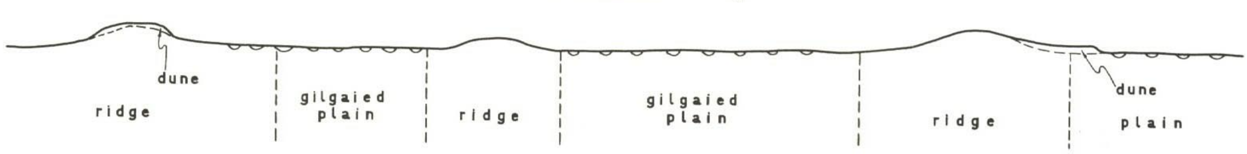
Hopetoun Land System

Fig. 21 – Hopetoun Land System

HOPETOUN LAND SYSTEM

(a) Distribution of land forms



(b) Land system diagram

AVERAGE ANNUAL RAINFALL : 12½″ – 14″

LAND USE : Cropping and grazing

		Ridge			Plain	Dune	
LAND FORM	Type	Ridge			Plain	Dune	
	Approx. percentage of land system	60			35	5	
	Approx. cross section	½–1 mile			¼–1 mile	4–6 chains	
PARENT MATERIAL		Parna (on gentle slopes generally towards base)	Coarse saltation material and parna (on moderate to steep slopes)		Parna	Mainly coarse saltation material	
NATIVE VEGETATION		Mallee Occasional woodland of pine, buloke, with belar in north			Mallee Occasional grassland Occasional big mallee	Mallee with savannah mallee on crests Occasional woodland of pine, buloke, with belar in north, on red sands	
SOIL	Textural group	Light clays	Sandy loams		Light clays	Sands	
	Morphological group	Light clays	Group A (On moderate slopes)	Group B (on steep slopes)	Light clays	Group D Reddish yellow	Red
	Proportion on land form	Subdominant	Dominant	Subdominant	Dominant	Dominant	Minor
	Moisture characteristics	Poor	Moderate		Poor	Good for deep-rooted species	
	Fertility reserves	High	Moderate		High	Low	
LAND USE	Most suitable form	> 13″ cropping and grazing < 13″ grazing	Cropping and grazing		> 13″ cropping and grazing < 13″ grazing	Grazing	
	Nutrients required in fertilizers	P	P, (N > 13″ ?)		P	P, N	
	Recommended pastures	Barrel medic, Wimmera ryegrass	Barrel medic, Wimmera ryegrass > 13″ lucerne		Barrel medic, Wimmera ryegrass	Lucerne	
	Land use class	> 13″ 1 < 13″ 3	2 (*a*)		> 13″ 1 < 13″ 3	4 (*a*)	
WIND EROSION HAZARD		slight ← easterly lower heavier soils — westerly higher lighter soils → severe			Slight	Very severe	
OTHER HAZARDS		Dry land salting	Seepage salting, channel seepage salting		Dry land salting		

More than any other man E. H. Lascelles was responsible for opening up the dense thickets of mallee to make way for farms. In the 1880's he had a grazing run centred on a homestead beside Lake Coorong. He realized that the surrounding country had a potential for wheat growing and in 1891 he began clearing the mallee and developing farms. Thus, in the Hopetoun land system were seen the beginnings of the vast settlements which were to follow. The township of Hopetoun has grown up around Lascelles' homestead.

The bulk of the land system occurs in a broad belt of some 1,180 square miles of country extending from Rainbow north-eastwards to Sea Lake. It also occurs in scattered areas further northwards and westwards, particularly to the north of Lake Tyrrell, to the south-west of Murrayville and to the north-west of Ouyen. The aggregate area of these scattered occurrences is about 300 square miles.

The landscape is composed of a regular series of N.N.W.-S.S.E. trending ridges on which dunes are superimposed and of inter-ridge plains (Fig. 21). The ridges occur at a similar density to those in the Tempy land system, the average distance between their crests being about 2 miles. The dunes are weakly developed and relatively few, occupying only about 5 per cent of the landscape compared with 15 per cent in the Tempy land system and 30 per cent in the Central Mallee land system.

Compared with the two latter areas, the Hopetoun land system contains a much larger proportion of gilgaied light clays. These soils predominate on the plains and on the lower slopes of the ridges. They may even cover the entire ridges where the slopes are gentler than average and this commonly occurs to the south-east of Woomelang. Sandy loams of Groups A and B predominate on the middle and upper ridge slopes, generally with Group B soils on the higher sites. Shallow sandy loams on limestone are not found to any extent, the most notable exception being in the Parish of Nypo to the cast of Lake Albacutya. Sands of Group D occupy the dunes. Reddish yellow sands predominate whilst the more fertile red sands occur scattered throughout.

The native timber is mainly mallee except on the dune crests where savannah mallee occurs. On all parts of the landscape there are scattered stands of pine and buloke woodland in the south and of pine-belar-buloke in the north. As in the Culgoa land system there are remnants of big mallee and grassland on the heavy plains and these communities were apparently more widespread before settlement in the northern than the southern parts of the land system.

The average annual rainfall varies from 11½ inches in the north to 14 inches in the south resulting in a marked increase in agricultural productivity in this direction. Towards the South Australian border the 13 inch isohyet swings northwards, bisecting an area of the Hopetoun land system to the south-west of Murrayville. The higher rainfall in this district compared with other land along the Ouyen-Murrayville line is reflected by a relatively high level of production.

The marked effect of variation in rainfall on the performance of the widespread light clays is similar to that in the Culgoa land system. These soils are suitable for cropping and introduced pastures only where the average annual rainfall is greater than approximately 13 inches. In the areas to the north-west of Ouyen and to the north of Lake Tyrrell the heavy plains support mainly native grasslands of spear and wallaby grasses with a low carrying capacity. To the south of the 13 inch isohyet the light clays are heavily cropped and their fertility remains high after some 70 years of intensive cropping. Investigations are required to determine whether crop yields are benefited more by spelling the land under a non-legume rather than barrel medic.

The effect of variation in rainfall on the land-use features of the sandy loams is also similar to that in the Culgoa land system. Having more favourable moisture characteristics than the light clays the sandy loams are cropped throughout the land system and the decline in fertility becomes progressively more serious towards the south.

The land-use features of the dunes are similar to those within the Central Mallee land system. Except perhaps for the red dunes of the more northerly areas the sands have declined in fertility to a point where profitable cereal crops, even of rye, cannot be grown without mixed phosphatic and nitrogenous fertilizer. The most stable and productive form of land use on the dunes is grazing of lucerne and the performance of this species improves with increasing rainfall.

The overall erosion hazard within the land system is considerably less than that in the Central Mallee and Tempy land systems but greater than that in the Culgoa land system. The hazard is greatest on the dunes and generally moderate on the sandy loams of the ridges except on the upper western faces which are most susceptible to windstripping.

By comparison with that of the Central Mallee and Tempy land systems the relocation of fences for differential treatment of the soils is relatively straightforward. The light clays of the plains and lower ridge slopes can readily be separated from the lighter soils of the upper ridge slopes. The greatest difficulty is met on these higher areas where a good separation of the sands from the sandy loams may be hard to arrange.

The potential for increased production within the land system lies mainly in increasing the area sown to introduced pastures on the lighter soils. Lucerne will stabilize the dunes and boost their production. In general, barrel medic is the most suitable species to include in the cropping rotation on the sandy loams. However towards the south where, symptoms of nitrogen deficiency indicate that the sandy loams require lengthy periods under a leguminous pasture, lucerne may well be the most suitable species. The relatively favourable rainfall of 14 inches per annum in the south is sufficient for good lucerne growth on these soils. As in the Culgoa land system the potential for increased production on the light clays is relatively low.

Salting

The problem of rising salt contents in topsoils has long been encountered in the irrigation districts of north-western Victoria where prevention and reclamation are achieved by the installation of costly drainage systems (Thomas. 1939). Similar problems have developed in the dryland farming areas where, in spite of their seriousness, they have had little systematic investigation. Within the Hopetoun land system and in other areas, three forms of salting have been recognized, namely seepage salting, channel seepage salting and dry land salting. The top soils have become saline since settlement and in this sense they are quite distinct from the saline soils of the Raak land system.

Seepage salting[*] occurs in low sites where seepage waters evaporate, thereby building up toxic concentrations of salt at the surface. In the earliest stages of salting, crop and pasture growth on the low sites is relatively heavy because of the additional supply of sub-surface moisture provided by the seepage. As the salinity levels rise, growth degenerates and salt-tolerant species such as curly ryegrass *(Parapholls incurva)* and sea barley grass *(Hordeum hystrix)* appear. When the level of salinity increases still further the land becomes bare. The salt patches so formed are found at the base of dunes (Plates 24 and 25) and occasionally at the base of hummocks and ridges in the southern parts of the region where the average annual rainfall is greater than approximately 12 inches. Damage is most widespread in the Hopetoun land system where the incidence increases progressively from the 12 to the 14 inch isohyet where salt patches occur at the base of most dunes. These patches have also been observed in the Tempy land system and in the southern parts of the Central Mallee land system.

Seepage salting has undoubtedly developed as a result of a change in the hydrological pattern which followed clearing of the native vegetation. The mallee and savannah mallee of the dunes and the mallee of the lower sites had a high potential transpiration rate so that there was relatively little seepage from the dunes and any moisture which did accumulate in the lower sites was quickly transpired, thus minimizing evaporation. After clearing, the land was bared, by fallowing and by erosion, and shallow-rooted species incapable of tapping moisture at depth were frequently grown. Thug transpiration decreased, resulting in increased seepage from the dunes and in waterlogging on the flats.

The fact that seepage salting does not occur to the north of approximately the 12 inch isohyet indicates that this line marks the dry limit to significant seepage.

The dune soils are sands of Group D which have permeable upper horizons sharply defined from compact subsoils. After heavy rains, moisture moves down slope above the textural boundary. It may move out beneath the surface of the flats, or it may break through to the surface towards the base of the dune. Where water tables are present in the flats the nature of the strata requires examination. For example, if a permeable layer is found at depth, it may be possible to lower the water table by boring through the impeding layer.

Plate 24 – Seepage salting in the Hopetoun land system, on the road from Hopetoun to Woomelang, looking south-west from the lower slope of a dune.
In the foreground is dormant lucerne. In the middle distance is stinkwort (Inula graveolens). Between the stinkwort and the dune forming the skyline is the salt patch which has a sparse cover, mainly of curly ryegrass. The mallees along the road are dead or dying.

[*] The occurrence of seepage salting in the 12 to 14 inch rainfall belt of north-western Victoria has previously been recorded by Cope (1958) in his detailed analysis of the distribution and ecology of salting in Victoria. The phenomenon is confined to districts in which the average annual rainfall is less than approximately 30 inches and it appears that the most significant factor preventing the development of salting where the rainfall is greater than this is the low original levels of salt in the soils.

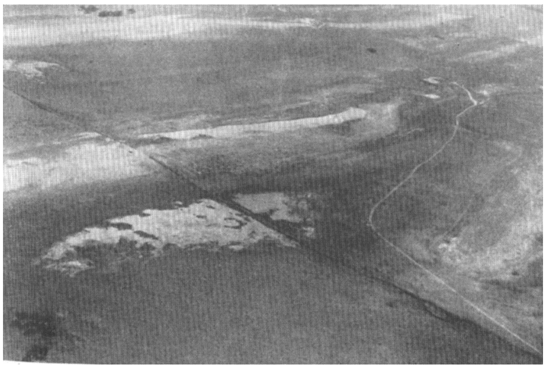


Plate 25 – Aerial photograph of seepage salting at the base of dunes, near Torrita in the Central Mallee land system, looking north-east.
Two salt patches can be seen in the left half of the photo.

The soils of the lower sites are mainly light clays and sandy loams of Groups A and B. Figure 13 shows that these soils contain large quantities of salt at depth so that when evaporation occurs from wet soils or from water tables the surfaces readily become saline. The contribution of salt from the dunes is likely to be relatively low, as indicated by the low chloride values for the sands of Group D.

The incidence of seepage salting appears to be increasing and a study is required to determine the extent of the area affected and if possible its rate of spread. To prevent this spread, seepage must be minimized by establishing on the dunes deep-rooted perennial vegetation which will transpire freely after rains at all times of the year. Lucerne is the most suitable species for this purpose.

The first essential in reclaiming the salt patches is also to minimize seepage by establishing lucerne on the dunes. If this is done the soils of the lower sites will dry out more quickly and water tables, where present, may fall. Records of the levels should be kept to determine this. Subsequent treatment should aim at leaching the salt from the surface and preventing its subsequent rise so that transpiration should be increased at the expense of evaporation. On incipient salt patches success has been achieved with the salt-tolerant Wimmera ryegrass which is established following good autumn rains when the salt has been leached from the surface. Subsequent transpiration must be kept at a maximum; therefore the area should be fenced to exclude stock, at least in the initial stages of reclamation. In subsequent years the Wimmera ryegrass requires cultivation to maintain a vigorous stand which should be grazed only lightly.

Where the salt patch is too saline for the establishment of Wimmera ryegrass evaporation can be reduced by covering the ground with a mulch of vegetative material. By this means it may be possible to reduce the surface salinity to a level at which Wimmera ryegrass can be established. Research is required, however, to find a more salt-tolerant suitable species. Native halophytes such as bluebush *(Kochia pyramidata)* show the most promise but they cannot be recommended for use until methods are found of overcoming the problem of poor germination.

Channel seepage salting occurs in areas served by water supply channels where the latter run on locally high positions, for example on dunes, ridges or hummocks. Seepage from the channel moves. downslope and forms water tables in the flats where salt patches similar to those mentioned above develop. Apart from the source of water and the contribution of salt from the channel water, the phenomenon is similar to seepage salting. However, prevention and reclamation are hampered by the difficulty of significantly reducing seepage during the period in which the channels carry water. Lucerne should be established below the channels to cut down the amount of seepage as much as possible. Meanwhile the extent to which seepage can be reduced by lining the channels, for example with clay, needs to be determined.

In addition to the question of the control of salting, investigations are required to determine the extent to which seepage from the channels can be used to promote pasture growth, not only in sites below the channels but also on plains where moisture may seep laterally. Deep-rooted species would be required. Lucerne would be suitable for the lighter, nitrogen-deficient soils and it may well be the most suitable species for the heavier land.

Dry land salting[*] occurs without seepage on heavy soils which had high subsoil or sub-surface salt contents in their virgin condition. After clearing, the surfaces become saline. The problem occurs widely on eroded sandy loams, of Group C and it has also been noted on the puffs of gilgaied light clays.

Wind erosion has exposed the clay subsoils of the sandy loams of Group C in several land systems (Plate 27). Salt-tolerant species frequently grow on the scalds, for example curly ryegrass *(Parapholis incurva),* sandspurry *(Spergularia rubra),*

[*] Dry land salting is a Western Australian term. In that State it is a serious problem on heavy soils in the 12 to 15 inch wheat belt (Smith 1961). It is particularly widespread in the pastoral country of western New South Wales on wind-eroded red-brown earths (sandy loams of Group C).

sea barley grass *(Hordeum hystrix)* and marsh saltbush *(Atriplex paludosa)*. Salt has risen to the surface of the scalds as illustrated by samples taken at Pirlta in the Millewa land system. The surface of a scald contained 0.18 per cent chloride which is well within the range toxic to plants. In adjacent uneroded soil such a high figure was not encountered above a depth of 1 foot into the clay B horizon.

The clays have unsatisfactory moisture characteristics in the semi-arid climate. Their aridity is heightened by the presence of a surface seal which develops following rains owing to the dispersing effect of sodium ions on the exchange complex. This seat retards the penetration of rain much of which is lost by evaporation. As in seepage salting, reclamation involves leaching of the salt from the surface and preventing its subsequent rise by increasing transpiration and by minimizing evaporation. Reclamation becomes progressively more difficult in moving from the 14 inch rainfall zone in the southern parts of the region (see Tyrrell Creek land system) to the 10 inch zone in the north (see Ned's Corner land system).

When analyzed in the laboratory the puffs of virgin gilgaied light clays were observed to have high salt contents close to the surface (an average of 0.02 per cent chloride at 0-3 inches and 0.2 per cent. at 6-12 inches in the three profiles examined). These analyses suggested that the soils have a dry land salting hazard. This suspicion was confirmed after samples were taken in the Sea Lake district from the surface of puffs on which the germination of a wheat crop was faulty. The chloride content in the top 3 inches was 0.07 per cent. This approaches the range at which damage to crop growth occurs. The surface structure of the puffs was poor, probably because of the dispersion of clay under the influence of sodium ions during periods of rainfall.

The gilgaied light clays are among the most widespread soils in the region and an investigation is needed to determine the extent to which the puffs are affected by dry land salting. The problem would be aggravated by evaporation from bare fallows. In addition the levelling action of cultivation in which topsoil is removed from the puffs and deposited in the shelves would tend to increase the salinity level at the surface of the puffs.