THE HIGH PLAINS LAND SYSTEM

LIST OF FIGURES

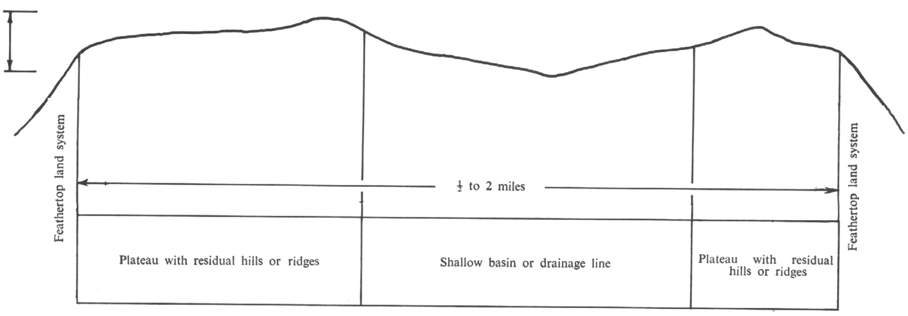
LIST OF PLATES

HIGH PLAINS LAND SYSTEM

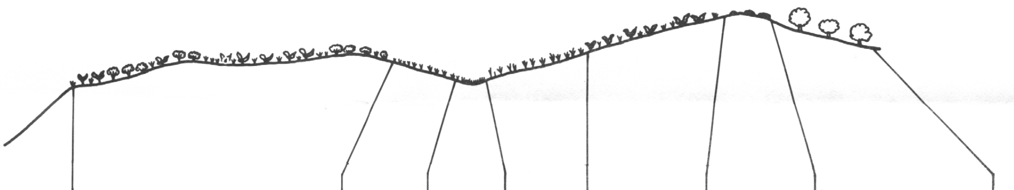
Area : 26 sq. mile : 4 per cent. of catchment

Map symbol H

(a) Distribution of land forms



(b) Land system diagram



Climate	Average annual precipitation 60 in. to 90 in. with persistent winter snow. Estimated average temperatures : Jan. 52°F : July 28°F to 30°F						
Geology and soil parent materials	Mainly gneiss and schist. Some Tertiary basalt around Mt. Jim and Loch. Ordovician slates and mudstones at Mt. Hotham. Soils generally highly organic						
Land form and topography	Rolling to undulating plateau	Gently sloping to rolling basin or drainage line			Rolling to hilly residual hill or ridge		
Soils	Shallow organic loams		Peats, organic soils	Shallow organic loams		Undifferentiated stony loams	Shallow organic loams
Vegetation formation	Alpine herbfield–shrub community mosaic	Alpine grass-land	Bog or fen	Alpine grass-land	Alpine herbfield	Feldmark ; Shrub or sub-alpine Woodland	Sub-alpine Woodland
Vegetation floristics	Snow grass, snow daisy : Hovea, Grevillea, Kunzea, Orites, etc.	Snow grass	Sphagnum moss or sedge	Snow grass	Snow grass Snow daisy	Edelweiss; Hovea etc. : or Snow Gum	Snow Gum
Present land-use	This is the most productive water-supply area in the catchment. Extensive hydro-electric power generation based mainly on water from this area. Summer grazing of cattle. Tourist attraction summer and winter						
Potential land-use	Development and maintenance of maximum yield of useful water. It is doubtful if grazing is compatible with the primary use		No grazing			No grazing	
Erosion hazards	Wind erosion hazard is high where ground cover is sparse, particularly on exposed north-westerly aspects. Water erosion damages ground-water vegetation by sedimentation or gullying which lowers the water-table						
Problems	Management of the area for water-supply purposes with traditional grazing and continued pressure from groups with special interests. Rehabilitation of degenerate areas. The environment is harsh and complex.						

Fig 18 - High Plains Land System - Distribution of land forms/land system diagram

8. HIGH PLAINS LAND SYSTEM

The High Plains land system is the highest within the catchment. It consists mainly of the Bogong High Plains in the extreme south of the catchment but includes small separate areas on Mt. Bogong, Spion Kopje, Mt. Hotham and Mt. Loch. A long peninsula-like extension runs north from the Bogong High Plains to include Mts. Fainter North and South. It has a total area of 26 square miles which is 4 per cent of the area.

The distribution of land forms is shown in Figure 18 (a) and the land system diagram is Figure 18 (b).

The steep and precipitous slopes of the Feathertop land system adjoin the High Plains land system within the catchment and it is continuous with the Bogong land system of the Hume catchment to the east (Rowe 1967).

Much of the area is held by the State Electricity Commission under a Crown Grant, and the rest is Crown land.

Annual average precipitation ranges from 58 inches at Mt. Hotham to over 90 inches on the Bogong High Plains. Snow is a major form of precipitation during winter and may fall in most months, although it is rarely heavy or persistent during the warmer months. At Hotham Heights the average number of wet days per month from December to March is about 8 and from May to October it is about 15.

Temperatures are generally low in this area and severe frosts may occur at any time of the year. Temperature records are available for both Hotham Heights and a Bogong High Plains station. The average temperature in January is about 52^{o} F. and in July it is about 29^{o} F. The average frost-free period at Hotham Heights is only 13 days. These low temperatures and frosty conditions result in a very short growing season on these areas.

Wind is also an important climatic factor. No records are available but it is clear from the, asymmetry of the snow gums and the direction of wind sorting of gravel on erosion pavements that the prevailing winds are north-westerlies, and that they may be very severe. Calm days are not common. Wind direction, persistence and severity are important factors in the development of snow drifts, in the distribution of vegetation and in the severity of the erosion hazard.

Shales of Ordovician age are the dominant rock in the Mt. Hotham area. Except for the basalt flow around Mt. Jim and at Basalt Hill at the head of Rocky Valley, gneiss is the dominant rock over most of the plains. Granodiorite occurs at the Niggerhead, and Mt. Nels and Mt. Bogong consist of schists.

The landscape consists of a series of broad, mature, alluviated valleys, with elevations from about 5,300 feet to 5,800 feet (Plate 36). From these, rise gentle divides to elevations of about 5,800 feet up to 6,500 feet on Mt. Bogong. The gently undulating to rolling topography contrasts sharply with the steep to precipitous slopes in the dissecting valleys of the adjacent Feathertop land system (Plate 37). Beavis (1962) considers this landscape to be the remnant of a pre-Kosciusko-uplift surface which had gentle relief. The possible relationship between this surface and the plateaux of the Big Ben and Stanley land systems has been mentioned (p. 41).

The soils of the high plains environment in Australia have been described and discussed in detail by Costin (1954, 1962). The most widespread soils are shallow organic loams (the alpine humus soils of Costin) which occur on most of the landscape where there is abundant moisture but where drainage is not impeded, and on all rock types. On the drier, open rolling plains, the soils are not as organic but are otherwise similar. In permanently wet situations peats have developed. These may be classified as fen peats, or raised or valley bog peats according to their drainage status and the type of vegetation which has produced them. Humified peats, which have been derived from normal peats, occur where stream entrenchment has lowered the water-table. Undifferentiated stony loams are the common soils on the exposed tops of ridges and peaks such as Mt. Nels and Mt. Hotham. A number of other soils are listed by Costin (op. cit.) but these are relatively uncommon and in total do not occur on more than 5 per cent of the area.

The shallow organic loams have a very friable and porous organo-mineral horizon up to 12 inches or more deep, reactions are as low as pH 4. 5 and fertility is generally low. Nutrient economy is achieved against a high leaching potential by active re-cycling and the retention of most of the nutrients in organic form or associated in exchangeable form with organic colloid.

The vegetative patterns typical of this environment have also been described by Costin (1954, 1957a, 1957b, 1962). For the convenience of this survey some modifications to terminology have been made but the vegetative units recognised are essentially similar.

The alpine herbfield of snow grass (*Poa australis*) and snow daisy (*Celmisia longifolia*) occurs extensively on freely drained areas. Scattered within the herbfield are numerous patches of shrubs, either as scattered single plants or as large patches. Carr (1962) pointed out that although it is normal for shrubs to occur in the herbfield or grassland, the abundance of shrubs is the result of their ability to colonise bare soil, and it is inferred that the herbfield must have been depleted to have allowed the shrubs to succeed in such numbers.

Plate 36. The High Plains land system between Mt. Nels and Spion Kopje. The race-line which runs across the centre of the picture diverts water from the High Plain's section of the Big River (Mitta Mitta) across the catchment boundary into the East Kiewa River

The shrub community normally occupies rocky areas and areas which are exposed and relatively snow-free. The common shrub species on well-drained sites are long-leaf Hovea (*H. longifolia),* alpine mint bush *(Prostanthera cuneata),* alpine Grevillea *(Grevillea australis),* alpine Phebalium *(Phebalium podocarpoides)* and alpine star-bush *(Pleurandropsis trymalioides).* Mountain Orites (*0. lancifolia)* and golden Oxylobium *(Oxylobium ellipticum)* are more common in rocky areas and under snow gum *(E. pauciflora).*

Yellow Kunzea *(Kunzea muelleri)* occurs with thyme heath *(Epacris serpyllifolia)* as a separate low-shrub community in areas with impeded drainage, such as along drainage lines. This is a widespread community in Pretty Valley where candle heath *(Richea continentis)* is also a common component of the vegetation.

In depressions and gently-sloping valleys where the accumulation of cold air causes abnormally low temperatures, alpine grassland of snow grass (sod tussock grassland of Costin (1957a)) is the dominant vegetation. The adjoining vegetation may be the shrub community or snow gum woodland.

The sub-alpine woodland of snow gum occurs mainly at the lower elevations on well-drained soils. It extends up onto some of the higher peaks, such as Mt. Cope, where large outcrops of rock apparently provide protection from wind or snow damage, or possibly reduce the extremes in diurnal temperature variation. The more windswept occurrences of snow gum arc reduced in form to a wet mallee or scrub formation.

In the permanently wet drainage lines and where groundwater emerges at the surface, there occurs bog vegetation which is dominated by Sphagnum moss *(Sphagnum cristatum).* Fen of tufted sedge *(Carex gaudichaudiana)* also occurs in permanently wet, almost level situations. The fen community occurs in less acid waters than the bog (Costin 1962). The gently sloping valleys of both Pretty Valley and Rocky Valley should be suitable for extensive bog development. Rocky Valley is now inundated by the waters of a dam (used to store water for hydro-electric power generations) and Pretty Valley Creek seems to have suffered entrenchment and straightening of its course in many places and bog vegetation is not common. In its place is the low shrub community of yellow Kunzea and thyme heath.

The High Plains land system is particularly valuable for the supply of large quantities of high quality water. An average annual yield of about 2,500 acre feet per square mile may be expected, compared with only about 1,700 acre feet per square mile from country between 3,000 feet and 5,000 feet and about 500 acre feet per square mile from country below 3,000 feet elevation (see p. 31). The delay in the release of the water, brought about by the accumulation of deep snow drifts in winter, adds to the value of the water.

Plate 37 - The western slopes of Mt Bogong. Very steep and rocky escarpments of the Feathertop land system below a small areas of the High Plains land system. The alpine ash forests of the Darbalang syb-system appear in the lower part of the picture

The Kiewa Hydro-electric Project has been based largely on the water derived from this land system. Several race-lines bring water from the adjacent Hume catchment into the scheme.

The grazing of cattle on the plains during the snow-free months is almost a traditional industry which has been going on since the 1850's. At times, sheep and horses were also grazed and wild horses still exist in the area. Since 1950 there has been a progressive increase in control over grazing in this area, exercised by the Soil Conservation Authority through the Bogong High Plains Advisory Committee on which cattlemen, the Soil Conservation Authority, the State Electricity Commission and the Lands Department are represented. Both stock numbers and dates of admission and removal of stock are controlled.

The area has a strong appeal for tourists in both summer and winter, and snow sports and hiking are very popular pastimes for which the area provides excellent conditions.

Although controlled grazing of cattle in summer may be an acceptable form of land-use on parts of the land system there are many areas which undoubtedly should be protected from grazing. The bogs perform a valuable function in retarding run-off and levelling out peak flows (Costin 1966). These have suffered much damage as a result of uncontrolled grazing in the past and something more than just protection will be needed to bring about their rapid rehabilitation. Exposed spurs and ridges normally have shallow soils, and the exposure to wind and frost creates extremely difficult conditions for plant growth. Obviously to eliminate grazing from these two types of area would involve an extensive complex of fencing. Furthermore the exclusion of the bog and fen vegetation would remove the sources of water for stock over large areas so that special stock watering points would have to be constructed. To effectively spread the grazing stock over the remaining available vegetation, the number of such watering points would have to be fairly large. It seems that the grazing industry may not be able to stand the cost of these works. Effective control of the grazing stock by herdsmen may be another alternative.

The hazard of erosion from wind is high over much of the land system because of the very friable nature of the soils and the effect of frosts which loosen the surface of bare soil. However, the most serious aspect of this erosion is not that it contributes to sedimentation of streams or reservoirs, although sedimentation in Rocky Valley Dam would be serious if it occurred, but that loss of the porous surface soil reduces the hydrologic efficiency of the area. The stream entrenchment and subsequent deterioration of bog vegetation and peat, which has occurred in most major drainage lines, also appears to have undesirable hydrologic effects.

The replacement of snow gum woodland by dense regrowth thickets has an adverse effect on snow accumulation and snow-melt (Costin et. al. 1961). It seems likely that the presence of the disclimax shrub community in grassland or herbfield may also cause early and more rapid snow-melt.

Considerable research is still needed before a thorough understanding of this valuable environment can be reached. Present knowledge leads to the conclusion that bad land-use in the past has left the area in a less efficient condition for water conservation than it should be.

Immediate problems are the ensuring of complete fire protection, the rationalisation of grazing in relation to water supply, the re-establishment of stability in stream channels and the encouragement of regrowth of the bogs. Experimental work should be carried out to provide answers to these problems and to test the validity of a number of theories concerned with the deterioration of hydrologic functions.