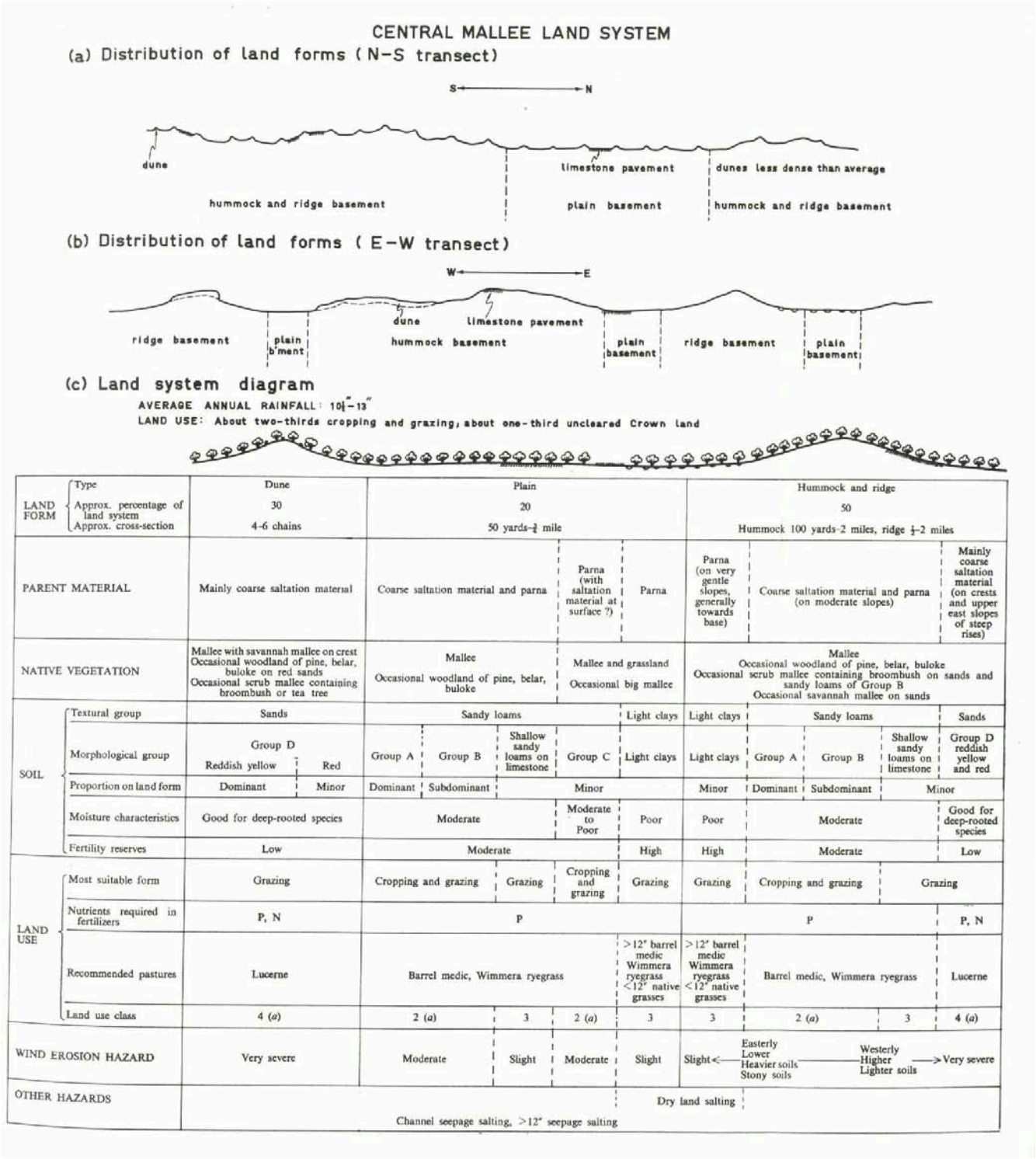
Central Mallee Land System

Fig. 16 – Central Mallee Land System



LAND FORM	Type	Dune	Plain					Hummock and ridge				
	Approx. percentage of land system	30	20					50				
	Approx. cross-section	4–6 chains	50 yards–¾ mile					Hummock 100 yards–2 miles, ridge ½–2 miles				
PARENT MATERIAL		Mainly coarse saltation material	Coarse saltation material and parna			Parna (with saltation material at surface ?)	Parna	Parna (on very gentle slopes, generally towards base)	Coarse saltation material and parna (on moderate slopes)			Mainly coarse saltation material (on crests and upper east slopes of steep rises)
NATIVE VEGETATION		Mallee with savannah mallee on crest Occasional woodland of pine, belar, buloke on red sands Occasional scrub mallee containing broombush or tea tree	Mallee Occasional woodland of pine, belar, buloke			Mallee and grassland Occasional big mallee		Mallee Occasional woodland of pine, belar, buloke Occasional scrub mallee containing broombush on sands and sandy loams of Group B Occasional savannah mallee on sands				
SOIL	Textural group	Sands	Sandy loams				Light clays	Light clays	Sandy loams			Sands
	Morphological group	Group D Reddish yellow / Red	Group A	Group B	Shallow sandy loams on limestone	Group C	Light clays	Light clays	Group A	Group B	Shallow sandy loams on limestone	Group D reddish yellow and red
	Proportion on land form	Dominant / Minor	Dominant	Subdominant	Minor			Minor	Dominant	Subdominant	Minor	
	Moisture characteristics	Good for deep-rooted species	Moderate			Moderate to Poor	Poor	Poor	Moderate			Good for deep-rooted species
	Fertility reserves	Low	Moderate				High	High	Moderate			Low
LAND USE	Most suitable form	Grazing	Cropping and grazing		Grazing	Cropping and grazing	Grazing	Grazing	Cropping and grazing		Grazing	
	Nutrients required in fertilizers	P, N	P					P				P, N
	Recommended pastures	Lucerne	Barrel medic, Wimmera ryegrass				>12" barrel medic Wimmera ryegrass <12" native grasses	>12" barrel medic Wimmera ryegrass <12" native grasses	Barrel medic, Wimmera ryegrass			Lucerne
	Land use class	4 (*a*)	2 (*a*)		3	2 (*a*)	3	3	2 (*a*)		3	4 (*a*)
WIND EROSION HAZARD		Very severe	Moderate		Slight	Moderate	Slight	Slight ← Easterly, Lower, Heavier soils, Stony soils — Westerly, Higher, Lighter soils → Very severe				
OTHER HAZARDS		Channel seepage salting, >12" seepage salting					Dry land salting					

Soon after it was settled, the Central Mallee land system became one of the worst-eroded areas in Australia. Being such a hazardous area and covering almost one-third of the region, it figured largely in public inquiries which were held into problems of wind erosion and which ultimately had much to do with the passing of soil conservation legislation in Victoria. Thus the popular concept of north-western Victoria as a whole has largely been determined by this land system.

It covers approximately 4,400 square miles, extending from the South Australian border in the west to the River Murray in the east. Towards the west it is divided into two zones separated by the Berrook land system.

The landscape is dominated by east-west trending dunes which occur at a greater density than in any other cleared parts of the region (Fig. 16). The dunes occupy, on the average, 30 per cent of the landscape, which corresponds to 5 or 6 dunes in a north-south transect of 1 mile (Plates 1, 15, 16), but their density varies from place to place. The basement on which the dunes rest is either level or undulating, consisting of plains, hummocks and N.N.W.-S.S.E. trending ridges.

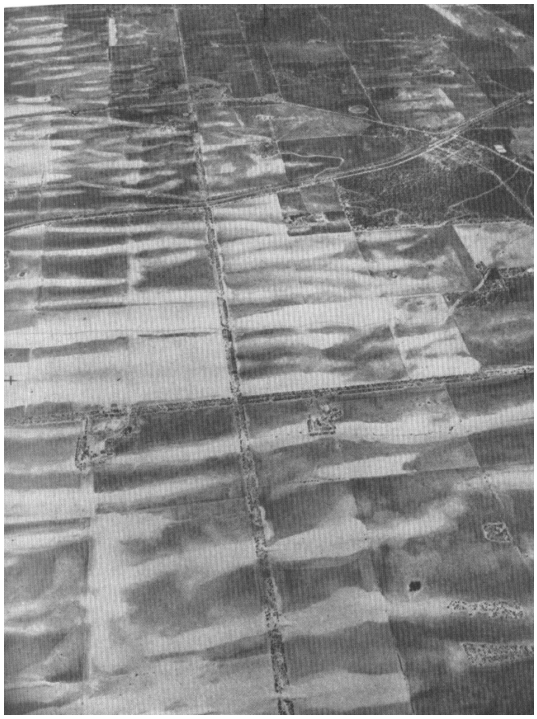


Plate 15 – Oblique aerial photograph of part of the Central Mallee land system, looking north.
The main north-south road follows the 142nd meridian. The white, east-west trending streaks are dunes. The dune-free country in the upper right-hand corner is part of the Boigbeat land system. In this part the township of Walpeup is situated.

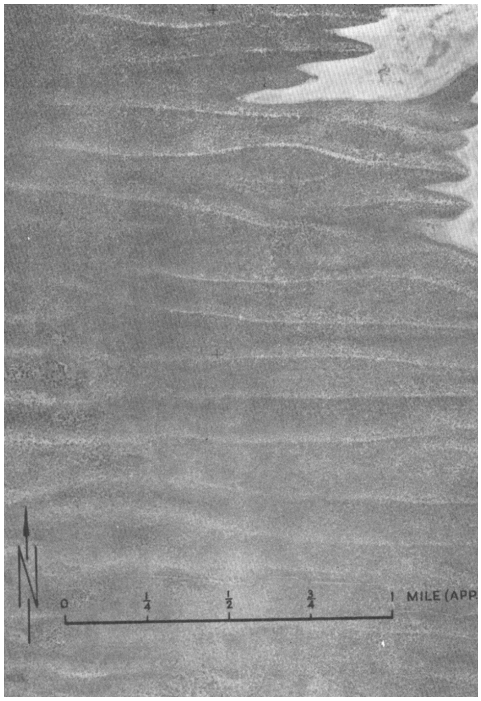


Plate 16 – Aerial photograph of an uncleared portion of the Central Mallee land system, west of Nowingi.
The east-west trending white streaks are the crests of dunes. The salt pans in the upper right-hand corner belong to the Raak land system.

The complexity of the soils distribution is governed by the degree of undulation of the basement. Where the dunes occur on a plain the soils pattern is relatively simple, consisting of sands on the dunes alternating with heavier soils in the interdune corridors. However, where the basement consists of hummocks and ridges and particularly where these two land forms are relatively steep the soils pattern is much more complex, as shown for example in Fig. 15.

The soils range in texture from sands to clays. Sands of Group D occupy the dunes and also the upper slopes of the steepest hummocks and ridges. Reddish yellow sands predominate. The more fertile red sands occur scattered throughout and their presence is indicated by remnants of pine, belar and buloke woodlands. Red dunes can occur singly as shown in Fig. 15 or in a body which may cover quite a large area as for example about 60 square miles in the Timberoo district to the south-west of Ouyen.

Sandy loams predominate on the interdune plains and on all but the steepest slopes of hummocks and ridges. Soils of Group A are the most widespread and they are mainly found in the lower sites. Soils of Group B are common, particularly on the upper slopes of hummocks and ridges. Although shallow sandy loarns on limestone are scattered throughout the land system they are most widespread towards the west. A typical example of the random distribution of these soils is shown in the array of soils on a farm to the south of Tutye where the limestone outcrops range in area from 1 to 83 acres, collectively amounting to 13 per cent of the farm (Fig. 15).

In low sites, and generally on wider-than-average plains there are minor areas of gilgaied light clays and sandy loams of Group C.

By far the most widespread native vegetation is mallee which alternates with strips of savannah mallee along the dune crests, whilst woodlands of pine, belar and buloke are scattered throughout on all landscape positions. There are occasional stands of big mallee and grassland on heavy soils in the lowest sites. There are limited areas of scrub mallee (mallees with an understorey of broombush or tea-tree) on reddish yellow dunes or on the steeper slopes of hummocks and ridges.

Although the average annual rainfall varies from less than 11 inches in the north to 121 inches in the south the gradation is not accompanied by significant changes in native vegetation or soils. However, agricultural production can be seen to increase appreciably from north to south so that, for land-use discussion, reference should be made to the isohyets in order to subdivide the land system into units of comparable climate.

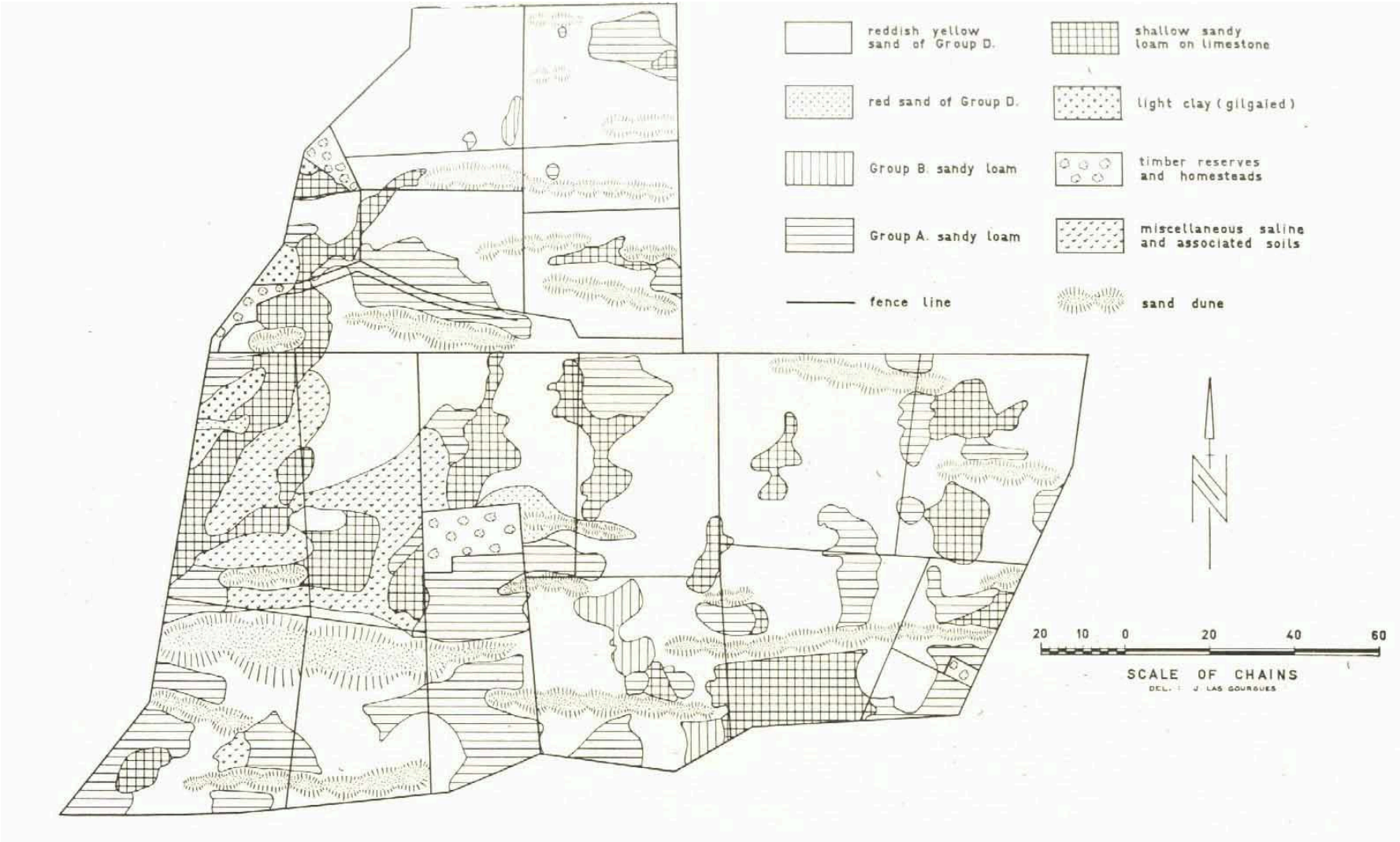
Settlement took place just prior to the first world war, leaving only about one-third of the land system uncleared, mainly to the north but also to the east of the Berrook land system. The land was subdivided into farm units known as "allotments" or "blocks" of approximately 1 square mile but it soon became apparent that this was not sufficient for a living area. Amid great hardship the population gradually dwindled until today, in the early 1960's, the average farm size is about two blocks or roughly twice the size of the original, farm units.

In the early stages of settlement the land was intensively cultivated, with wheat. as the main crop. For several years the dunes were the most reliable cropping sites but because of their low fertility reserves, over-cropping and the loss of topsoil by erosion, they will no longer produce profitable wheat crops under average conditions with the standard dressing of superphosphate. On the reddish yellow dunes wheat and oats have been replaced by cereal rye *(Secale cereale)* and barley which can grow well on soils of low fertility. The yields of all cereals are increased by applying a mixture of superphosphate and sulphate of ammonia and it has been shown that profitable crops, even of wheat, can be grown with applications of about 120 lb./acre of a 1-in-1 mixture (Department of Agriculture 1961). The response of cereals to applied nitrogen varies from year to year, depending on the extent to which nitrate which has accumulated under fallows is leached from the sands. Rain which falls in late autumn and early winter before the crop becomes established is particularly significant. When it is heavy the response to nitrogen is most marked. Thus the need for nitrogen as fertilizer can be assessed from year to year. It appears that the response is uneconomical only in those years when autumn-winter rains are relatively light.

Similar problems with cereal growth occur on the. sands of the upper slopes of the steepest hummocks and ridges and also on the scattered red sand dunes. Because these red sands are more fertile, the problems on them are less serious.

Under average conditions the sandy loams of Groups A and B still produce profitable wheat crops with phosphatic fertiliser alone. This is usually applied with wheat crops sown on previously fallowed land and not to any extent on stubble-sown crops or pastures. The recommended rates are about 60 to 90 lb. per acre (Department of Agriculture 1961). Although Woodroffe and Williams (1953) have shown that there is a continual build up of available phosphorus with repeated applications of superphosphate to Group A soils, profitable responses are still being obtained. This indicates that the general level of available phosphorus is still below the optimum.

Fig. 15 – Soil morphological groups and sub-groups on a farm in the Central Mallee land system.



Although the shallow sandy loams on limestone are not well suited to cultivation because of damage caused to machinery, they are frequently cropped and produce reasonable yields. Owing to their unsatisfactory moisture characteristics the light clays are of doubtful value for cropping. They are definitely unsuitable in the drier northern parts of the land system and although yields on them improve with increasing rainfall, they appear to be only marginally suitable for cereals in the southern parts.

In the early stages of settlement stock were not carried to any extent and the rotations used were mainly fallow-wheat or fallow-wheat-oats. With the gradual introduction of sheep the rotation was lengthened slightly to include a period of pasture, the feed being provided mainly by self-sown cereals, barley grass *(Hordeum leparinum)* and weeds. Introduced pastures became available at the close of the second world war and their use has gained momentum and is still increasing. Of these, barrel medic *(Medicago tribuloides)* has proved to be the most useful species. Wimmera, ryegrass (*Lolium rigidum)* also became available but it has not been sown so widely because, being relatively difficult to control by cultivation, it frequently becomes a serious weed beneath cereal crops. In the late 1950's lucerne *(Medicago saliva)* began to be widely sown. It has become the main pasture species on the dunes to which it is well suited. Being deep-rooted it can tap moisture which penetrates deeply into the sands, and being a legume it can thrive under the low nitrogen levels of the dunes. It gives large response to superphosphate (Department of Agriculture 1961). This suggests that previous applications of phosphate over the years have not resulted in a large build-up of this nutrient because erosion has removed the surface layer which retain the applied phosphorus.

The Central Mallee land system has a high erosion hazard due mainly to its dense array of dunes. The hazard is also severe on the sands of the upper slopes of hummocks and ridges where the western faces are stripped and where the eastern faces are areas of drift accumulation. The problems of stability on the sandy loams of Groups A, B and C are variable, being moderate to severe on the exposed western faces of hummocks and ridges and relatively slight on the eastern faces and plains. The limestone soils and the light clays have only a slight, erosion hazard.

Almost all of the dunes on farms have had their A_1 horizons completely stripped or buried (Plate 17). Drift moves from the west to the east and also from the crest to the northern and southern slopes so that the dunes are lower and broader than originally and displaced further towards the east. Occasionally the drift is fashioned into a secondary sharp-crested dune known as a "razorback" and where this has occurred reclamation is particularly difficult because the upper slopes are inaccessible to machinery. Cereal rye is outstanding in the initial stabilisation of the dunes because of its ability to withstand sand blasting and to grow on soils of low fertility. However, many of the reddish yellow dunes are of such low fertility that a satisfactory cover of cereal rye cannot be obtained without a mixed dressing of phosphate and nitrogenous fertiliser. After the initial stabilisation of the dunes by cereal rye, pastures are needed to maintain stability in subsequent years and the perennial, lucerne has been found most suitable for this purpose. Reclamation is particularly difficult where the compact sandy loam subsoils are exposed. These raw surfaces have a very poor structure and they cannot be satisfactorily reclaimed until a cover of sand is obtained either by mechanical means or by the judicious trapping of drift.

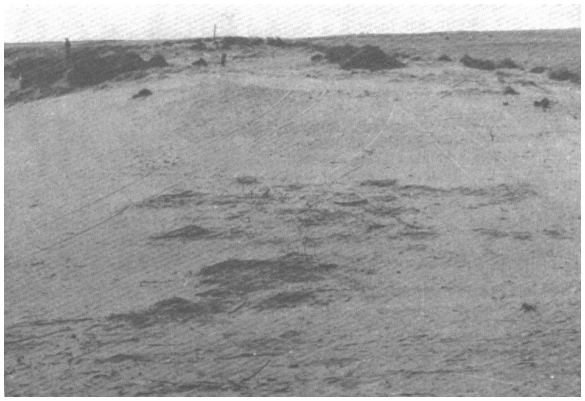


Plate 17 – Erosion of a dune in the Central Mallee land system, north of Danyo.
The cemented core of the dune is exposed in the foreground. The vegetation is porcupine grass.

The most stable form of land use on the dunes today involves the establishment of lucerne and the maintenance of a complete cover by the avoidance of overgrazing. This will lead to the build-up of a fertile A_1 horizon which, however, should not be jeopardised in the future by intensive cropping. Wind erosion cannot be eliminated with as much certainty under cropping, particularly when, as is general at present, several months of fallow are involved. Although techniques have been developed to minimise drift on fallows, such as cultivating in a manner which preserves a cover of stubble or dry pasture, or sowing a cover crop and grazing it, or cultivating only when wet to leave a rough surface, they are all prone to failure during prolonged dry periods. However, for flexibility of management, it will probably be necessary to crop the dunes lightly after some years under lucerne. The two main reasons for fallowing are to build up a supply of available nitrogen and moisture. Thus it may be expected that after some years under leguminous pasture, and with the relatively favourable moisture characteristics of the sands, it will be possible to crop the dunes without a period under fallow, and with phosphatic fertiliser only.

The problems of erosion and the methods of reclamation and prevention outlined above for the dunes apply also to the less widespread sands of Group D which occur on the upper slopes of the steeper hummocks and ridges.

Erosion of the sandy loams is less spectacular because of the relatively small amount of drift produced. However, serious damage occurs on the stripped areas where hard patches are formed. These can be cultivated readily only when moist but the resulting tilth is poor. In addition chemical fertility has been lost with the removal of the surface soil which is the richest source of nutrients. The Department of Agriculture (1961) has shown that the yields of wheat are considerably reduced by the development of hard patches. Their reclamation is a long term process involving improvement of topsoil structure. This is assisted by spelling the land under pasture. Reclamation can be hastened, however, by giving the patches specialised treatment, for example by spreading heavy dressings of superphosphate or sand or animal manure, combined with seeding and cultivations.

Provided overgrazing is avoided and suitable cultivation techniques are used, wind erosion on the sandy loams can be effectively prevented. Where a fallow is prepared on land which has a sparse vegetative cover, for example on a well eaten-down pasture, a mouldboard plough should be used rather than a disc plough to develop a rough surface which, owing to the favourable structure of the sandy loams is fairly resistant to breakdown. Subsequent cultivation to control weed growth should be done only with a tyned implement and only when the soil is moist. High tractor speeds should be avoided so that a fresh rough surface can be prepared. A better protection is obtained if a fallow is prepared on land which has a good stubble cover and if ploughing is done in a manner in which much of the stubble is retained as a protective surface cover. In this case a disc plough can be safely used.

As the sandy loams are the main cropping soils the maintenance of their fertility is a major consideration. However under the semi-arid climate this has two aspects. On the one hand, if the fertility is too high cereals make strong vegetative growth when the rainfall is adequate and when a dry period ensues "burning off" occurs, resulting in low yields. This happened regularly in the early years of settlement and the subsequent improved yields appear to be due in part to the lowering of fertility by intensive cropping. On the other hand, if the fertility falls too low, yields are reduced because of low nutrient supply, particularly of nitrogen (Department of Agriculture 1961). Most of the sandy loams appear to be in this condition today except towards the northern parts of the land system where the average annual rainfall is only about 11 inches. Towards the south where the rainfall is about 12½ inches or more the yellowing of crops indicates severe nitrogen deficiency.

To maintain and improve the fertility of cropping soils, periods under an annual leguminous pasture are required, and barrel medic is effective for this purpose (Department of Agricuture 1961). Ideal management for cropping would balance the relative periods under medic and crop to maintain the optimum level of fertility. The proportion of time required under pasture varies across the land system and also within the one district, depending on the intensity at which particular paddocks have been cropped. At present relatively long periods under medic appear to be required along the southern margins of the land system.

Seepage salting is a serious problem in the southern parts of the land system where the average annual rainfall is greater than about 12 inches. Channel salting is also a problem, except in the western parts where stock and domestic water is obtained from bores. Dry land salting may also be a hazard on the puffs of the gilgaied light clays in all districts. The nature of these three forms of salting and the methods required for their prevention and reclamation are discussed in the section on the Hopetoun land system.

The land system has a considerable potential for increased production of cereals and livestock. Crop yields and quality can be improved by the more widespread use of the medic-lea principle and by the introduction of more suitable cereal varieties recommended by the Victorian Department of Agriculture as the result of trials at the Mallee Research Station, Walpeup. The greatest scope lies in increasing livestock production by the more widespread use of introduced pastures and of fodder reserves and by improved methods of stock management. Experience has shown that lucerne can convert the dunes from the least productive to perhaps the most productive sites on farms. Barrel medic and Wimmera ryegrass provide considerably more feed than the natural pastures which develop in the period between crops. The Department of Agriculture has released harbinger medic *(Medicago littoralis*) which produces earlier feed and sets seed earlier than the commercial strain of barrel medic and thus is may well be the more suitable species for the drier, northern parts of the land system. There is vast scope for improved methods of sheep husbandry in particular by improving the quality of flocks by breeding and by supplementary feeding when pasture growth is insufficient, not only during droughts but also during normal seasonal periods when pasture growth is at a minimum. A considerable amount of data on these aspects of sheep management has been gathered at the Mallee Research Station, Walpeup (Department of Agriculture 1961). There is also scope for the introduction of beef cattle which would help to diversify the source of farm incomes.

To achieve maximum potential the sands and heavier soils require different treatment. Thus it is unfortunate that the original subdivision of the land into allotments and paddocks was carried out with little regard to soil types, but rather on a geometric basis, largely into rectangular units (see Figure 15). One of the main tasks and perhaps the most difficult one in the future is to reorganize the fencing layout, as far as practicable according to soil types. Figure 15 shows that, although a perfect subdivision

may not be possible because of the irregular pattern of the soils, considerable improvement can be made on the original fencing scheme. The soils pattern in Figure 15 is more complex than average for the land system.

Erosion within the land system today is much less widespread than formerly. The turning point came following the general instability which accompanied the disastrous drought of the mid-1940's. In the late 1940's and in the 1950's a run of good seasons enabled the farmers to apply the techniques which had been developed for reclaiming land and preventing erosion. Introduced pastures became widely sown and this was accompanied by a decrease in the area of fallows which, in addition, were left with rough and stubble-protected surfaces. The spectacular decline in the rabbit population following the introduction of myxomatosis in the early 1950's greatly assisted the maintenance of a cover of crops and pastures. The marked success with which lucerne was introduced must have been largely due to the low rabbit population.

Perhaps the main threat to stability lies in the general inadequacy of fodder reserves. During a drought, stock should be hand fed on a heavy soil of low erosion hazard rather than being allowed to roam the farm eating out the scant vegetation, baring the soil and trampling the surface into a powdery state susceptible to erosion. There are still many farmers who have not yet adopted the pattern of conservation farming which has evolved, in which unstable sands are protected by lucerne, in which the fencing layout is being re-organized to achieve differential management of soils and in which adequate fodder reserves are kept. For this reason, if a drought of a similar intensity to that in the mid-1940's were to recur, the extent of erosion would undoubtedly increase greatly. Conservation farming involves the determination to prevent wind erosion combined with considerable skill in farm management and constant attention to detail. Those farmers who have adopted it have shown that it is eminently rewarding, both financially and aesthetically.

In the uncleared, northern country which amounts to about one-third of the land system, the average annual rainfall ranges between 11 and 12 inches per annum, indicating that its agricultural potential is relatively low. Although the soils cover the same range as those in the cleared areas, the dunes are denser except towards the South Australian border, where there are atypical areas of large sand plains on which the soils are reddish yellow sands of Group D. Until conservation farming becomes properly understood and completely established in the settled districts, it would be unwise to clear these northern areas with their lower rainfall and greater-than-average dune density. It may be argued that a form of tenure could be adopted in which soil conservation could be enforced but this may well be impracticable because of the large area involved.