"Some Notes on Coastal Sand Drift Fixation in Western Australia"

A Paper prepared for the
AUSTRALIAN FORESTRY
CONFERENCE
1949

by
D. H. PERRY & L. N. WESTON

SOME NOTES ON COASTAL SAND DRIFT FIXATION IN WESTERN AUSTRALIA

By D. H. PERRY and L. N. WESTON

This work has so far been confined to the south-west coastal regions where the rainfall is not less than 30 inches per annum and where Marram Grass (Ammophila arenaria) thrives. This coastal strip consists essentially of a sandy belt of country stretching from the Moore River in the north to Albany in the south and varying in width from three to 20 miles. It has been recognised generally as belonging to the Cainozoic formation which fringes the western boundary of the continent, although that section referred to herein is more aptly described as forming part of the Tertiary Calcareous Sandstones and associated sand drifts.

Owing to its sandy nature, this region, following the destruction of the indigenous ground cover by over grazing, repeated severe burning or other causes, is particularly liable to erosion by wind. It contains at present many large areas of shifting sand, the major portions of which occur in uninhabited country of little economic value. There are exceptions, however, and dunes at Swanbourne, near Perth, Boranup at Augusta, and several areas in the vicinity of the mouths of the Margaret and Warren Rivers have been, or are in the course of being fixed. The dunes at Swanbourne were encroaching on valuable suburban property, those at Boranup on roads, railways, farmlands, and that at the mouth of the Warren River gave indications of serious obstruction to stream flow. Satisfactory fixation of the dunes was effected by the systematic planting of Marram Grass (Ammophila arenaria). This grass is admirably suited to the purpose as it thrives on white beach sand in close proximity to the sea where the mean annual rainfall is not less than 25 inches. It possesses the ability to grow rapidly through the accumulating sand and after the short period of one year is responsible for the formation of a hummock from six to eight feet in height. This rapid growth, however, is arrested once the sand movement ceases and stable or fixed dunes are characterised by tussocks of dormant dead or dying grass. By this time much of the indigenous flora has become sufficiently re-established to prevent any serious erosion by prevailing winds.

Another grass which is giving encouraging results on some of the dune areas in the vicinity of the Margaret River is Ehrharta villosa or Pyp Grass. At Gnarabup, between the Margaret River and the Leeuwin, Pyp Grass has been established within 30 yards of high water mark and at time of writing is thriving. This result is supported by South African experience where this grass apparently thrives on a rainfall of 15 inches to 18 inches per annum.

The first area of serious sand drift reported along the coast occurred at Boranup, about 14 miles north of Cape Leeuwin. This was first noted about 1876. Moving inland on a front of about two miles, it engulfed the main Augusta-Busselton track about two miles from the sea. During the following years, it was necessary to shift the track on three occasions, until it was three miles from the sea.

In the early 1890's, the owners of the Karridale Mills (M. C. Davis and Sons) whose plant and mill site were threatened with obliteration obtained Marram Grass from South Africa, and employed school children to plant it on the sand drift.

Although the drifting dunes, about 200 feet high, with a very steep advancing face had already covered an area of tall Karri forest, their further progress was arrested immediately.

Now some 50 years later this dune is quite stable although small wandering dunes occasionally occur at some spots, generally after a fire. These usually become fixed naturally by the Marram before assuming dangerous proportions. It is interesting to note that on this dune the natural vegetation has failed to penetrate very far from the outer perimeter, a distance of about 10 chains appearing to be the maximum and five chains the average. The only vegetation on the central part of this huge dune is Marram Grass. On the other hand after the passage of 20 years, the small dune of about 100 acres at Swanbourne is entirely fixed and the indigenous vegetation has re-established itself over the whole area.

Drift sands that have been dealt with in this State fall naturally into two classes:—

(1) Those commencing immediately from high water mark and spreading inland.

(2) Areas of drifting sands separated from the coast by a belt of country on which the indigenous flora remains unharmed.

(1) In dealing with dunes of the former type the main difficulty is associated with the establishment of the Marram Grass close to the high water mark. This position is usually so exposed that in many cases the grass is blown out before it can become rooted. Fortunately in Western Australia we have an indigenous plant, Spinifex hirsutus, which will thrive just out of reach of high tide and this plant is admirably suited for raising a littoral dune to protect the first plantings of Marram Grass. Immediately behind the low dune thus formed the Marram is planted in rows parallel to the sea. The greater the degree of exposure the closer the planting distance and rows from three feet to six feet apart, and the sets of Marram from two feet to three feet in the rows have been found satisfactory for even the most exposed sites. Where there is an excavating movement going on the Marram should be planted deeply, at least 75 per cent of the cutting being buried.

It has not been found necessary in any of our work to date to erect palisades to build up a protective littoral dune and it is not proposed to discuss this phase of the work. Constant attention for several years will be necessary to establish Marram on the windward side of the littoral dune as it is often blown out before it can become rooted and must be replanted.

(2) Dunes which are separated from the coast by a strip of country on which the indigenous flora is still intact are comparatively easy to fix as they are usually not so exposed. The dune may be planted up with Marram Grass, the rows being at right angles to the direction of the prevailing or most damaging winds. The espacement may vary from 12 feet between the rows and four feet between the sets to 60 feet between the rows and five feet between the sets, depending on various factors which will be discussed later.

The establishment of Marram Grass from seed may be effected only in protected areas or where artificial protection has been provided in the form of a thick covering of branches over the sand. As the cost of this method would be prohibitive in most localities planting is the most economical and satisfactory method of establishment..

Cuttings may best be obtained by opening up a trench 12 inches deep immediately in front of a clump of Marram Grass and severing the roots by a horizontal cut with a spade at the bottom of the trench. The grass cuttings are heaped in bundles of convenient size and topped to leave them approximately 24 inches long with three or four nodes in the bottom 12 inches. Each of these nodes is capable of producing roots which appear about 10 to 12 days after planting out. The cuttings when prepared are tied up in bundles and covered up or heeled in. They should not be exposed to the air longer than is absolutely necessary to trim them and tie them up.

The transport of the grass to the planting site is always a serious problem. Modern four-wheel drive vehicles with the tyres run at about 14 to 16 lb. pressure will traverse a good deal of the dune surface, but there are many areas where the sand is too loose for this type of vehicle. Where it has been impossible to get a truck or a horse-drawn vehicle on to the job as at the Warren River, two men distributed the grass on an improvised stretcher. Probably the most successful method of distributing the grass is to utilise a specially constructed cart. It need only be a platform and shafts on an old car front axle springs and wheels. This type of vehicle has a very light draught as the pneumatic tyres do not sink in the sand if run in a semi-deflated condition.

Pack horses are useful in isolated localities.

Of the various planting methods available, that of pit planting has been found most satisfactory. This is almost as cheap as notching or spearing in soft sand and ensures the sets of grass being planted deeply enough. Spearing may be done only where the surface is wet and firm as otherwise the sand runs in when the spade is removed. A simple V-shaped pit should be opened up with a spade or planting hoe, the set consisting of two cuttings, inserted, and the sides stamped in. The digger should place the excavated sand on the lip of the hole to facilitate planting and should not be permitted to open up more than a dozen holes ahead of the planter as the sand quickly dries and runs in. One digger to one planter has been found a very satisfactory unit.

The factors that influence espacement are many; the more important of these include money available, degree of exposure of the site to be planted, the amount of grass available and the time in which it is necessary to fix the area. Since the cost of the work is governed directly by the espacement it becomes necessary at the outset to evaluate properly all the factors concerned in order that the most economical planting distances may be utilised. When there are large areas of moving sand to be fixed and the degree of exposure or sand movement is not great, a maximum espacement of 60 feet between the rows and five feet within the rows may be allowed. Each row of grass will form a low hummock or ridge and in time the Marram will regenerate itself from seed in the intervening hollows. It is absolutely essential that the grass be planted closely in all exposed positions and particularly where the sand is being excavated. Rows should be from three feet to six feet apart and the sets two feet to three feet in the rows according to the degree of exposure.

In Western Australia the transport question is a very difficult one as most of the areas of shifting sand are in very isolated and inaccessible country. Supplies of grass on such areas could best be made available by the establishment of small nurseries close to the planting site. These nurseries should be about two or three acres in extent, from which sufficient supplies of grass for the planting of approximately one square mile of dune might be obtained. The sets of Marram should be planted three feet x three feet in the nursery and left for two or three years to develop. Once established such a nursery may be worked over for cuttings each year as the grass quickly shoots again. The most suitable site for a nursery is a fairly sheltered position where sand is being built up or deposited and is to be found generally on the lee side of a gently sloping dune.

If the maximum benefits are to be derived from any planting programme, sheep and goats should be totally excluded and the grazing of horses and cattle strictly regulated.

A number of factors govern the cost of these operations, but the following figures may be regarded as an indication of expenditure to be incurred on average sites. (Basic wage, £6 10s. 6d. per 40-hour week):—

Espacement 3 ft. x 3 ft.—Total cost £11 16s. per acre.
Espacement 6 ft. x 6 ft.—Total cost £5 per acre.
Espacement 30 ft. x 5 ft.—Total cost 15s. per acre.

The methods of sand dune fixation outlined above have produced such satisfactory results that little difficulty should be anticipated in the undertaking of similar works under conditions pertaining in Western Australia.

REFERENCE.

"Drift Sand Reclamation and Coast Stablisation in the South-Western Districts of the Cape Province." C. R. Gohl.

"Some Notes on Coastal Sand Drift Fixation in Western Australia." D. H. Perry. Aust. Forestry. Vol. I., No. 2, 1936.

31487/10/49—500