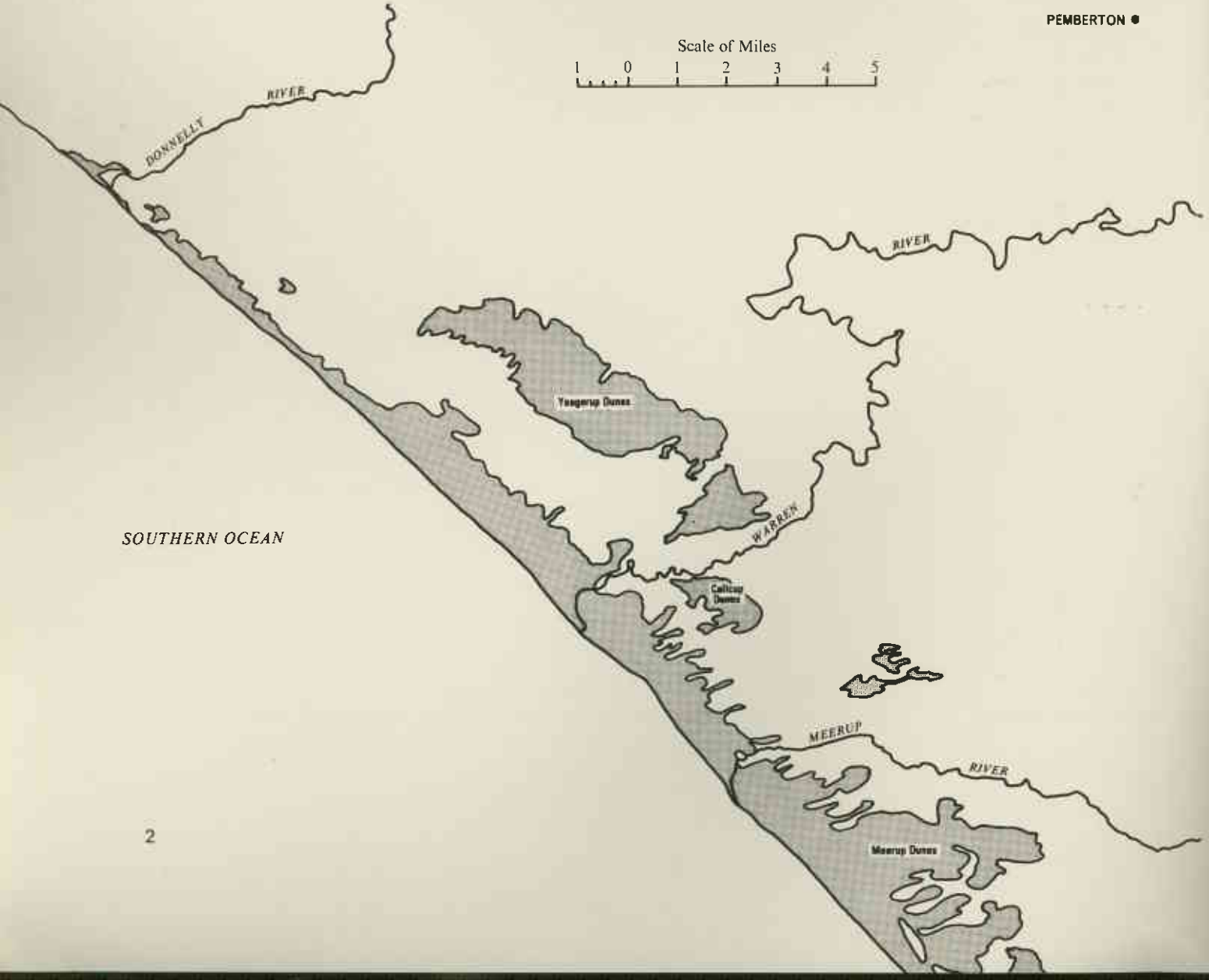
8

FOREST FOCUS

NUMBER 8 AUGUST 1972

SHIFTING SANDS
DRYANDRA, AN ECOLOGICAL OASIS


PEMBERTON
Scale of Miles
1 0 1 2 3 4 5
DONNELLY RIVER
RIVER
Yeagerup Dunes
WARREN
SOUTHERN OCEAN
MEERUP
RIVER
Meerup Dunes

FOREST FOCUS

Number 8, August 1972

Published for Mr. B. J. Beggs, Conservator of Forests, Forests Department of Western Australia, 54 Barrack Street, Perth.

Printed in Western Australia by the Government Printing Office on Double Royal (25 x 40") 141 grams per square metre Enamel A art paper.

Text (10 on 12 pt. Times) by Monofoto Typesetters. Offset plates by Art Photo Engravers Pty. Ltd.

Compiled by Dale Watkins.

Front cover

The total desolation of the Yeagerup dunes makes a lasting impression on many who visit it. This wandering dune dwarfs the beach buggy beside it.

Back cover

Forest being progressively overwhelmed by a moving dune.

◀ *Top: Markers were installed one chain apart to measure rate of movement. First pole is covered (near Mr. White) and sand has crept half way to other pole in five months. This dune is riding over another.*

Bottom: Area of coastline of primary concern in this article.

Focus On SHIFTING SANDS

from a Research Paper by

Silviculturist B. J. WHITE,

Head of the Forests Department's Manjimup Research Station

The south-west winds bringing much needed rain to the lower part of Western Australia sometimes wreak havoc with the coastal region during their passage from the sea to desert.

They can cause forests to be buried, rivers to be choked off at the mouth, and lakes to be obliterated. This appears to have been the history of the coastal areas south-west of Pemberton.

The loose sandy nature of the south-west and central-west coastline of Western Australia renders it particularly susceptible to wind erosion. From Shark Bay to Eucla the coastline is unstable, and any factors such as overgrazing or fire which destroy the vegetative cover, will start the sand moving.

Sand drifts in the area of particular concern to the Forests Department may range from a few acres to desolations many square miles in extent.

While it is evident that the dunes have always been a feature of the coastal belt, their formation has undoubtedly been accelerated since the country was occupied and grazed.

Some of the dunes facing the Southern Ocean were engulfing jarrah and karri forests up to 200 ft. high.

Few areas have more or bigger dunes than those between the Donnelly River and Cape d'Entrecasteaux. The more notable ones are Yeagerup and Callcup, either side of the Donnelly River mouth, the Meerup and the Doggerup.

Coastal limestone is the common rock formation of the entire length of the Donnelly-Cape d'Entrecasteaux coastline. In some places this has been eroded by wave action into sea cliffs, but for the most part it occurs as sand-covered hills which rise up to 800 ft. from beaches of varying width. When not covered by moving sand or swept bare by wind, these hills support a dense heath dominated by *Acacia cuneata, A. cyclopis* and *Dryandras. Agonis flexuosa* (W.A. peppermint) occurs in sheltered hollows near the sea, and becomes dominant in pure stands up to 50 ft. high further inland.

Two dune types

Two types of sand dune were recognised in this area by Forester Perry in 1942. One originates at high water mark and progresses inland, usually seeking out a saddle between peaks of the limestone hills. These dunes are fed with sand from the beach, and the moving front tends to fan out once the first hills have been passed. Wind velocities in the constricted funnels between hills are usually high enough to continually remove sand, exposing the limestone beneath.

The other type is separated from the coast by a continuous belt of undisturbed natural vegetation, not relying on a continual supply of sand from the beach to maintain its forward movement. The vast Yeagerup dune is of this type.

At Meerup and many other locations, both types occur together and

(Continued on page 6)

▲ *Part of Callcup dunes planted to marram in 1936.*

▼ *Marram failed to check this moving dune.*

▼ *Dead jarrahs killed before present dune was revegetated. Now another moving dune is overwhelming the lot.*

▲ *Blow-out exposes coastal limestone.*

▲ *Coastal dune, Warren beach.*

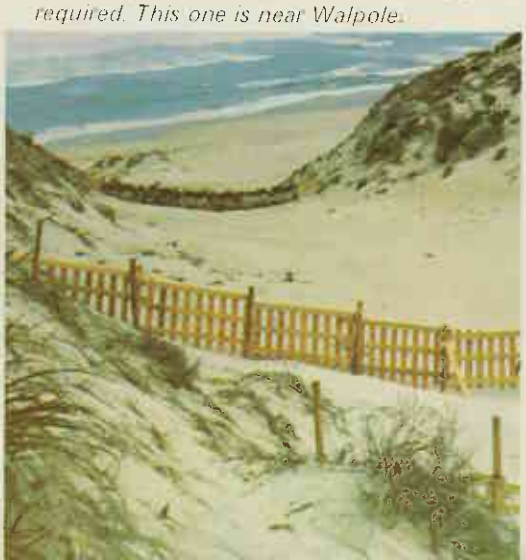
▲ *Marram hummocks, 1959, before beach buggy days.*

▼ *Pinaster pine, Callcup.*

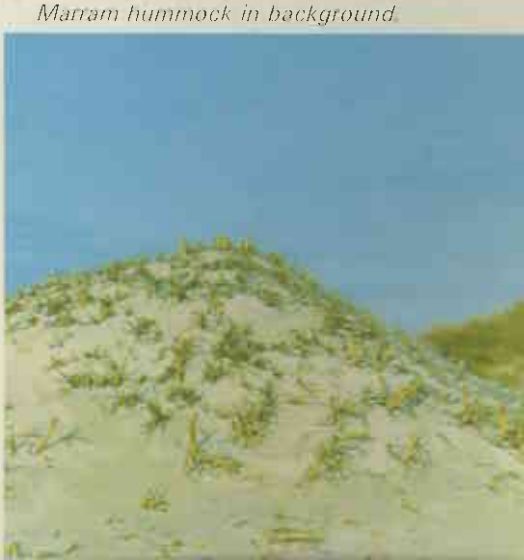
▲ *Warren River and Callcup dune, July 1972. See photographs page 6. Sand drift into Warren River stabilised despite burning and grazing.*

▼ *Distant beach buggy emphasizes size of wandering dunes.*

▼ *Windbreak fences have occasionally been required. This one is near Walpole.*



▼ *Heavily grazed spinifex hummock. Marram hummock in background.*



▲ *Warren River and Callcup dune, after planting in 1936. Dune was threatening to block the river.*

▼ *Same view in 1948. See page 5 for 1972 view.*

▲ *Height of the Warren River sand dune can be seen in this photograph. River can be seen in background.*

(Continued from page 3)

only islands of natural vegetation remain.

Evidence, confirmed by aerial photographs, suggests that drifting sand dunes have been a permanent feature of this landscape.

Prior to being anchored by natural vegetation, drifting sand dunes have in the past progressed much further inland than is the case today. Some of the oldest dunes, furthest inland, now support mature jarrah and karri forests, the dominant trees of which are undoubtedly centuries old. When this age is added to that required for the ecological succession from bare sand to where eucalypts can establish, it is obvious that these dunes were mobile far into the distant past. Therefore, European settlement can not be blamed for the existence of

(Continued on page 10)

(Continued from page 6)

moving dunes—though no doubt it has added to the speed of their development.

The shape of the old and new dunes seen on aerial photographs suggests that west-south-west winds have been dominant in their spread, and that the pattern of spread of each blow-out is similar to a bushfire: rapid movement at the head and less rapid movement on the flanks. The result, following fixation by natural scrub, is a series of ridges aligned mostly east-west.

What has caused dune movement to start in the past, and what natural processes allow them to halt and become revegetated are matters of conjecture.

What is certain is that the plant associations stabilising these dunes are inherently fragile, and that activities in cattle grazing and deliberate mid-summer burning must accentuate their fragility.

First Forests Department action

In November, 1914, a Mr. Hugh Oldham submitted the first report known to the Forests Department on the movement of sand dunes near the mouths of the Warren and Donnelly rivers. Concern was expressed that the course of the Warren River could be obstructed, and that some reasonable quality karri and jarrah forest was being overwhelmed.

In 1916 Mr. Lane-Poole, then the second Conservator of Forests, commenced corrective operations by establishing marram grass on the Callcup dunes south of the Warren River.

The ability of the marram grass *(Amophila arenaria)* to grow vigorously through accumulating sand, causing it to hummock and lose mobility, was well known. It is the outstanding medium for stabilising dunes in this State, being easily established and extremely hardy within the 20 in. rainfall belt where usually it thrives on any sand not containing more than 60 to 70 per cent. calcium carbonate in the form of shell particles.

Marram grass had been planted in 1892 at Boranup by the sawmilling firm M. C. Davis & Sons, who imported it from South Africa. Its natural home is Europe. From Boranup it was introduced to Capel and other areas.

Two early settlers near the Warren River mouth, Col. Vialls and Mr. W. Brockman, spread grass over further areas of the Callcup dune, concentrating mainly on the moving front which was engulfing Col. Vialls' property. The following year Forester McKay broadcast two bags of marram seed over part of this area which had had only a 10 per cent. survival rate.

◀ *Track to nowhere. This forest track is being covered at a faster rate than it can be overgrown by forest plants through lack of use.*

▲ *Footsteps and wheel ruts in this photograph illustrate the variability of sand surface when compared with wheel marks on front cover.*

Shortage of funds prevented further Forests Department work until 1936 when it was reported that urgent action was needed to arrest the movement of a steep 500 ft. high sand dune, part of the Callcup complex, which was encroaching into the Warren River. If not halted, serious impedence of the river flow could result. Attention was also drawn to the vast areas of moving sand in the Yeagerup dunes complex which, though not at the time doing serious damage, were filling in the Naenup swamp and burying fair stands of jarrah and karri.

The Treasury allocated £250 for the immediate planting of the Callcup dune. This enabled 600 to 700 acres, most of its surface, to be planted in 1936. The following year a similar sum was allocated for further work on both the Callcup and Yeagerup dunes, including four miles of moving face on the Yeagerup and several hundred acres in small plots.

In the years 1936-41 further plantings, both new and patching up, were made in widely separated locations on the south and south-west coast. These included in addition to work at Yeagerup: The stretch of coastline from Cowaramup southwards to Augusta; Point Peron; Garden and Rottnest Islands (during the second world war); and Swanbourne.

Unfortunately certain Rottnest sands and similar lime sands at Greenough River and Mahomet Flat near Geraldton contain up to 98 per cent calcium carbonate, and some other fixing method is necessary.

(Continued on page 14)

▶ *Yeagerup dune area after planting in 1938. Sand spilling into forest on left.*

▲ *Yeagerup, 1972. Lines of marram planted in 1953 still in evidence 19 years later. Stabilised Callcup dune in background. These lines are clearly visible from the Callcup hill fire tower on the horizon.*

(Continued from page 11)

Swanbourne dunes

Resulting mainly from unrestricted grazing in what is now part of the metropolitan area, a large sand drift of about 200 acres had developed on Education Endowment Lands between North Street and the rifle range, by 1924. It was advancing towards private homes at an alarming rate.

Following a request for help from the trustees, the Forests Department was provided with £333 over five years for stabilisation of the area. The first move was to produce a stock-proof fence (at extra cost) followed by the planting of marram grass. Thirteen years later the area was quite stable and indigenous plants had become re-established.

A limited amount of work was done on the Yeagerup and two smaller dunes nearer the Warren River in 1948, after which activity lapsed until 1952, when further work in the area was undertaken.

In 1957 responsibility of sand dune fixation officially passed into the hands of the Agriculture Department, and only limited Forests Department activities took place until 1969.

In that year the Forests Department resumed the task adjacent to southern forest areas and limited though continuing activity—whether marram planting or tree planting—has taken place up until the present time.

With tree planting where no natural scrub was present, failure was certain and prompt, but promising establishment took place where scrub was present.

In the 1972 planting season the Forests Department undertook stabilisation operations in nearby National Park land.

Planting techniques

Success was achieved in arresting both types of dunes by planting of marram grass. Most difficulty had been experienced with the type originating at high water mark due to the high wind velocities that tended to expose the grass before it became rooted sufficiently well to create its own hummocks.

The need to create a frontal dune to protect the marram was realised, and this was accomplished by closer planting and with the aid of native spinifex *(Spinifex hirsutus)* which has the capacity to create the required protection.

In particularly exposed situations the construction of fences was necessary.

The larger inland types of dunes presented fewer difficulties because wind velocities seemed to be lower. Marram was planted at right angles to the most damaging wind at spacings of from 4-12 ft. with 5-60 ft. between the rows, according to the degree of exposure.

Success was dependent upon a large area being planted in a short space of time.

The necessity of the correct method of attack is emphasised by the little success following attempts by some settlers to arrest movement of dunes approaching their properties.

In one attempt only the advancing front of the dune was planted, with little attempt made to plant to any depth behind. The marram was incapable of arresting the quantity of sand being superimposed on it.

Planting was favoured over broadcast seeding because the cost of placing a protective covering of brush essential to the establishment phase was considered to be prohibitive.

Planting stock consists of cuttings two feet long with three or four nodes in the bottom foot. Operations are usually confined to the wetter months of June to August to avoid drying out. Nodes produce roots 10 to 12 days after planting.

1972 survey—Callcup dunes

A recent Forests Department investigation in June, 1972, 36 years after the first large scale planting, indicated that the threat to the course of the Warren River and the old Vialls property no longer exists. In each case the previously advancing dunes now support a mixed vegetation of shrubs and small trees, plus a ground layer which still includes

clumps of decadent marram grass.

The acacias and dryandras previously mentioned, together with W.A. peppermint, the species which will dominate the eventual stable community, are all present in quantity. It appears that the succession from bare drifting sand is well advanced and a darker humus layer is becoming evident particularly under the acacias.

On the windward slopes and depressions bare uncolonised sand still exists, but a progressive colonisation of the leeward slopes is evident.

The 1940 planting of the blow-out coastal type dunes threatening to connect with the Callcup were not successful. Bare uncolonised sand still exists. However, their forward progress is not rapid and the feared joining has not occurred. An approach more sustained than a single general planting is needed to control such coastal blow-out dunes.

Yeagerup dunes

In contrast to Callcup, change on the Yeagerup is imperceptible. Indeed the text of a report by Assistant Forester Sutton, in 1936, could well be describing the dune in 1972. However, significant changes have taken place in specific localities.

The most notable marram development has resulted from the edge filling and thickening done on the south-eastern extremity in 1953. The dune is no longer mobile and colonisation with native species has begun. It appears the 1953 planting prevented mobile dunes from burying the 1937 planting.

From 1937 all Yeagerup operations were concentrated in the south-eastern sector. Now, in 1972, there is a vast difference in character between it and the north-eastern sector. Change is taking place in the south-east, where the forces of destruction are being matched by the forces of production. By contrast in the north-west, the forces of destruction have full sway and only on the upwind edges can colonisation be said to be taking place.

The planting of the eastern edge without concurrent planting back into the moving dunes has failed to halt movement, despite 35 years of marram growth. It may well prove preferable to plant the whole Yeagerup then attempt control of its moving edge by repeated refilling, even to some depth.

Efforts in 1948 to control a smaller dune closer to the Warren River have also failed. It is, however, revegetating from its upwind edge—assisted by, but not dependent upon marram.

Unique beauty—human inspiration

The total desolation of the Yeagerup has a unique beauty which makes a lasting impression on many who visit it.

The change from high forest with its green claustrophobic undergrowth into the unlimited vistas and unconfined wind patterns of the dunes never fails to promote a sensation of release.

Since the Yeagerup threatens no valuable production forest, drainage system or man made commercial venture, the question arises whether or not it should be left as it is rather than be stabilised.

The Callcup experience suggests that stabilising the Yeagerup presents no technical problem—but the possession of the technical knowledge need not suggest any compulsion to make use of it.

Production of human inspiration and recreation might well be its most logical and satisfactory use.

The Meerup dune which poses a threat to the Northcliffe farming area, two dunes threatening the flow of the Warren River, and the Doggerup dune which occupies part of a flora and fauna reserve, could well be stabilised before attention need be given to the Yeagerup dunes.

▶ *General view of the generally well stabilised Callcup dune.*