27. GRAMPIANS RANGES AND GRAMPIANS PLAINS LAND-SYSTEMS.

As a physiographic region and as a tourist attraction the Grampians are of considerable interest. They consist of sandstone ranges and the outwash slopes of siliceous sand that surround the ranges. There is a sequence of geology, soils and vegetation from one to the other and in fact the outwash slopes would not exist apart from the ranges. For these reasons the two land-systems into which the ranges and slopes have been mapped are grouped together in this chapter. Grampians Ranges land-system will be considered first and then Grampians Plains land-system.

Plate 39 – Most of the Grampians Ranges land-system consists of rugged sandstone cuestas with prominent ridges and near-vertical escarpments of rock. The forests have limited commercial value and serve mainly as protection forests for soil and water conservation

Grampians Ranges Land-System

The Grampians Ranges land-system covers 424 square miles. It includes all the areas of sandstones dated Upper Devonian to Lower Carboniferous in age which are collectively called the Grampians sandstones. These sedimentary rocks are briefly described in Chapter Four. The most important and most extensive example of the Grampians sandstones is the Grampians themselves and the smaller areas are the western Black Range, Mt. Arapiles, Mt. Bepcha and a very small outcrop along the Mackenzie River south of Horsham. Most of the following description of the land-system applies specifically to the Grampians.

The Grampians are centrally situated within the area of the survey. They extend in a north-south direction for 53 miles, from Mt. Zero at the northern end to Mt. Sturgeon at the southern end, and they have a maximum width of 25 miles.

Their general height varies from 1,500 feet to 2,000 feet above sea level and individual peaks rise above 2,000 feet, culminating in Mt. William at 3,830 feet. The sandstones outcrop as three parallel ranges. Mt. William Range is to the east and Victoria Range is to the west, and between them is an unbroken range stretching the full distance from Mt. Zero to Mt. Sturgeon. For convenience the middle range is divided into Mt. Zero Range at the northern end, Mt. Difficult Range surrounding the Wartook basin, Wonderland Range behind Halls Gap township, Mt. Victory Range stretching westward from Halls Gap, and Serra Range continuing south to Mt. Sturgeon. Figure 2 shows this pattern.

Between the three parallel series of sandstone ranges there are valleys which have developed by the much greater geological erosion of the comparatively soft and thin beds that alternate with the very hard and massive sandstones (Hills 1936, 1959). The valley between Mt. William Range and Serra Range contains the headwaters of both the Wannon River and Fyans Creek, and the valleys between Serra Range, Victoria Range and Mt. Victory Range contain the headwaters of the Glenelg River and also a small tributary of the Wannon River called Dwyer's Creek.

Land-Forms

The land-system diagram in Figure 31 summarizes the features of environment and land-use and it shows the cuesta as the only land-form. Actually there are three small areas of plateaux in the land-system where the sandstone beds have very low angles of dip, namely, Major Mitchell's Plateau, Mt. Arapiles and a small area within Mt. Victory Range above Zumstein's. Also the northern end of Mt. William Range near Halls Gap takes the form of a series of hogbacks in which the sandstone beds dip at very high angles to form sharp ridges with slopes of approximately equal gradient on both sides.

Apart from those four exceptions, all the ranges in the land-system take the form and appearance of the cuesta which is described in some detail in Chapter Four. Mostly the cuestas face eastwards, that is, the dip slope is to the west and the scarp face and scree slope is to the cast however, a few peaks such as Mt. Zero and Asses Ears face west and Mt. Victory faces south.

The cuesta is the most important land-form because its distinctive shape gives the Grampians their characteristic appearance and also because it has a definite influence on the environmental habitats within the mountains. The

important features of the cuesta in this regard are the slope of the sandstone beds, their characteristics of fracture and dissection, the slope of the ground surface, the depth of soil and the exposure and shelter provided.
An important consequence of the fracturing of the beds is the degree of dissection of the dip slope. Dissection is severe where there is intensive and deep fracturing and mild where there is mild fracturing. Three kinds of dip slope are recognized according to the degree of fracturing and dissection and each has its own pattern of inter-relationships of slope, soils, soil parent materials, exposure, shelter and vegetation. The three dip slopes are the smooth dip slope, dissected dip slope and colluvial dip slope.

The *smooth dip slope* arises from the absence of fracturing and dissection, and this results in extensive areas of smooth, bare, dipping rock. Two excellent examples are the "Elephant's Hide", immediately behind Halls Gap at the northern end of the Wonderland Range, and Flat Rock next to Mt. Zero at the northern extremity of the mountains. Other examples are found on the upper dip slopes of some of the peaks in the Serra Range and on the upper dip slope of Mt. William.

Plate 40 – A view of Serra Range form the Victoria Valley. The jagged, serrated outline of its ridge is clearly visible

The *dissected dip slope* occurs wherever the strata are fractured and dissected into large rock buttresses or “islands” separated by chasms or canyons of variable width and depth. The rock buttresses are the remnants of the original dip slope before fracturing and dissection, and they clearly show the stratification of the sandstones. An example of the dissected dip slope is that part of the dip slope of Wonderland Range below Signal Peak and The Pinnacle.

The colluvial *dip slope* resembles the smooth dip slope by being an unbroken land surface, but it has closer affinities with the scree slope because of its surface layer of loose, fragmentary rock material identical to the mantle of scree of the scree slope. The colluvial dip slope is the most common of the three dip slopes and an example of it is where the road up to the Mirranatwa Gap traverses the Serra Range.

Some dip slopes do not belong entirely to one type but have two or even all three types present. For example, some are smooth on their upper surface, but are colluvial on the middle and lower slopes. Some dissected dip slopes have extensive areas of smooth rock between the buttresses so that in effect they combine two of the three dip slopes.

Soils

Soils have developed on the mountains despite the extremely rocky and steep terrain. They are skeletal soils (lithosols) and rocky, iron nomopodzols of the Grampians Ranges series, and they are described in detail in Chapter Five.

Lithosols occur as isolated, shallow pockets of sandy soil amongst areas of bare rock such as scarp faces, smooth and dissected dip slopes and wherever there are large rock masses. The rocky, iron nomopodzols are located on the scree slopes and colluvial dip slopes where a mantle of scree material covers the underlying rock in situ. Over parts of Mt. Victory Range, particularly between Reed's Lookout and a point above Zumstein's, the topography is flat and gentle sloping. Here the soils are deep and sandy and are classified as leptopodzols and nomopodzols.

Vegetation

The numerous habitats over the Grampians cuestas can be described by referring to the plant communities.

The dry scrubs are confined to areas largely of bare rock that have restricted occurrences of lithosols. Such a habitat is provided only by, and therefore restricted to, the smooth dip slopes, dissected dip slopes and scarps, as a result of the fracture and dissection of the rock strata. In the case of the smooth dip slope, bare rock areas are formed by sloping, unbroken expanses of rock strata, and the pockets of lithosols are located in cracks, crevices, recesses, level areas, behind boulders and around the edges of slabs, that is in all places where soil material can accumulate and receive additions from higher positions without being washed away by rain and run-off.

On the dissected dip slope, the bare rock areas are found on the rock buttresses, and on the sloping rock floors of the chasms and canyons separating the buttresses. The lithosols accumulate in similar situations to those described in the previous paragraph. In addition, deeper soils develop in the larger chasms and sometimes nomopodzols are found where sufficient soil material has accumulated.
On the scarp, the bare rock areas are formed by the vertical cliffs and the outer extremities of the rock ledges. The lithosols accumulate on the level rock ledges and sometimes in very narrow vertical cleavages in the cliffs.

These habitats provide a very dry and rigorous environment for a plant community. This arises by the operation of at least three factors, namely, the shallow, sandy, infertile soil which has an extremely low moisture status, the proximity of the underlying rock which restricts the development of a root system, and the very high summer temperatures of the rock surface and of the shallow soil which would very likely reduce the establishment of seedlings.

The vigour and height of the plant communities within the dry scrubs are influenced by the intensity of these three factors. The more rigorous the conditions, the lower the height. On the smooth dip slope, where the communities are most stunted, the eucalypts are no more than about twelve feet in height and in places they are less than six feet. In the chasms and gullies on the dissected dip slope, the conditions can be less rigorous and there is sometimes a deeper soil and more moisture. In these sites, the communities are higher, with the eucalypts commonly twelve to fifteen feet and up to twenty feet high.

Altitude and exposure are not particularly important factors governing the occurrence and distribution of dry scrubs in this area. Dry scrubs can occur at ally altitude and in considerable shelter as well as exposure, provided the conditions making up the required habitat are present.

The eucalypts forming the dominant layer are Grampians gum, long leaf box and brown stringybark. The first two grow on the smooth dip slope and scarp where it is uncommon to find brown stringybark. On the dissected dip slope, brown stringybark and long leaf box are found and it is rare to find Grampians gum.

The second formation over the ranges, the *dry heath, is* found in almost identical habitats, and the lack of trees is the result of shallower and less frequent pockets of soil.

Wet sclerophyll forests are restricted to a few sheltered gullies in the central area of the mountains where the average annual rainfall is 35 inches. The habitat is relatively moist and humid and the forest is composed of mountain grey gum, messmate and a sub-dominant tree layer of blackwood and hazel pomaderris. On the gully floor is a specialized community, and some of the members are soft tree-fern, fishbone fern, shield ferns and clematis.

The *dry sclerophyll forest is* the most widespread sub-formation in the mountains and it grows on most positions over the cuesta, the exceptions being the smooth dip slope, dissected dip slope and scarp. The environmental factors limiting its distribution are those which allow the development of the other sub-formations. That is, the distribution of the dry sclerophyll forests is limited, first, by very dry and rigorous habitats where the dry scrubs and dry heaths are present, and second, by sheltered, moist, humid habitats where the wet sclerophyll forests are present.

It is convenient to sub-divide the sub-formation into tall and short forests which show a broad relationship with the depth of soil and the average annual rainfall. The tall dry sclerophyll forests generally are found within the area of higher rainfall in the central Grampians wherever the land is relatively flat and the soils are deep. The trees have a typical forest form, that is, they have very tall and straight trunks and a small canopy of leaves. In the more sheltered positions they reach a height of seventy to one hundred feet. The short forests grow typically on the colluvial dip slopes and scree slopes where the soil is shallow and the terrain is very steep. The trees vary in height from about thirty feet to fifty feet and they have a more or less forest form with many tending toward a woodland form.

The common eucalypts are brown stringybark, long leaf box and messmate and there is a heath understorey of short shrubs.

Land-Use

Water conservation is the most important form of land-use and the main one to which the land-system is suited. The features of the rainfall pattern over the land-system have been discussed in some detail in Chapter Three, particularly for the Halls Gap-Wartook Reservoir area where the highest recorded rainfalls occur. Briefly, the central part of the land-system has a reliable average rainfall of 35 inches per year which comes mainly during the winter and early spring. For example, Halls Gap receives, on the average, four inches of rain for each of the months of June, July, August and September and the probability is that this amount will fall one year in two on the average, while three inches of rain for each of those months will come in three out of every four years.

The central Grampians can, therefore, be regarded as an isolated zone of comparatively high and reliable rainfall situated on the southern edge of the moderate and low rainfall regions of the Wimmera and Mallee. The value of the Grampians in providing water for these regions was emphasized on pp. 82 to 84 where a comparison was made with the catchments in the eastern mountains of the State.
By Victorian standards, the Grampians catchments are only mediocre sources of water and yet they are vital to the stability of the Wimmera and Mallee as farming areas. All present and future plans for the management and development of these mountains should be aimed at improving their water-supplying potential.

The water potential of the Grampians has been used to advantage by the State Rivers and Water Supply Commission in its system of water storages and channels serving the Wimmera and Mallee Stock and Domestic Water Supply Scheme. Also a number of local Water Trusts supply domestic water to the cities and towns immediately surrounding the mountains. These aspects have been dealt with more fully in Chapter Seven.

The most important aspects of forest management within the land-system are the protection of the catchments from soil erosion and the maintenance of the quantity, quality and regularity of the stream flows. One of the most important tasks in this direction is to prevent bushfires, and where this fails, to put them out as quickly as possible. Methods of fighting bushfires have been improved in a number of ways, particularly in the construction of access roads and the installation of lookout towers and a system of radio communication. Associated with these aims is the preservation of native plants and animals and their habitats. Timber production is restricted to a few small areas of tall brown stringybark and messmate forest that are in sheltered sites with deep soils. The timber is used for scantling and transmission poles. The land-system is both Reserved Forest and Crown land, and the forests are managed in such a way that all these aims of forest utilization are satisfied.

Grampians Plains Land-System

The Grampians Plains land-system surrounds the Grampians and western Black Range as narrow zones of siliceous sand that are derived from the sandstone ranges by weathering and erosion. The only land-form is the sand sheet in which the sand deposits take the form of outwash slopes below the ranges. The sand sheets have very gentle slopes with maximum gradients of about five per cent. at the foot of the ranges, gradually flattening out to an imperceptible slope along the outer edge next to the plains. The total area of the Grampians Plains land-system is 211 square miles and its diagram is shown in Figure 31.

The soils are mostly deep nomopodzols and they overlie clay subsoils that are usually deeper than four feet. Except for the influence of organic matter in the A, horizon, the texture throughout the profile is a sand of both coarse and fine grades. On the middle and lower slopes of the land-system, organo nomopodzols and iron nomopodzols are both common. On the upper slopes, organo nomopodzols are seldom found and iron nomopodzols predominate with also a minor occurrence of iron and clay leptopodzols.

Heath woodlands and short dry sclerophyll forests intermingle on the outwash slopes, with the woodlands predominating on the wetter middle and lower positions and the forests on the drier upper positions. Messmate, brown stringybark and apple box are the important eucalypts with peppermint also present. Long leaf box is found occasionally on the uppermost slopes immediately below the ranges. A continuous and tall (three to four feet) understorey of heath species characterizes the vegetation and serves to indicate the presence of the podzols. Some of the common heath species are listed in Appendix 11A. The heath sub-formation occurs in many scattered areas along the flat and poorly drained sections of the outwash slopes adjacent to the plain, where the soil is too wet for trees.

Most of the land-system is unused Crown land that is in demand for agricultural development. However, those parts already under freehold tenure are largely unused for agriculture despite a number of scattered attempts along the margin of the land-system where failure or only limited success has resulted.

Plate 41 – In the Grampians Plains land-system, gently sloping deposits of deep sand have accumulated at the foot of the ranges. They are covered with heath woodlands of brown stringybark, messmate and apple box.

The soils and climate make the land-system very doubtful for agriculture because they create productive and economic hazards which must be carried by those who would attempt development. The productive hazards are related to problems of plant nutrition, soil moisture and soil drainage. The first two problems have been discussed in Chapter Five under the sub-heading of "Soils of the Area and Land-Use." Briefly, the first problem is to overcome deficiencies of phosphorus, nitrogen, potassium, copper and zinc, and to reduce the acidity of the soil, all of which are necessary for the successful establishment and maintenance of introduced pastures. The second problem is to overcome the moisture stress that pasture plants in sandy soils experience during the dry period of the year.

The third problem, that of soil drainage, takes the form of excessive wetness of many low-lying parts of the land-system, particularly where streams flow out onto the plains. The difficulty here is to find species that are capable of withstanding excessive soil wetness during winter and early spring and then excessive soil dryness during summer and early autumn.

To date, experimental and commercial attempts at development have concentrated on subterranean clover but the need is to use deep-rooted perennials such as lucerne and phalaris which can tap deep reserves of soil moisture. AS with the sandy lunettes in Parrie Yalloak land-system and the sand dunes in Kowree and Warratong land-systems, the first task is to achieve a good germination and establishment by overcoming stresses within the seeds and seedlings arising from inadequate reserves of soil moisture.

Plate 42 – The deep deposits of sand that form the Grampians Plains land-system are marginal for land development. An unsuccessful attempt to develop a productive farm is shown here by the fence and partly cleared land reverting to scrub.

These productive hazards create a serious economic hazard because the high costs of development cannot be met by low, uncertain returns from pastures or crops growing in droughty and infertile soils. The economic hazard is accentuated by the high costs of clearing the native vegetation. The density of the timber requires heavy machinery for its removal and the regenerative powers of the heath species necessitates a prolonged period of fallowing and burning.

One enterprise showing some success in its early stages is olive growing. Plantations are in production near Mt. Zero under an average annual rainfall of about 22 inches. The best results are coming from trees growing in yellow leptopodzols and these soils are not as infertile as the white nomopodzols in the same area.

Plantations of pines (Pinus radiata) have been considered but the nomopodzols are marginal for profitable softwood plantations and should not be used while better soils are available (refer to the last sections of Chapter Five and Chapter Seven). The few attempts in Victoria to grow pines in these soils have had only limited success.

There is no erosion hazard or erosion under the present cover of native vegetation. However, there is a hazard of gullying and sheet erosion when clearing operations and bushfires expose the soil. Particularly does this apply in roadside drains and on the upper positions of the outwash slopes where the gradient is up to five per cent. The sands, being deep and porous, can absorb large quantities of water provided the run-off is steady and slow. However, because of their very coarse texture and lack of structure and consistence, they are susceptible to scouring and gullying if heavy rain sweeps across the bare area. Drainage lines should be left uncleared.

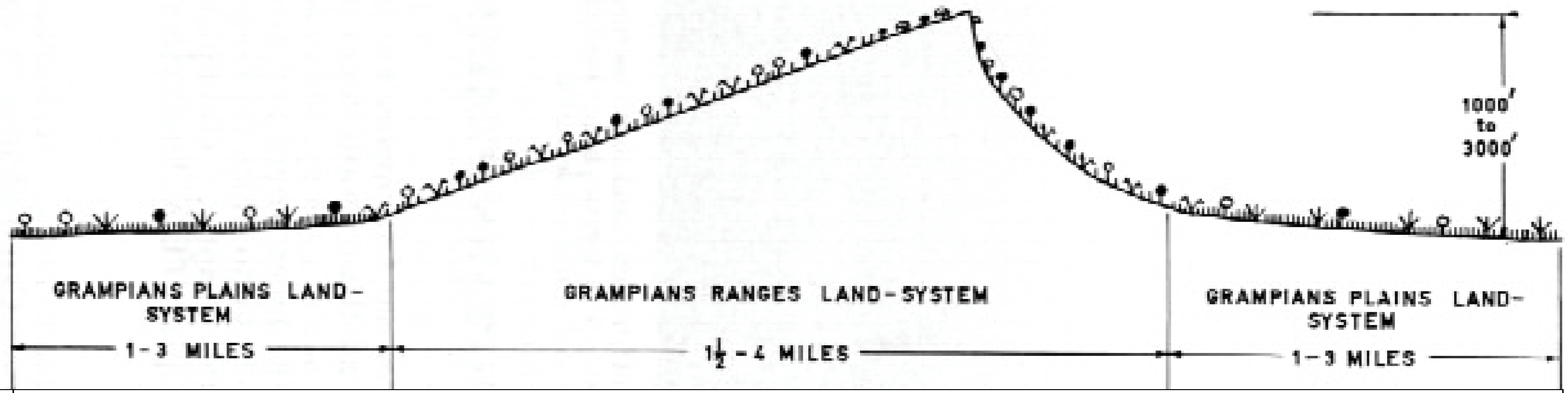
Land-Units

The Grampians Plains land-system is made up of two land-units.

Grampians Plains land-unit occupies most of the land-system and the description and discussion of the land-system applies to this land-unit in every detail.

Mt. Cassell land-unit is a small area near Pomonal township with somewhat different features. It is almost totally cleared and for many years has supported apple orchards and dairy farms with varying success. Some farms have been abandoned and others have continued successfully. The main reason for the settlement of this area is the more fertile soil. It is a light brown sand overlying a friable clay at depths ranging from 28 to 48 inches. There is little evidence of podzolization so it is considered that this soil has greater fertility than the podzols in the Grampians Plains land-unit. The greater fertility of the soil is reflected in the native vegetation which is a tall woodland of manna gum, yellow box, red gum, and black wattles. It may have been this feature that attracted the attention of the first settlers who singled out this area from the extensive areas of poor quality vegetation and soils that make up the other land-unit.

GRAMPIANS RANGES AND GRAMPIANS PLAINS LAND-SYSTEMS



Climate		Average annual rainfall 22-35 inches : growing season April to September or October			
Land-Form		Sand sheet	Cuesta		Sand sheet
Geology		Early Holocene siliceous sands	Upper Devonian – Lower Carboniferous quartzose sandstones		Sand sheet
Topography		Flat and very gentle slopes	Steep and very steep slopes		As shown on the left
Soil		Nomopodzols (dominant), deep solonetzic soils and leptopodzols (minor)	Skeletal soils and rocky iron nomopodzols (Grampians Ranges series)		
Land-Class		3, 4A (pastures of low yield)	6		
Land-Use	Present	Mostly unused, some attempts to grow pastures	Protection forests for water catchments, small quantities of hardwood are extracted for milling		
	Problems	Finding a productive form of land-use	Preventing and extinguishing bush fires		
Water Erosion	Hazard	Low under the forest cover, high when clearing operations and gush fires expose the sol			
	Actual	None except for sheet erosion after bush fires			
Native Vegetation	Structure	Heath woodland mainly, also dry sclerophyll forest	Dry sclerophyll forest	Dry scrub	
	Species	Brown stringybark, messmate, apple box, peppermint, heath understorey	Brown stringybark, messmate, long leaf box, heath understorey	Grampians gum, long leaf box, heath understorey	

Figure 31 – Grampians Land System