6. LAND SYSTEMS

A land system is an area of land, distinct from surrounding terrain, within which there are particular ranges of land characteristics and maximal covariance between them, expressed as a recurring sequence of particular land components.

They are comprised of land components, which are areas of land, distinct from surrounding terrain, having an integrated assemblage of particular classes of geological material, landform, soil and native vegetation. The land components generally occur in similar proportions and have similar interrelationships in each occurrence of a particular land system.

Land components are usually distinguishable by changes in the dependent variables, soil and native vegetation. Land systems are distinguished by a change in the pattern or nature of the land components, usually accompanied by a major change in one or more of the independent variables such as geology and topographic pattern.

In land systems several physical features of the environment are integrated. This creates a better understanding of the ongoing natural processes which is essential to guide land use management decisions. The patterns of climate, parent rock, topography, vegetation and soils are consistent, therefore the natural processes which operate within it, as well as the hazards of soil deterioration under various forms of land use, are consistent too. Thus, land systems are useful for general purpose evaluation of soil conservation and potential land use problems.

Twenty-nine land systems have been recognised in the study area. (See Land System map and Summary of Land Systems in Table VII.) Land systems with sedimentary, volcanic and metamorphic parent materials have distinct characteristics, and are therefore easily delineated. As this is not so for the land systems on basalt, a discussion of these land systems is given.

Eleven of the land systems (Cottrell, Djerriwarrh, Footscray, Kangaroo Ground, Maribyrnong, Mickleham, Monegeeta, Pretty Sally, Rockbank, Romsey and Wollert) have basalts as their parent material. These basalts are at different stages of weathering and erosion possibly depending, among other things, on the time of extrusion.

Also variable is the chemical composition of the original magma, the surface expression of the different flows and the soil subsequently developed.

Sometimes soil variation can be associated with topography; e.g. in the Wollert land system, shallow, stony red gradational soils are found on the stony rises. On the apron of the stony rise are black clay soils and on the plains, yellow-brown calcareous sodic duplex soils. However, in the Monegeeta and Mickleham land systems, for example, the situation is not so simple, with several soil types being developed on the scarps.

Another unexplained feature is that the grey clay soils which, where occurring, are always immediately above the basalt, sometimes form the surface soil, but in most places are found as a B or B22 horizon.

Basically the interrelationships between basalt parent material, topography and soil are complex and not well understood. Consequently delineation of land system boundaries has been arbitrary in some places. Some of the characteristics of the environment used to separate the land systems are given below.

The Kangaroo Ground land system differs from the others in that the black clay soils are the predominant soil type; in the other land systems they have only a minor occurrence.

The Romsey and Pretty Sally land systems are different in that weathering of the basalt and soil development are older. These two land systems are separated from each other on the basis of predominant soil; Pretty Sally has mottled, red sodic duplex soil and Romsey, red gradational soil with weak structure.

Wollert land system is the only land system on basalt which has stony rises. Although the other basaltic land systems have stony areas, their development is considered to be different from that of the rises. The rises are thought to have formed from lava flows where tongues of lava broke out from the main flow after a surface crust had formed. This crust collapsed into the hollow produced when the lava 'broke out', forming depressions and rises. The stony areas of the other land systems are likely to have developed from differential erosion and the gradual deposition of greater amounts of soil in the depressions.

Monegeeta and Mickleham land systems are separated from the others on the basis that they have predominantly mottled yellow, grey sodic duplex soils, possibly associated with surface wash from the higher areas of the Dividing Range. They are separated from each other by climate, Monegeeta being the wetter of the two.

Cottrell land system is on the lower slopes of Mt. Cottrell and
Mt. Atkinson, which are south-west of the study area, and the Rockbank land system is distinguished by numerous depressions.

Footscray land system has predominantly grey clay soils, whereas in the Djerriwarrh land system, red calcareous sodic duplex soils overlie this clay. Maribyrnong land system has a more complex sequence of soils, of which the red calcareous sodic duplex soil is the most common. Also, stony areas are found in the Maribyrnong land system but are absent from Footscray and Djerriwarrh.

Tabular Descriptions

On the following pages the land systems have been characterized by a generalized description which is based on the most commonly occurring attributes of each characteristic.

These descriptions are presented in tabular form.

Components are allotted numbers to aid in identification and an estimation of the relative proportions of each component is given.

Using the data from the Bureau of Meteorology, the annual rainfall for each land system is shown, including the range from the driest to the wettest parts of each land system. The wettest month and the driest month, with the average precipitation received in these months, are also given.

Temperature data refer to average daily values and not to extreme maxima and minima. The annual range on a monthly basis lists the July average temperature (coldest month) and the January average temperature (hottest month).

Major climatic limitations to plant growth are listed under seasonal growth limitations (see chapter 2). Restrictions to potential plant growth occur to varying extents in winter, due to low temperatures, and in summer, due to lack of available water. It should be noted that soil moisture storage extends the growing season beyond the point where potential evapotranspiration exceeds precipitation (see chapter 2).

Local relief is a measure of the average change in elevation from the top of a hill or ridge to the nearest drainage line within the land system.

Aerial photographs and large scale topographic maps have been used to determine drainage patterns (Thornbury, 1969) and their density.

The native vegetation has been classified according to the structure of the dominant stratum (Specht, 1970). The species commonly found in the dominant stratum are listed in their normal order of abundance.

A three-class system has been used for the estimation of permeability based on profile characteristics such as porosity and texture. The estimate refers to the vertical hydraulic conductivity of the solum which is limited by the least permeable horizon. Very high permeabilities are allotted to sands with no compacted layers while very low permeabilities are given to clays, with few pores or cracks.

Soil depth refers to the distance to solid rock or to a cemented layer which severely restricts root penetration and water movement.

The main existing land uses have been listed. The forms of soil deterioration found to occur in each component, the critical features of the landscape and the processes leading to these forms of soil deterioration are outlined.

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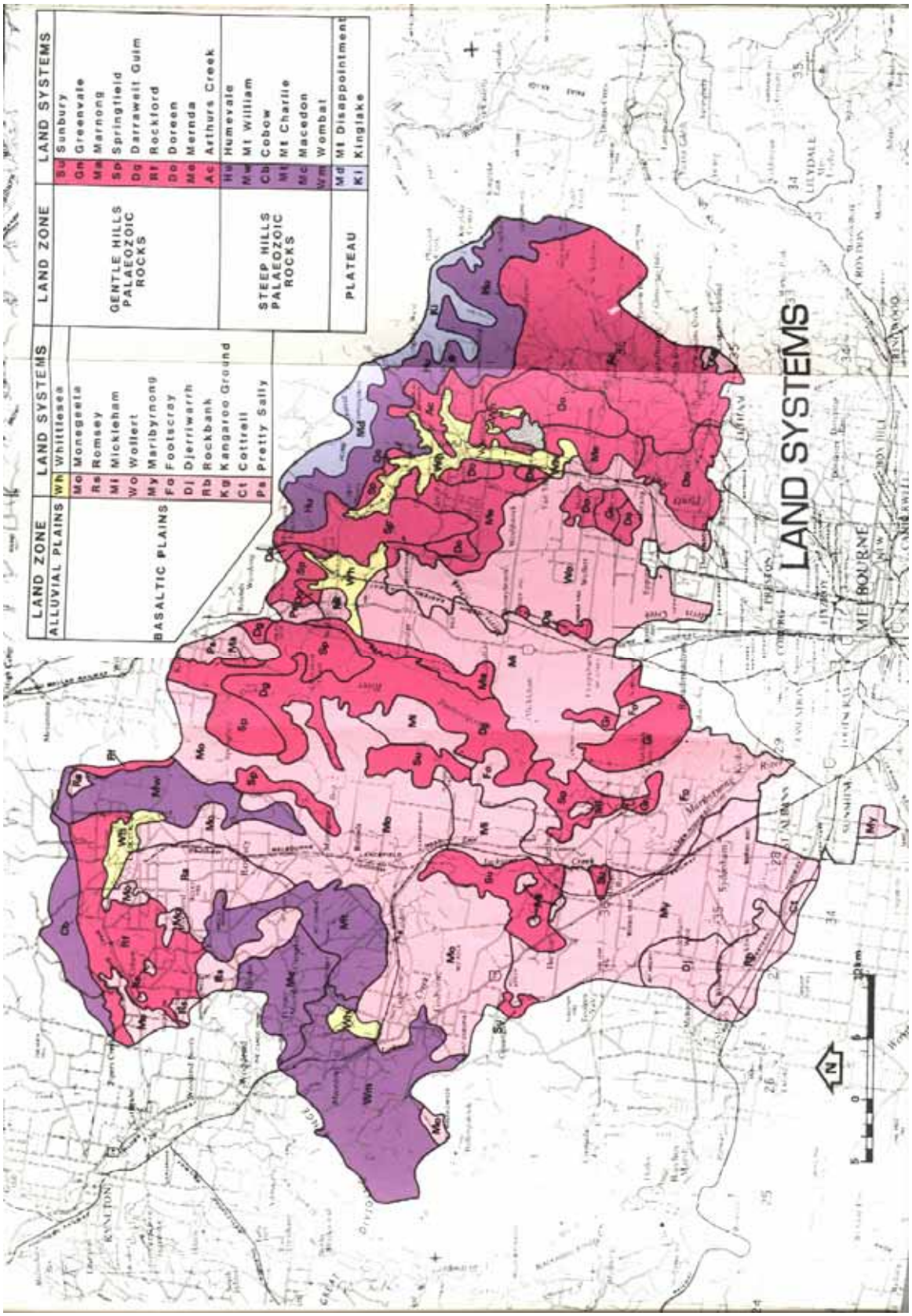
LAND SYSTEMS
LAND ZONE
LAND SYSTEMS
LAND ZONE
LAND SYSTEMS
ALLUVIAL PLAINS
Wh Whittlesea
Mo Monegeeta
Rs Romsey
Mi Mickleham
Wo Wollert
My Maribyrnong
Fo Footscray
Dj Djerriwarrh
Rb Rockbank
Kg Kangaroo Ground
Ct Cottrell
Pa Pretty Sally
BASALTIC PLAINS
GENTLE HILLS PALAEOZOIC ROCKS
Su Sunbury
Gn Greenvale
Ma Marnong
Sp Springfield
Dg Darrawell Gulm
Rf Rockford
Do Doreen
Me Mernda
Ac Arthurs Creek
STEEP HILLS PALAEOZOIC ROCKS
Hu Humevale
Mw Mt William
Cb Cobow
Mt Mt Charlie
Mc Macedon
Wm Wombat
PLATEAU
Md Mt Disappointment
Kl Kinglake
MELBOURNE
N

Table VII - Summary of Land Systems

Land System	Symbol	Area		Average Annual Rainfall mm	Landscape (Topography and Parent Material)	Predominant Soils	Native Vegetation Form and Predominant Species	Land Use
		km	%					
Arthurs Creek	Ac	199.3	7.8	660-690	Low hills Elevation 60-180 m	Mottled yellow, brown sodic duplex soils, coarse structure	Open forest. In well drained situations, Red Box, Long Leaved Box, Red Stringy Bark. On lower slopes, Yellow Box. In lower lying areas, Candlebark Gum, River Red Gum and Manna Gum.	Mainly grazing, some cropping (orchards)
Cobaw	Cb	25.5	1.0	750-1000	High hills Elevation 460-760 m	Red gradational soils, fine structure	Open forest. On slopes and crests, Mesemate, Narrow Leaved Peppermint and Manna Gum. In lower lying areas, Swamp Gum and Manna Gum	Forestry, recreation, nature conservation
Cottrell	Ct	7.8	0.3	460-480	Long gentle slopes Elevation 60-210 m	Red calcareous sodic duplex soils, coarse structure	Grassland probably with *Stipa*, *Danthonia* and *Themeda* species	Mainly grazing, some cropping (cereal)
Darraweit Guim	Dg	104.6	4.1	630-730	Gentle ridges Elevation 260-300 m	Mottled' yellow, brown sodic duplex soils, coarse structure	Open forest. On crests, Long Leaved Box. On slopes, Narrow Leaved Peppermint, Broad Leaved Peppermint, Grey Box and Mesemate. In lower lying areas, Manna Gum and River Red Gum	Grazing
Djerriwarrh	Dj	29.3	1.1	480-530	Flat to gently undulating plain Elevation 120-180 m	Red calcareous sodic duplex soils, coarse structure	Open woodland. River Red Gum and Casuarinas	Cropping (cereal), some grazing
Doreen	Do	106.5	4.1	620-750	Hills Elevation 100-300 m	Shallow stony gradational soils	Open forest. In well drained situations, Long Leaved Box, Narrow Leaved Peppermint, Red Stringy Bark and Yellow Box. In lower lying areas, Candlebark Gum	Grazing
Footscray	Fo	133.0	5.1	560-620	Broad plain formed on basalt with some granitic and silurian wash in places Elevation 90-250 m	Grey calcareous sodic clay soils, uniform texture, coarse structure	Grassland. Probably with *Danthonia* and *Stipa* species	Mainly grazing, some cropping
Greenvale	Gr	51.6	2.0	500-620	Low hills Elevation 90-180 m	Brown sodic duplex soils, coarse structure	Open forest. River Red Gum with some Narrow Leaved Peppermint, Yellow Box and Grey Box	Mainly grazing, water supply, some forestry and some cropping

Land System	Symbol	Area		Average Annual Rainfall mm	Landscape (Topography and Parent Material)	Predominant Soils	Native Vegetation Form and Predominant Species	Land Use
		km	%					
Humevale	Hu	117.1	4.5	750-890	Long ridges Elevation 200-550 m	Shallow stony yellow gradational soils	Open forest. In exposed areas, Red Stringy Bark and Long Leaved Box. In wettest areas, Messmate, Narrow Leaved Peppermint, Mountain Grey Gum. In the lower lying areas, Mesemate and Mountain Grey Gum	Forestry, recreation, some grazing
Kangaroo Ground	Kg	2.8	0.1	620-750	Undulating plain Elevation 150-210 m	Black clay soils, uniform texture, coarse structure	Open forest. Candlebark Gum and Red Box	Mainly grazing, some cropping (cereal)
Kinglake	Ki	24.9	1.0	760-1200	Dissected plateau Elevation 490-760 m	Red gradational soils,, fine structure. Yellow gradational soils, fine structure	Open forest. On crests and slopes, Messmate, Narrow Leaved Peppermint, Mountain Grey Gum and Broad Leaved Peppermint	Forestry, some cropping (potato, strawberry) water supply, recreation
Macedon	Mc	47.3	1.8	750-1000	Mountains Elevation $_{550\text{-}950}$ m	Red gradational soils, fine structure and/or yellow gradational soils, fine structure	Open forest. In wettest areas, Messmate, Manna Gum, Snow Gum and Alpine Ash. In exposed areas, Messmate, Broad Leaved Peppermint, Long Leaved Box and Narrow Leaved Peppermint	Forestry, recreation, water supply, rural subdivision, some grazing and cropping
Maribyrnong	My	168.8	6.5	500-660	Undulating plains with volcanic cones Elevation 110-240 m	Red calcareous sodic duplex soils, coarse structure	Grassland. Probably with *Stipa* and *Danthonia* species	Mainly grazing, some cropping (cereal)
Marnong	Ma	18.1	0.7	640-710	Undulating plains Elevation 270-400 m	Yellow sodic duplex soils, coarse structure	Open woodland. On slopes, Narrow Leaved Peppermint, Messmate and Candlebark Gum. In lower lying areas, Manna Gum and Swamp Gum.	Grazing, some cropping (cereal)
Mernda	Me	51.6	2.0	620-750	Low hills Elevation 150-220 m	Mottled yellow, brown sodic duplex soils, coarse structure	Woodland. In exposed position, Long Leaved Box, Yellow Box and River Red Gum. In lower areas, River Red Gum and Swamp Gum	Mainly grazing, some cropping

Land System	Symbol	Area		Average Annual Rainfall mm	Landscape (Topography and Parent Material)	Predominant Soils	Native Vegetation Form and Predominant Species	Land Use
		km	%					
Mickleham	Mi	209.9	8.1	660-790	Gently undulating plains with volcanic cones Elevation 300-460 m	Mottled yellow, grey sodic duplex soils, coarse structure	Open woodland. On slopes, River Red Gum and Acacias, some Casuarinas. In lower lying areas, Manna Gum and Swamp Gum	Mainly grazing, some cropping (cereal)
Monegeeta	Mo	353.8	13.8	660-685	Gently undulating plains with volcanic cones Elevation 150-300 m	Mottled yellow, grey sodic duplex soils, coarse structure	Open woodland. On slopes, River Red Gum, Grey Box and Acacias, some Casuarinas. In lower lying areas, Manna Gum and Swamp Gum	Mainly grazing, some cropping (cereal)
Mt. Charlie	Mt	62.3	2.4	750-1000	Hills Elevation 360-600 m	Mottled yellow duplex soils, fine structure	Low open forest. On wet higher areas, Messmate, Candlebark Gum, Narrow Leaved Peppermint and Manna Gum. On dry higher areas, Broad Leaved Peppermint, Long Leaved Box, Yellow Box and Narrow Leaved Peppermint. Woodland. On slopes and swales, Narrow Leaved Peppermint, Long Leaved Box, Swamp Gum, River Red Gum, Messmate and Acacias	Forestry, grazing, rural subdivision
Mt. Disappointment	Md	26.4	1.0	800-1100	Dissected plateau Elevation 490-760 m	Red gradational soils, fine structure	Tall open forest. Alpine Ash, Mountain Grey Gum, Narrow Leaved Peppermint and Mesemate	Forestry, water supply, recreation
Mt. William	Mw	51.7	2.0	620-750	Ridge, north-south trend Elevation 420-550 m	Mottled yellow, brown gradational soils, fine structure. Red duplex soils	Open forest. On crests, Messmate, Narrow Leaved Peppermint, Long Leaved Box, Broad Leaved Peppermint and Manna Gum. On slopes, Narrow Leaved Peppermint, Long Leaved Box, Swamp Gum, Candlebark Gum and Broad Leaved Peppermint. Woodland. In lower lying areas, Swamp Gum, River Red Gum, Candlebark Gum and Manna Gum	Mainly grazing, some cropping

Land System	Symbol	Area		Average Annual Rainfall mm	Landscape (Topography and Parent Material)	Predominant Soils	Native Vegetation Form and Predominant Species	Land Use
		km	%					
Pretty Sally	Ps	•19.0	0.7	620-750	Undulating plains with volcanic cone Elevation 300-520 m	Mottled red sodic duplex soils, fine structure	Open forest. Narrow Leaved Peppermint, Manna Gum, Messmate and Acacias	Mainly grazing, some cropping (cereal)
Rockbank	Rb	28.7	1.1	480-500	Undulating plain with depressions Elevation 100-120m	Red calcareous sodic duplex soils, coarse structure	Open woodland. River Red Gum	Mainly grazing, cropping (cereal)
Rockford	Rf	83.8	3.2	750-1000	Undulating plain Elevation 480-620m	Yellow-brown sodic duplex soils	Open forest. On crest and slopes, Messmate, Broad Leaved Peppermint, Narrow Leaved Peppermint, Manna Gum and Acacias. In lower lying areas, Swamp Gum and Manna Gum	Mainly grazing, some cropping (cereal)
Romsey	Rs	79.8	3.1	740-790	Undulating plains with cones Elevation 470-620 m	Red gradational soils, weak structure	Open forest. Swamp Gum, Snow Gum Manna Gum, Messmate and Acacias	Grazing, cropping (potato)
Springfield	Sp	121.8	4.7	710-750	Low hills with convex slopes Elevation 250-400 m	Shallow stony gradational soils	Low open forest. On crest and slopes, Long Leaved Box, Red Stringy Bark and Narrow Leaved Peppermint Open forest. In lower lying areas, Narrow Leaved Peppermint, Long Leaved Box, Messmate, Manna Gum, Yellow Box and Red Stringybark	Grazing
Sunbury	Su	81.5	3.2	580-640	Low hills Elevation 180-410 m	Mottled yellow, brown sodic duplex soils, coarse structure. Shallow stony gradational soils	Woodland. On crests and slopes, Yellow Gum and Yellow Box. In lower lying areas, Manna Gum, River Red Gum and Grey Box	Mainly grazing, cropping (cereal)
Whittlesea	Wh	74.1	2.9	680-740	Terraces Elevation 170-210 m	Mottled brown-yellow, red duplex soils	Open woodland. River Red Gum	Mainly grazing, some cropping (cereal)
Wombat	Wm	115.4	4.5	870-900	Broad ridges Elevation 460-670 m	Shallow stony red-brown gradational soils	Open forest. On crests and slopes, Narrow Leaved Peppermint, Messmate, Broad Leaved Peppermint and Manna Gum. In lower lying areas, Swamp Gum, Manna Gum and Narrow Leaved Peppermint	Forestry, recreation, nature conservation, water supply

Land System	Symbol	Area		Average Annual Rainfall mm	Landscape (Topography and Parent Material)	Predominant Soils	Native Vegetation Form and Predominant Species	Land Use
		km	%					
Wollert	Wo	182.9	7.2	630-710	Undulating plains with stony rises Elevation 120-180 m	Shallow stony red gradational soils	Open woodland. River Red Gum	Mainly grazing, some cropping (cereal)