content of land system descriptions and their associated diagrams is not at a uniform level of detail. The most accessible terrain and the parts covered by the larger scale air photos have yielded the best known land systems. Obviously, a similar reasoning applies to the accuracy of boundaries on the map. But here one must also allow for the fact that different kinds of country may grade into one another, rather than change abruptly. Therefore, when some kind of land use is proposed for individual parcels of land, and if the proposed use carries a series environmental hazard, a site inspection by a qualified person is required. These issues should not be decided upon exclusively by lines on a map at a scale of 1 : 50 000 and nutshell descriptions of land systems and their components.

1.4 Land Systems Description

The land systems have been described according to a standard format, to facilitate quick access to qualities of the land and to make comparisons between land systems easier. The topographic expression of all land systems has been idealised in the form of cross sections at the head of the respective tabular description sheets. At the top of the cross section is an estimate of area of the land system. Below the cross section, the land components are indicated by number. No significance attaches to the listed sequence of these components, as they simply follow the idealised cross section. The components are described further down in tabular form. Explanations of the successive headings in the tables are:

(1) Proportion: An estimate of the percentage area occupied by each of the land components throughout the total area of the land system. This is based on field experience, air photo interpretation an reference to topographic maps.

(2) Climate: At this stage defined only in broad classes of average annual precipitation.

(3) Geology: The major kinds of bedrock or parent material for each land system.

Topography:

(a) Elevation: The altitudinal range above sea level (in metres) within which the land system occurs. This can be used in a broad sense to infer the temperature regime of the local climate, e.g. a land system occurring between 800 and 1,200 metres will experience cold winters with periods of persisting snow.

(b) Position: A characterisation of the landscape within each component.

(c) Local Relief: An estimate of average differences in elevation between adjacent and high and low parts in a land system. This is based on contour lines shown on the 1 : 50 000 topographic maps and on field estimates. Local relief is given in metres.

(d) Land Form: A characterisation of the landscape in the land system.

(e) Sideslope: An estimate of the common range of slope gradients and/or average gradients for individual land components. Where the component occupies a drainage line, the stream gradient has been estimated. Slope gradients have been obtained from the abovementioned topographical maps as well as from field measurements.

(f) Slope Shape: A brief characterisation of the slope in terms of convexity, concavity and linearity as these influence surface runoff resulting from rainstorms, and its effects at lower levels.

(5) Native Vegetation: A brief description of the natural vegetative cover or, if there has been extensive clearing, an estimate of the original condition on the basis of scattered remnants. If there are significant differences between components, and if sufficient field observations are available, the native vegetation is described for each component separately.

(a) Structure: A characterisation of the form of vegetative cover in terms of height and percentage canopy cover of the main plant stratum, following Specht (1970).

(b) Association: A listing of the main plant species making up the plant community. Where the main cover consists of trees, the eucalypt species are given by their common names.

(6) Soil: A brief description of the main kinds of soil.

(a) Group: A broad description of the soil profile employing terms used in Australia. (Northcote, K. H. 1974).

(b) Northcote Classification: This refers to a classification system for soil profiles and the naming of specific classes of soils by a letter and numerical code. The classification may help correlate the behaviour of certain soils with certain soil properties and kinds of soil profiles. Hence, these soil classification units may have some predictive value for extrapolating observed behaviour to similar soils in areas where no experience is yet available. In this study, the soils have been keyed out into very generalized classes only, because of the lack of detailed field observation. Where sufficient data allowed full classification using the key, this has been carried out.

(c) Surface Texture: Texture refers to particle size distribution of mineral soils. Soils rich in very fine particles are called clays; those in which coarse particles predominate are sands; a high content of particles of intermediate size would make a soil silty; when all sizes are present in approximately equal amounts the soils are called loams. (See Northcote (1974) for further details.) Surface texture thus refers to the particle size distribution of the topsoil and knowing this, inferences can be made regarding ease of cultivation, erodibility, and the rate of infiltration of rain water.

(d) Subsurface Texture: The subsurface texture refers to the particle size distribution of the lower part of the "agricultural" soil profile, generally at a depth of 0.5 to 1.5 metres. In many sites of the area, the texture in the subsoil is more clayey than the topsoil. Generally speaking, the permeability of the subsoil decreases as its clay content increases. Other soil properties are also affected.

(e) Permeability: A subjective assessment of the vertical permeability of the soil profile as a whole in terms of *excessive, high, moderate* or *low*. A soil with moderate permeability is envisaged as one that can cope with normal rainstorm intensities in the study area, i.e. it can transmit such rainfall to the deep subsoil at a rate fast enough to prevent the profile from becoming waterlogged. With a low permeability the profile, or a part of it, may become temporarily waterlogged following heavy rain or a series of wet days.

Soil permeability is assessed on the layering of the soil profile, the texture, structure and porosity of the layers, and the colours in the soil. Form these permeability ratings one can infer performance characteristics such as the soil behaviour for disposal of effluent from septic tanks where reticulated sewerage is not available.

(f) Soil depth: The depth listed here applies to the depth of the unconsolidated mass overlying the bedrock, which may be a greater depth than the thickness of the soil profile upon which the soil classification is based. The latter does not include unconsolidated weathered rock, or transported soil materials, which form a parent material to the overlying soil profile, or which may be unrelated to that soil. The knowledge of soil depth is pertinent tot eh cost of excavations, foundations, moisture storage capacity and available rooting depth for crops and trees, etc. Soil depth has been assessed from field observations, mostly along road cuts. In hilly country, road cuts exposing the full depth of soil are common, except where roads follow ridges.

(7) Land Use: A statement of the main uses of the land within the land system, based on familiarity with the terrain and air photos taken between four and eight years ago.

(8) Hazards: A prediction of the main risks inherent in each of the components of the land system when its natural condition is disturbed by any change in use.

(9) Capability: An evaluation of the ability of the land to sustain a predetermined kind of use for an indefinite length of time. The three broad use categories considered are *Urban, Rurban* an *Agriculture*. Capability class definitions are given in Chapter 2 of this report.

1.5 Recognition of Land Systems

The land system mapping has been conducted with the aim of breaking up the complex geographical area into smaller parts – land systems – in such a manner that the user can quickly become familiar with them while working in the field. The land systems should also be practical entities from a land management point of view. The same aim has guided the definition of the land components in each land system.

Topographic Factors

Land systems can conveniently be defined and grouped, according to topography, into categories of mountains, plateaux, high hills, low hills, rolling country, and alluvial flats. Apart from the simplicity of this breakdown, there is also a broad correlation between the kinds of land uses to which and in these categories can be put. Obviously, an element of arbitrariness exists in a topographical breakdown because, for example, not everyone would place the boundary between undulating and rolling country at the same place.

Apart from elevation and local relief, the topographic variables are slope gradient, slope shape, and slope length. Slope gradient and length are of vital significance to potential soil erosion, and therefore to the possible uses to which an area may be put (see Appendix 1). Hence the importance of using topographical considerations defining land systems.

Geological Factors

A further breakdown is based on differences in geology, but geology is only used if it results in obvious differences in the characteristics of the land. In the mountainous land category, for example, a split has been made between the granodiorite and the rhyodacites and rhyolites. This was done because field observations indicate that the soils on the slopes of the latter rocks, certainly the upper slopes, are considerably shallower and more stony than on the granodiorites. The topographic maps also beat our field observations that there are more very steep slopes in mountains and rhyodacites and rhyolites than in mountains on granodiorite. As these differences are likely to be significant for construction of roads and tracks for forestry and for rurban subdivision (insofar as there is privately held land), two land systems have been mapped: Mount Riddell for mountains on rhyodacites and rhyolite and Mount Myrtalia for mountains on granodiorite.

On the other hand, high level broad plateaux or crest areas occur in the study are on genodiorite and granites, on volcanic rocks (rhyodacites), metamorphic rocks and also on mudstones and siltstones. The features which all these crest areas have in common, an which seem to overshadow all other features from a land use point of view (urban, rurban, agriculture) are their cold climate and high rainfall. There are also similarities in the native vegetation and the soils, with the exception of the high level plateaux on sedimentary mudstones and siltstones. The soils on these sites are mainly shallow and probably of considerably lower value to forestry than on the igneous, volcanic and metamorphic rocks. Thus the broad crest areas on the latter three categories of rocks have been aggregated into one land system, called Siberia Gap, after the ‘type’ location. The counterpart of Siberia Gap land system on the sedimentary rock is called The Triangle land system. All this does not imply that the crest areas on any of the rock types in Siberia Gap land system are identical in every respect. On the granodiorite, the drainage pattern is controlled by sets of intersecting parallel major joints, resulting in a very angular network of steams. This is very different on the rhyodacites or the hornfels (metamorphic rock). This difference however, is not seen as relevant to any of the land uses considered in this report.

Climatic factors

Differences in precipitation which are reflected in natural vegetation cover have been used to separate the Paul Range land system from the Reefton Spur land system. Lower tree height, sparser tree cover, and a shift in species suggest that Paul Range land system is considerably drier than Reefton Spur land system. This is also reflected in differences in soil type. It was felt that this difference was significant in terms of agricultural potential and thus the separate was made. Similarly, the crest and dissected crest areas in the Dandenong Ranges (Olinda and Sassafras land systems) occur at lower levels and hence are significantly warmer than their higher mountain counterparts (Siberia Gap and Deep Creek land systems).

Soil factors

Variations in soil types due to differences in past landscape evolution and climatic history are responsible for the recognition of two land systems which are both hilly and on basalt (Chirnside and Silvan) and two hilly land systems n rhyodacites (Montrose and Don Valley). At Chirnside Park the red soils which are typical of the Silvan land system occupy the crest of the hill. This soil is probably the last remnant of an old soil mantle which developed on the basalt under a warm humid climate. Subsequent geological erosion slowly removed most of this soil mantle on the slopes below the crest, and exposed weathered basalt. A new soil gradually formed on this material but, as the local climate was much drier when this took place, the new soil became a black cracking clay. The differences in soil behaviour are quite marked. The black cracking clay is a sticky, plastic, expansive clay and can create problems of foundation and pavement stability. It is also far from ideal as a soil for suburban gardens. The red soil does not have volume instability and is easily worked, while its lower fertility is easily corrected by fertilisers.

The soils in the Montrose land system are predominantly duplex soils, having a paler coloured, often hard setting topsoil overlying, rather abruptly, a brighter coloured mottled clay subsoil. The lower part of the subsoil appears to be quite dense in the localities where it was observed. The Don Valley land system has predominantly red and reddish brown, porous and well structured gradational soils, rather similar to the red soils of the Silvan and Gembrook land systems. Here too, differences in soil types influence agricultural potential, septic tank effluent absorption and several other uses, making separate mapping of these land systems desirable.

In conclusion, it is expected that any person working with the land system map of the Four-Shire Study Area can become familiar with the factors which differentiate between land systems, if the condensed land system descriptions are compared. In deciding which land is to be come a land system, arbitrary decisions have been frequently made but the informality of this approach offers more flexibility than the CSIRO Terrain Classification System. It is hoped that these land systems will present practical entities for planning and for developing land management procedures. Nevertheless, given feedback from the users, there is bound to be scope for modification.