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STABILISATION OF DUNES BY SANDHILL CANEGRASS

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Abstract

Changes in cover afforded by sandhill canegrass (*Zygochloa paradoxa*) have been studied on a low dune near Menindee in western New South Wales for 23 years. Areal cover of live and dead culms has varied in accordance with rainfall conditions, from 5.0 to 19.9% during the study period. Despite the low cover and an extended 4-year drought, the dune has not been changed significantly in profile by erosion during that time.

The plant is a perennial drought-evading species that actively grows in response to above-average rainfall conditions and dies back during drought. Changes in cover during the trial were mainly related to changes in clone size rather than to fluctuations in the plant population. In the last 18 months of the trial new plants established in response to the favourable rainfall conditions.

Introduction

Sandhill canegrass (*Zygochloa paradoxa* (R. Br.) S. T. Blake) is an important stabilising plant on sand dunes in the arid and semi-arid areas OF Eastern Australia (Black, 1960; Specht, 1972). It is generally confined to the crests of the deeper sand dunes, lunettes and sand ridges and is found in and around the Simpson Desert, extending through south-western Queensland and western New South Wales to north-western Victoria (Blake, 1941). In southern areas it is more commonly found as small discontinuous colonies on light coloured, unstable sand dunes associated with old lakes and river systems.

It is a glabrous, dense, spreadingly branched, dioecious hummocky perennial grass that grows to 1.5m in height and diameter. Its stout rhizomes, dense bushy habit and high resistance to drought make it an excellent sand binder (Blake, *op cit*; Ratcliffe, 1937). Jessup (1960) has described how canegrass accumulates mounds of soil blown by wind from between the plants.

Sandhill canegrass is not an important pasture plant. It is only slightly palatable to sheep (Ratcliffe, 1937; Jessup, 1951), but is said to be eaten by cattle (Blake, *op cit.*). However, Ratcliffe (1936)

reported a great reduction in sandhill canegrass following drought in the Birdsville Track region and attributed death to damage of the roots caused by rabbits burrowing under the clumps.

At Lake Menindee in western New South Wales serious wind and water erosion has occurred on the lunette in areas where the natural vegetation (including mainly sandhill canegrass) has been removed to establish recreation areas. These areas require expensive and time consuming reclamation techniques to restabilise them (S.C.S. unpublished data).

To understand more fully the growth habits and protective role of this important sandbinding plant, the Soil Conservation Service of New South Wales commenced observations in 1953 on sandhill canegrass growing on a low dune in an exclosure 16km north-west of Menindee.

The Study Area

The trial was established on a low sand dune behind the Lake Menindee lunette. The soils in the area consist of light red-brown sands on the dune crests with compact calcareous cloddy loams on the flats.

The dunes have a relief of less than four metres and are orientated in an east-west direction. The shoulders and flats are severely scalded and loose sand and "blow-outs" occur near the crests of the dunes.

The area is treeless with the dune crests being dominated by clumps of sandhill canegrass and the flats by black bluebush (*Maireana pyramidata*). The lower stable slopes of the dunes support both sandhill canegrass and black bluebush.

Average annual rainfall for the area is about 225mm and rainfall is highly variable with no seasonal pattern of distribution.

The study area, which was part of a stock route, was fenced out prior to the commencement of the project. The commencement of the study also coincided with the demise of the rabbits in the area due to the initial spread of myxomatosis in the district. The area has remained ungrazed except for two periods between 1970 and 1972 and 1974 to the end of the trial when rabbits were uncontrolled due to fence maintenannce difficulties.

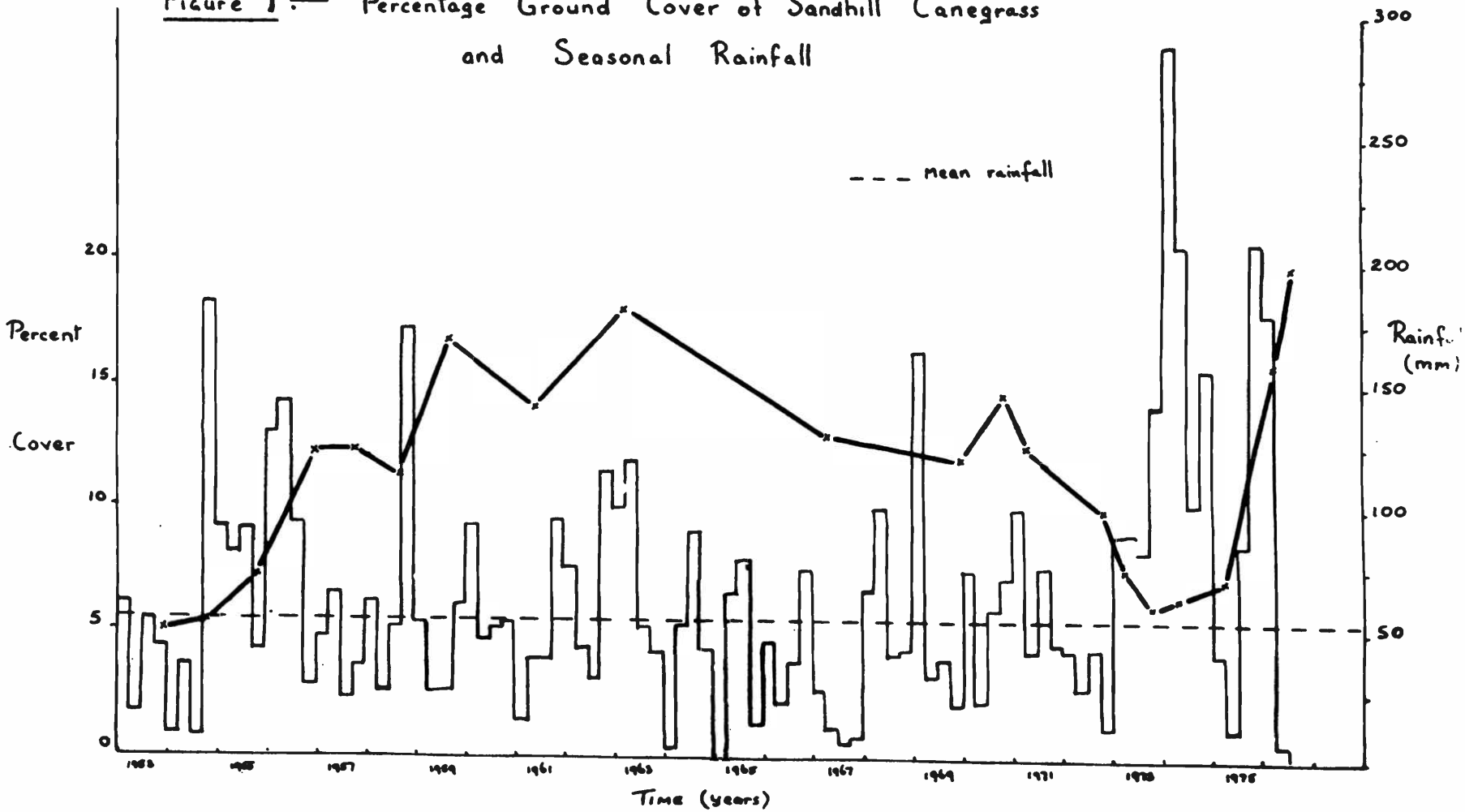
Methods

Plant Cover

Areal cover of sandhill canegrass was measured along a belt transect (65m long and 5m wide) running over the crest of the dune. Each side of the transect was marked at 5m intervals with 1.27cm diameter steel rods and cover was determined by plotting the area covered by each plant within or overhanging the transect. The plots were made on 2.54cm^2 graph paper with each square representing a 5m^2 section of the belt transect. This allowed quick, reliable recordings of plant shape and size to be made as well as accurate estimates of areal cover.

Twenty observations were made between November 1953 and August 1976 at intervals of between six months and four years.

Figure 1 :— Percentage Ground Cover of Sandhill Canegrass and Seasonal Rainfall



Soil Stability

Changes in dune profile which reflects soil stability, were monitored by two line transects along each side of the belt transect and measured by stadia survey of peg tops as well as measuring the height of each peg above the soil surface. Soil accumulation gives a relatively shorter peg length and vice versa for soil loss.

Eight observations were made during the period between 1961 and 1976.

Results

Plant Cover

The percentage areal cover of canegrass along the transect at each observation during the trial is shown in figure 1. Also shown is rainfall during the period grouped seasonally into three monthly totals commencing with summer rainfall (January-March). The areal cover and number of clones of canegrass present at each observation is tabulated in table 1.

During the trial canegrass cover ranged from a minimum of 5.0% at the commencement of the trial in 1953 to a maximum of 19.9% in 1976. During the 23 years of observations there were five periods of increase in cover and four of decrease.

Figure 2 shows each individual plant or clump of plants along the transect at selected observation periods. These periods were the troughs and peaks of cover by canegrass. In plotting plants it was observed that during drought conditions the above ground parts of the canegrass plant (culms and leaves) died back but still persisted for several years. When conditions were favourable growth recommenced from basal buds and from buds along the culms at the periphery of the dormant plant.

In April 1974, during an extended wet period several plants were recorded as "dead," and although most of these plants later re-shot, at least one had definitely disappeared by the following year.

During 1975-1976 there was a large increase in areal cover from the canegrass, this being due partly to increase in clone size but also due to the large establishment of new plants (see figure 2).

Soil Stability

Due to the long term nature of the project and the method of measuring soil accumulation or loss small differences were not regarded as important. Small errors were regarded as inherent to the method due to errors in stadia readings and peg height measurements. The presence of litter accumulations and the angle of repose of sand around the base of the peg gave small differences at each reading (when comparing heights, differences between readings of less than 2cm were regarded as insignificant).

The profiles across the dune along each side of the transect at 1961 and 1976 are shown in figure 3 and figure 4.

Discussion

Plant Cover

Correlation between plant growth and seasonal conditions is not

TABLE 1

PERCENTAGE AERIAL COVER AND NUMBER OF CLONES OF SANDHILL CANEGRASS ON THE TRANSECT

Date	% Cover	No. Clones
Nov. 1953	5.0	27
Oct. 1954	5.4	29
Oct. 1955	7.3	29
Dec. 1956	12.3	20
Oct. 1957	12.4	23
Sep. 1958	11.4	32
Aug. 1959	16.8	25
May 1961	14.2	33
March 1963	18.2	23
April 1967	13.0	31
Dec. 1969	12.0	25
Oct. 1970	14.7	25
April 1971	12.5	25
Oct. 1972	10.0	24
March 1973	7.6	29
Oct. 1973	6.1	22
April 1974	6.4	26
March 1975	7.1	40
March 1976	15.9	31
Aug. 1976	19.9	35

ZYGOCHLOA PARADOXA TRANSECT
1953 - 1976

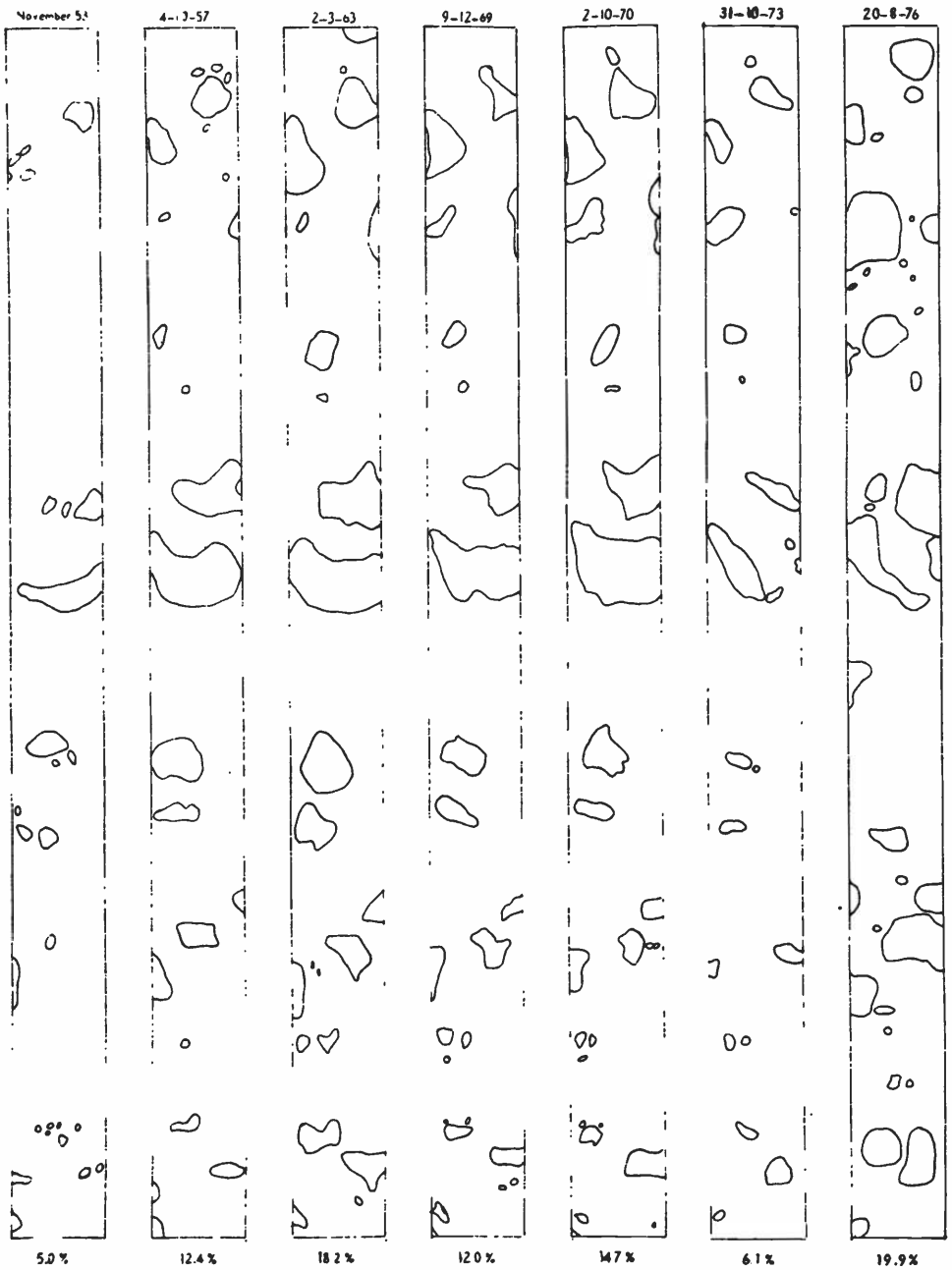


Figure 2 :- GROUND COVER

Figure 3 :- Changes in Dune Profile with Time (Transect A)

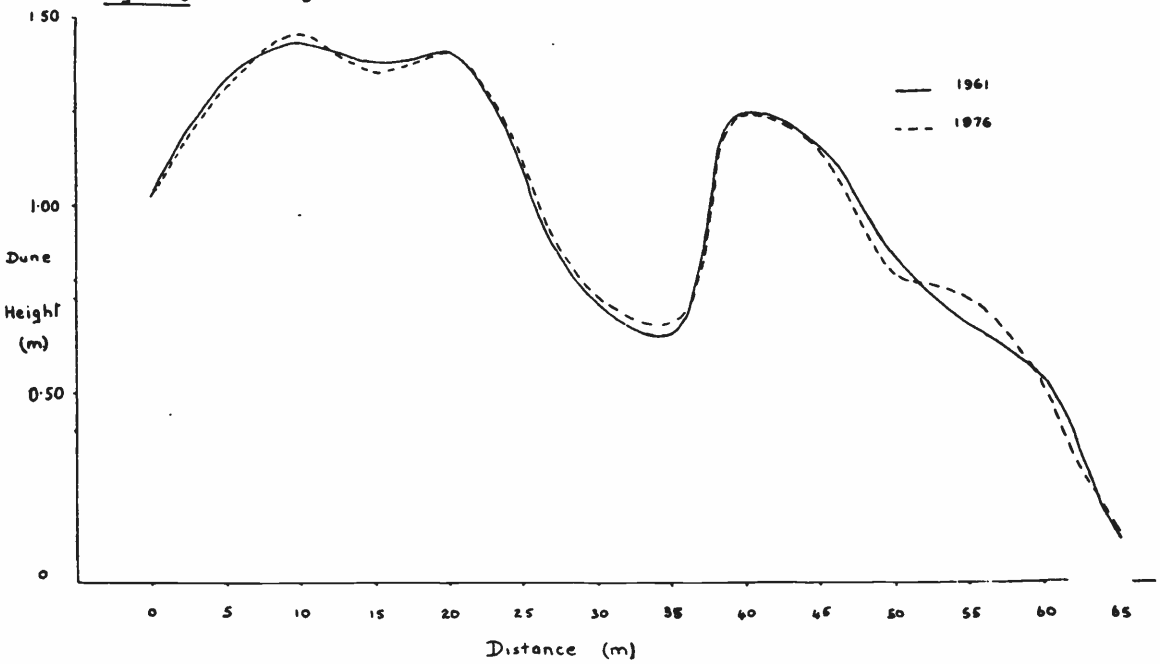
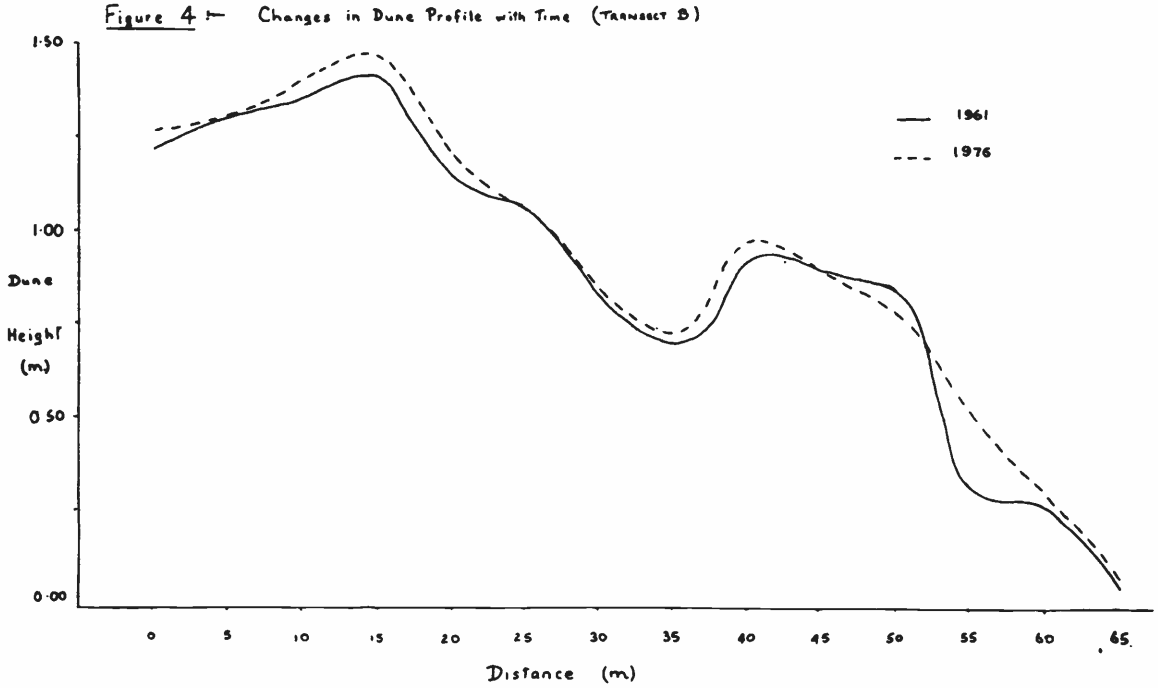


Figure 4 :- Changes in Dune Profile with Time (Transect B)



easily made because observations were generally made at intervals of one year or more. However, it appears that increases in plant cover occurred during periods when rainfall was well above average, and that decreases were related to average to dry rainfall conditions.

The first increase in cover occurred during the period from October 1954 to September 1956 when rainfall was well above average.

The second, third and fourth periods of increase in cover followed good spring and/or summer rain.

The final increase in cover may be divided into two sections. The final increase in cover may be divided into two sections. The first involved an increase of only 1.0% in transect cover between October 1973 and March 1975, despite the fact that 864mm of rain fell during this period, including a record of 766mm for Menindee in 1974. The second involved a large increase of 12.8% in cover between March 1975 and August 1976, during which time 500mm of rain was recorded.

Spring/summer rainfall was very high in both periods, but whereas in the second period autumn/winter rainfall was average, it was almost three times above average in the first. As sandhill canegrass is a summer grower and favours well-drained soils, it appears that in exceptionally wet autumn/winter periods it may suffer from "wet feet," growth is inhibited and death of plants may also occur.

Because of its growth habit, changes in cover during the period have generally been related to change in size of individual plants or canegrass clumps, rather than to an increase or decrease in plant numbers except in the latter period.

Soil Stability

The dune profiles have remained relatively stable throughout the trial.

The profile along peg transect A has changed very little. Greatest loss was nearly 5cm at the 50m peg, and the greatest gain nearly 7cm at the 55m peg. There has been no change, or slight accumulation of soil at all except the 50m peg along transect B, where between 5 and 6cm of soil has been lost. Greatest accumulation was 20cm at the 55m peg.

The 50 to 55m pegs are on the northern slope of the dune where erosion by water and strong north and north-westerly winds is most likely.

The most significant feature of the profile is that during the extended dry period from 1964 to 1967 virtually no soil loss or accumulation took place even though sandhill canegrass was the only species providing protection to the dune, however from 1967 to 1969 a blow-out occurred between pegs at 55 and 60m and accumulation occurred at the 50m peg in transect B.

Conclusion

In the absence of grazing it appears that areal cover of land between 5 and 20% by sandhill canegrass will offer reasonable protection to dune crests from wind erosion in all but prolonged drought conditions.

Canegrass offers little protection to the soil from water erosion and soil loss can be expected following heavy storms.

The establishment and spread of canegrass is heavily reliant on infrequent favourable climatic conditions. However, once established the plant is highly persistent in dry times and offers protection to the soil. It tends to disappear during wet periods, particularly in autumn-winter periods.

The restabilisation of eroded land once vegetated and protected by canegrass can be expected to be a long process, even in the absence of grazing animals.

Acknowledgments

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