PART IV
A METHOD OF STUDYING THE LAND

9. THE ECOLOGICAL SURVEY AND ITS ENVIRONMENTAL PATTERNS

So far in this study, the area of the survey has been described by discussing each feature of the natural environment and by considering the results of white man's occupation of the area, that is, the present forms of land-use and the incidence of soil erosion and salting.

In Part IV, the area of the survey is described again by integrating the environmental features with each other and relating this to the forms of land-use and the forms of land deterioration. The principles and method of this type of survey were developed within Victoria by the Soil Conservation Authority and they were first described by Downes et al (1957) and later exemplified in detail by Gibbons and Downes (1964).

Principles of Survey

Soil surveys have been made for many years in Australia but their use is limited because the soil is only one of a number of features of the natural environment that affect agricultural production and the practice of soil conservation. A better understanding of the environment is obtained if all the environmental features are considered together and their interactions recognized.

Most forms of primary production are based on the growth of plants. The fundamental needs of plants are water, air, light, nutrients and suitable temperatures, all in the required amounts and at the required place and time. The features of the natural environment that control these needs and therefore control primary production are climate, parent material, topography and soil. A further feature, the native vegetation, is included in the study because often it is a useful expression of the manner in which the other features interact with each other.

Each of these five environmental features may vary within an area to be surveyed. The various forms or range of each feature combine with those of the other features in numerous ways to give different types of land. Each type of land has its own characteristic combination of certain forms of climate, parent material, topography soil and native vegetation, and a limited number of such combinations may form a pattern which is characteristic of a wider area of land. When each environmental combination or pattern of such combinations has been recognized and the processes operating within it understood, it is then possible to determine the forms and techniques of land-use needed to ensure both the conservation of the soil and the attainment of the required level of production.

The ecological survey, then, involves the recognition of different areas of land and the mapping of their distribution. Diagrams are drawn to illustrate the environmental features, the combinations and the patterns of combinations which they form, and their relationships to each other. Because of this approach, the surveys are regarded as studies in applied ecology. They provide a basis for planning the broad land-use and also the details of development, whether it be development of virgin land, improvements in farming techniques in existing rural areas, or the maintenance of natural conditions for a particular reason. One example of their application is to assist in the selection of suitable sites for experimental pasture trials and to indicate the areas over which the results of the trials can be applied.

Mapping Units of the Ecological Survey

The smallest unit of mapping is the land-component, which is an area of land where the climate, parent material, topography, soil and vegetation are constant within the limits considered to be significant for a particular form of land-use. This definition thus takes into account the inherent variability within natural systems, which is often gradual and continuous, and limits are fixed for the allowable range of variation of each environmental feature within the land-component. Such a range varies with the level of detail of the survey and the current or projected use of the land. For example, land-components adopted for irrigation will show only slight variation in soil type and slope but these two features can vary more widely within land-components used for sheep grazing, A land-component therefore has a characteristic combination of a defined range of each of the five environmental features considered.

Land-components are usually too small to be mapped in an extensive reconnaissance survey. However, they form a recognizable sequence or pattern which is repeated many times over a limited area and is related to one of the features of the environment, usually topography. Thus an area much larger than the land-component can be defined on a map and described by its pattern of components. Such an area is called a land-unit. A land-unit diagram shows the pattern made by problems and present degree of development of their land-use, and the hazards and incidence of deterioration such as erosion.

Land-units that are similar to each other in one or more major feature, such as land-form and geology, together form broad patterns of land at a larger scale than the patterns of land-components. The areas so formed by grouping similar land-units are called land-systems, and in this survey, the land-systems are separated from each other mainly by

differences of land-form and geology. The features of each land-system are shown on two diagrams. The first, the landscape diagram, indicates the relationships of the land-forms to each other and is a guide to their relative proportions it is a pictorial representation of a cross-section of the land-system. The second, the land-system diagram, heads a table that lists the environmental and land-use features of each land-form the table is a summary of the description of the land-system in the text of the report.

Gibbons and Downes (1964) use a further broader scale of pattern called the land-zone, but it has not been used in this survey.

Mapping Units in the Grampians Survey

In the area described in this publication, nineteen land-systems and forty-nine land-units have been mapped, and their distribution is shown on the coloured map accompanying the report.

The criteria used for recognizing the land-systems are the geomorphological sub-divisions and land-forms and also parent material and soils. The eight geomorphological sub-divisions are divided into the nineteen land-systems primarily on the types and arrangement of land-forms. Where the land-forms are identical, further separation of land-systems is made according to their parent materials and/or soil groups. Table 13 lists the land-systems and shows their relationships to the elements of geomorphology, parent materials and soils.

In the subsequent chapters the land-systems are described in detail, with reference first to their features of environment and then to aspects of land-use and erosion hazard. The land-use features are discussed mainly from the point of view of pasture improvement because most of the farms are pastoral properties and pasture improvement is an important technique in erosion control and conservation farming.

Each land-system diagram shows the features of environment, land-use and erosion and also indicates the land-use classes allotted to the land-forms. Land-use classes adopted by the Soil Conservation Authority are broad categories of land-use defined on the basis of erosion hazard and on the suitability of the land for cropping or grazing (see Appendix III.).

The brief description of land-units within each land-system highlight important variations in the environment of the larger mapping units.

Plate 27 – Three land-systems are shown in this photograph taken near Mt Zero.

- In the foreground are sandstone slopes of Grampians Ranges land-system.
- In the background are partly cleared woodlands of East Wonwondah land-system.
- Across the middle is uncleared woodland and forest of the Grampians Plains land-system

Table 13 – The land-systems of the Grampians survey and their features of geomorphology, geology and soils.

Geomorphological Sub-Division	Land-System	Land-Form	Geology	Dominant Soils
1. Plains of fluviatile and estuarine sediments	Horsham	Flat plain	Plio-Pleistocene fluviatile and estuarine sediments	Gilgaied grey soils of heavy texture.
	East Wonwondah	Flat plain	Plio-Pleistocene fluviatile and estuarine sediments	Brown soils of heavy texture (gilgaied)
	Telangatuk	Flat plain, swamp, lunette, sand sheet	Plio-Pleistocene fluviatile and estuarine sediments, Early Holocene wind-deposited sands	Solonetzic
	Ullswater	Flat plain, ridge, swamp, lunette, sand sheet	Plio-Pleistocene fluviatile and estuarine sediments, Early Holocene wind-deposited sands	Solonetzic
	Mt William Creek	Flat plain	Plio-Pleistocene fluviatile sediments	Solodic and solonetzic
	Parrie Yalloak	Flat plain, swamp, lunette	Plio-Pleistocene fluviatile sediments, Early Holocene wind-deposited sands and clays	Solodic
2. Dunes and sheets of siliceous sands	Grampians Plains	Sand sheet	Early Holocene water-deposited sands	Nomopodzols
	Warratong	Sand sheet, sand dune	Early Holocene wind-deposited sands	Podzolic deep sands and solonetzic
	Kowree	Sand sheet, sand dune, ridge	Early Holocene wind-deposited sands	Nomopodzols and leptopodzols
3. Areas where (1) and (2) closely intermingle	Moora Valley	Flat plain, sand sheet, swamp	Plio-Pleistocene and Late Holocene fluviatile sediments, Early Holocene water-deposited sands	Nomopodzols and solonetzic
4. Plains of basalt	Willaura	Undulating plain, swamp	Pleistocene basalt	Solodic
	Dunkeld	Undulating plain, stony rise	Pleistocene basalt	Acidic brown clays and solodic
5. Lateritic tableland	Dundas	Dissected tableland	Lateritized Tertiary sediments over a core of Palaeozoic basement rocks	Solodic
6. Lateritic plains	Brimpaen	Undulating plain, flat plain	Lateritized Tertiary sediments	Solodic and solonetzic
7. Hills and plains of maturely dissected Palaeozoic rocks	Ararat	Undulating plain, rolling plain, hill	Ordovician and metamorphosed Ordovician sedimentary rocks	Solodic
	Mirranatwa	Undulating plain, rolling plain, hill	Granites and related rocks	Solodic
	Mt Dryden	Hill, rolling plain	Cambrian greenstone, cherts, shales	Solodic
	Darracourt	Undulating plain	Deeply weathered Palaeozoic basement rocks	Solonetzic
8. Central mountainous zone	Grampians Ranges	Cuesta, tableland	Grampians sandstones (Upper Devonian – Lower Carboniferious)	Lithosols and rocky, shallow podzols.