



A PHYTOGEOGRAPHIC SURVEY OF SOME ARID-ZONE SPECIES
IN NORTH-WESTERN SOUTH AUSTRALIA.

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SUMMARY

The distribution of 41 woody plant species over a large area of arid South Australia was determined from ground traverses and mapped on a detailed grid. Character plant ratings and regeneration of some of the more widespread and important ones were also mapped. Data were obtained by scoring each species over contiguous 2 mile (3.2km) sampling intervals along the traverse routes, while undertaking other work. Identifications were checked by making herbarium collections and counts were made to check density limits of character plant classes.

The collection of incidence data in this way permitted accurate delineation of the distribution patterns of most species, and these were then correlated with published maps of environmental variables over the area studied. Many species exhibited well defined patterns which were unexplainable on the basis of the published information presented. In these cases comments were made after recourse to field observations.

This approach proved most successful for broadscale mapping of species distribution, and the gathering of data required very little extra field time. Both lack of knowledge of the autecology of the species studied, and of detailed information on physical parameters in the survey area, limited the elucidation of results obtained.

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INTRODUCTION

This volume contains the results of the phytogeographic survey described in Volume I, Chapter 6. The survey was carried out in conjunction with a reappraisal of the work of Jessup (1951) on bush density estimations. Altogether 41 species were included, based on the accuracy of spot identification at distance, and representing most of the taller shrubs and trees found in the survey area, as well as a few conspicuous smaller shrubs and perennial grasses. The area covered by the survey includes all of the pastoral country within the dog fence west of Woomera and north of Lakes Gairdner, Harris and Island Lagoon, with the exception of Mabel Creek and Mt. Penhryn Stations. It also includes Kychering and Billa Kalina Stations outside the dog fence. This area of 54,000 km² covers 17 pastoral stations and is shown on the base maps included herein.

All data collected on the survey were recorded directly into field log books, which were kept as neatly as possible, and can be used by anyone wishing to carry out a resurvey of the area. The information used to compile the maps included here was collected in 2 mile (3.2km) intervals along a continuous traverse. That is, in the case of occurrence of a particular species, a sighting anywhere along an interval resulted in its presence being scored for that interval. Character plant ratings were recorded in similar manner, but on the basis of density rather than incidence. A character plant, as used here, creates or contributes very significantly to the general appearance or "facies" of the vegetation community. Regeneration of three widespread species reproducing entirely by seed was also mapped, on the basis of numbers of seedlings less than about 3m. high seen in each sampling interval.

EXPLANATION OF FORMAT.

In the following information presented, each species studied is considered separately. Firstly, a title page and description of photographs and maps which follow is given, and this also includes comments on the species. This is followed by the relevant photographs and maps.

1. Title.

The scientific and common names for the species shown on the maps are given. Authors of scientific names are given where they are not recorded in Appendix 1, Volume 1. The common names are those that apply locally to the species, and in some cases these may not be the "generally accepted" names. For example, the "Broom bush" of the South-east heathlands of South Australia (*Melaleuca uncinata*) is more closely resembled in habit by *Eremophila scoparia* in the survey area, and the common name is used accordingly. *Melaleuca uncinata*, although also present, is of somewhat different habit and is usually called "Tea tree".

2. Photographs.

Many of the photographs included were taken from permanent photopoint posts set up during the survey (see Chapter 7). In general these photopoints were set up expressly to observe the species in question, and where possible a site was chosen where both a seedling and mature individual were included. The scale post used is 1 metre high and the lower 50cms is marked with 5 decimetre divisions. The general location of the photograph is given, and reference is made to all conspicuous plants. Comments concerning the habit of the plant and the community it is growing in are also noted. Follow-

ing this, the general soil type and profile is recorded. This was observed while digging the hole for the photopoint post. An estimate of "grazing pressure" in relative terms is also given, based on proximity to stock watering points, evidence from surrounding vegetation, and amount of dung present. Finally the approximate average annual rainfall, based on the isohyets drawn on Map 45 is noted.

3. Distribution Maps.

Mention is then made of the distribution map or maps for that species as well as the type of data recorded on it (occurrence, regeneration etc.). The blue background map shows the traverse routes and the mid-points of all the sampling intervals. On the distribution map for each species where blue dots are showing, the plant was not seen over that interval. In most cases, the occurrence of a species or its regeneration is represented by solid red circles over the blue dots, while character plant and "significant" regeneration classes are shown by solid black circles. Where an herbarium collection of the species was made, the collection number is shown in red.

4. Comments.

The comments and discussion form the final part of the description of each species. These are restricted to an explanation of the distribution patterns revealed on the basis of information on Maps 45-50 (see below), other published information, and field notes and observations where available. Correlation of findings here is made, where possible, with other published data on the species. The

habit of each species in the area is usually also discussed, and finally a note on the relationship between the distribution shown here and the known phytogeography of the species is made. The latter details were obtained from Black (1948-65), Beard (1964), Eichler (1965) and Boomsma (1972), as it was not possible to check all collected specimens of each species.

Where other parameters of the species are also mapped, in particular regeneration and mortality, these are discussed in detail.

Maps 45-50 show the relevant portions of published maps on rainfall, soils, geology, vegetation and topography which may help explain the distribution patterns observed. The description and legend of these maps is inserted on the opposite page. These maps were redrawn, where necessary, with the authors permission.

The incidence data for all species shown here were subsequently analysed for interspecific association. The results from this are given in Volume I, Chapter 8.

MAP 1 - BASE MAP OF SURVEY AREA.

This map is essentially the same as that used for the distribution maps and printed in light blue. It was compiled using the 1:250,000 topographic map series R502 produced by the Royal Australian Survey Corps, using Transverse Mercator projection. All traverse routes on which phytogeographic data were collected are shown, although some sampling intervals were removed in the most densely sampled areas to achieve greater uniformity of sampling coverage. At least two miles (3.2km) of traverse was run through each 10,000 (9.15km) yard grid square on the map series noted above.

MAPS 2-4. ACACIA ANEURA F.v.M. ex Benth.- "Mulga" and A. BRACHYSTACHYA Benth.
"Umbrella Mulga"

Page 12. Photopoint 24: *Acacia aneura* in arid woodland, Ingomar Station. Two seedlings, 1 and 2m high, are on the left and foreground of the photograph, and a young *Acacia kempeana* (Witchetty Bush) is at middle distance on the right. Scattered *Kochia sedifolia* (Bluebush) are also present, with one specimen in the centre foreground. Ground cover plants are dead ephemeral grasses, *Aristida contorta* and a few bushes of *Ptilotus obovatus*.

Soil: About 40cms of sandy loam overlies calcrete.

Grazing Pressure: Light.

Rainfall: 5.8" (148mm).

Page 13. Photopoint 29: Dense arid woodland of the "Broadleaved Mulga", *Acacia aneura* var. *latifolia*, McDouall Peak Station. A typical seedling of this variety 60cms high is shown in the left foreground. Ground cover is perennial tussocks of *Eragrostis eriopoda* ("Woollybutt" or "Mulga grass"). A steel water pipe is in the foreground.

Soil: Deep sand.

Grazing Pressure: Light.

Rainfall: 5.6" (143mm).

Page 14. Photopoint 97: *Acacia aneura* in watercourse, Millers Creek Station. This photograph illustrates the typical form of this species when it occurs as isolated specimens in drier regions. *Acacia tetragonophylla* (Dead finish) is in the watercourse in the left middle distance. Ground cover is mainly *Atriplex vesicaria* (Saltbush) and *Bassia divaricata* (Bindyi) with *Ptilotus obovatus* in the watercourse.

Soil: Coarse alluvium and stony clay.

Grazing Pressure: Negligible.

Rainfall: 4.8" (122mm).

Page 15. Photopoint 38: Extensive mortality of *Acacia aneura*, Ingomar Station. The ground cover apart from dead timber is dead *Aristida* sp., with a few live tussocks of *Eragrostis eriopoda*. In the distance some live mulgas are discernible.

Soil: Deep sand.
 Grazing Pressure: Moderate.
 Rainfall: 5.6" (143mm).

Page 16. Distribution Map: *Acacia aneura* and *A. brachystachya* - occurrence and character plant classes.

Page 17. Distribution Map: *Acacia aneura* - regeneration. The distribution of two classes of seedling numbers is shown.

Page 18. Distribution Map: *Acacia aneura* - mortality. The criterion used here required that more than 90% of the standing trees seen along the traverse route were dead.

Comments:

- (a) Distribution:- Mulga woodlands form the most characteristic and widespread tree or shrub community in arid Australia. In south-west Queensland, near the northern limits of its distribution, stands with a density of 1,000 stems/ha. or more have been recorded, and it is regularly cut to provide forage for stock (Burrows and Beale, 1969). In contrast the densest stands observed here had about 50 stems/ha, while the character plant ratings referred to densities greater than 10-15 stems/ha. Photopoint 24 illustrates a stand of about this density. The two species mapped together here are closely related and occupy a similar range of habitats. However *A. brachystachya* is considerably less common and widespread in the study area. They can both be very similar morphologically, and flowering or fruiting specimens are necessary for accurate identification.

Maximum development of these species populations occurs in the 5-7" (128-178mm) rainfall belt, on deep sand or sandy loam soils. They are replaced by *Acacia linophylla* and *Casuarina cristata* in the higher rainfall sand-dune areas, and by *Callitris columellaris* and *Acacia ligulata* in the lower rainfall sand-dunes of the far east. In the north-east of the survey area, low rainfall was the limiting factor. Throughout the remainder of the survey area, on shallow calcareous soils and the more saline sands, Mulga communities were largely replaced by chenopod shrublands.

(b) Regeneration:- The method of scoring this parameter needs clarification. In each sampling interval within the major Mulga areas, seedlings below about 3 metres in height were searched for and noted. If more than 10 individuals were seen, the interval was scored by a solid red circle on the map. Black circles represent intervals over which at least half as many seedlings as mature plants were seen. This was considered a reasonable criterion, when it was noted that these areas of extensive regeneration were clearly delimited. From documented growth of Mulga seedlings on the Koonamore Vegetation Reserve, the 3 metre height limit would include juveniles up to about 40-50 years in age. Interpretation of the patterns revealed was facilitated by further examination of areas of extensive regeneration, and by the many published references to Mulga regeneration. The most prolific and well-defined area of regeneration was that shown on the north boundary of Commonwealth Hill Station (north of H.S.). Within this area there was evidence of a fairly severe fire, which had killed most of the mature trees. There was also evidence of a past fire in a small area of regeneration about 40km north-west of Tarcoola on Carnding Well Station. However Cleland (1929) noted a large area just north of Tarcoola as having been recently burnt, but there is little evidence of regeneration there now. In this context it is of interest to note that fire, caused by a rocket from Woomera, swept through a large area of Mabel Creek and the north-east corner

of Commonwealth Hill Station in 1968, while in 1967 an even larger fire, caused by lightning burnt along the Commonwealth Hill Dog fence, and westwards through unoccupied country to the Wilkinson Lakes (see photopoint 73, page 51). In both cases these fires have resulted in the death of about half of the mature Mulga.

There are interesting occurrences of regeneration near the homesteads of Mt. Eba, Bon Bon, Mt. Vivian and Bulgunnia. Jessup (1951) noted that regeneration at Bulgunnia appeared following flooding of the homestead area after heavy rains. This could also explain the regeneration near the other homesteads, as they are all located near ill-defined watercourses or depressions. Establishment of the seedlings was probably due to the protection from grazing in the horse paddocks near the homesteads, where most regeneration occurs. Further support of the idea that this is rain-induced regeneration is found in several of the occurrences of extensive regeneration on Mt. Eba Station. In these cases, dense regeneration has only occurred along watercourses. Everist (1949) attributes germination of Mulga to heavy summer rains in south-west Queensland.

The extensive area of regeneration on Ingomar Station does not show overt evidence of fire. However the sandy country carries abundant ephemeral growth (Photopoint 24) after rain, and would carry a fire at that time. It is also possible that the regeneration occurred after heavy rain, the seedlings becoming established due to absence of stock. The western half of Ingomar Station was unstocked until about 1950.

In general, it may be said that significant regeneration is only occurring over a small proportion of the area, represented by only 6% of the sampling intervals in which the species occurred as a character plant. Most of this regeneration is in the northern parts of the area, possibly due to the fact that regeneration may have occurred before the stocking of the country, assuming that juveniles do not survive in stocked paddocks.

(c) Mortality: - As with extensive regeneration, the limits of areas of extensive mortality (>90% standing trees dead) are remarkably well defined. Mulga death has been noted by Ratcliffe (1936), Condon (1949), Jessup (1951), Speck (1963) and Lange (1966). However there is no general agreement on the reasons for this occurrence. Observations of the areas shown on Map 4 may help to explain the phenomenon.

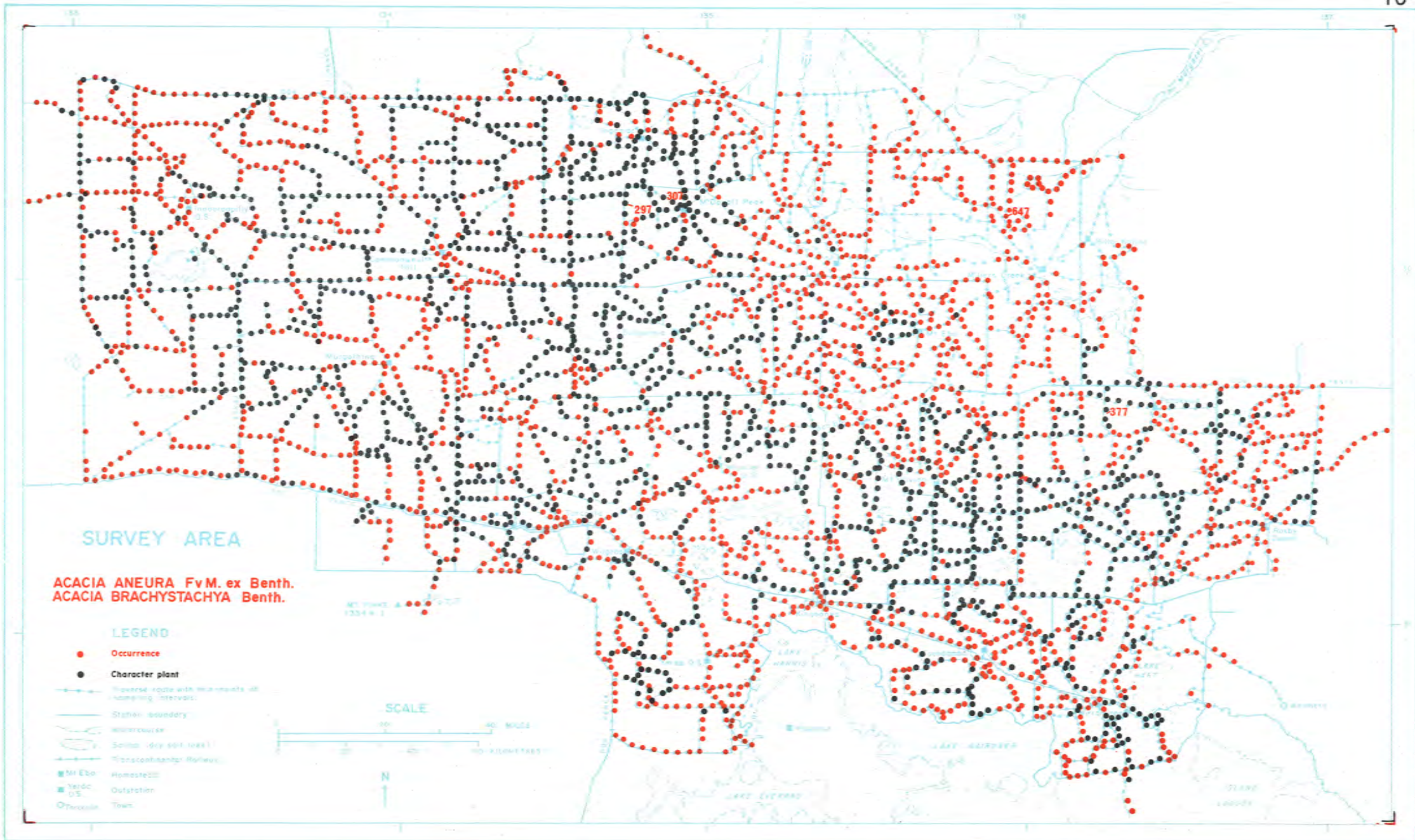
For several reasons it appears that drought is a contributing factor in this mortality. In many of these occurrences, where virtually no living trees were found, it was noted that death or die-back of many other woody plants also occurred. Most noticeable was the die-back in *Kochia sedifolia*, *Atriplex vesicaria*, and woody species such as *Myoporum platycarpum* and *Cassia* spp. The most convincing evidence that drought is a critical factor is the observation of "avenues" of live Mulga along the graded station roads on Commonwealth Hill Station. Such roads, being below the general ground surface, accumulate runoff from heavy rain and prevent competition for the soil moisture from ephemeral herbage. The mortality was explained by the Manager of the Station (M. Burden, pers. comm.). He noted that between two dry periods about 10 years ago heavy thunderstorms occurred on several occasions which were patchy in distribution, and present mortality is in the areas that received no rain then. However this cannot be reconciled with the rainfall records of Indooroopilly outstation, even though incomplete. Since 1950, rainfall of less than 2" (51mm) occurred in 1957, 1962 and 1967. It is unlikely that such a long lived species well adapted to arid conditions should prove so susceptible. A likely explanation, therefore, is that the areas of mortality represent an even aged stand. Having reached maturity and senescence during a run of good seasons, it was then susceptible to even moderate environmental stress. Certainly no dead seedlings or young plants of the species were seen in these areas.

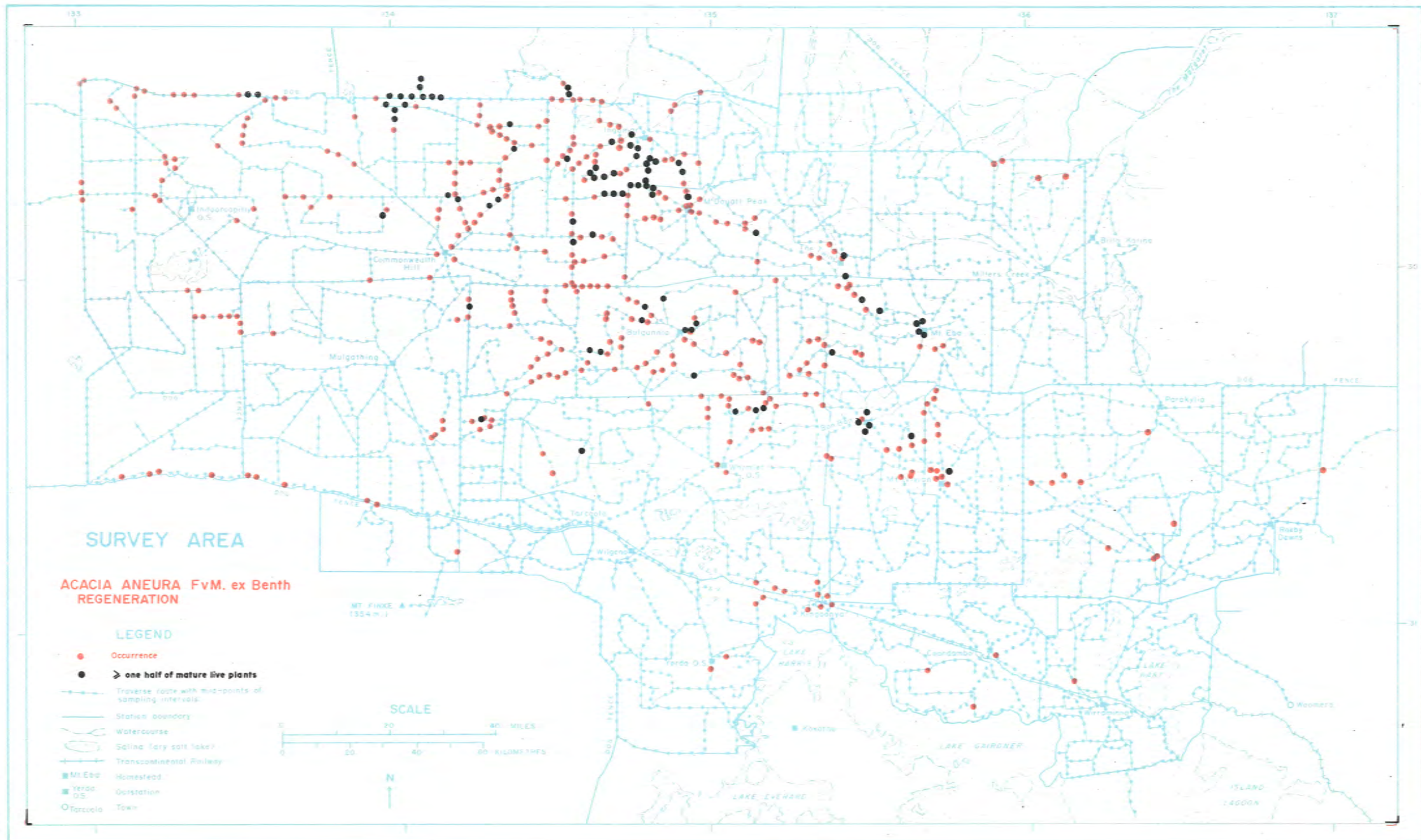












MAP 5 - ACACIA BURKITTII F.v.M. ex Benth.

Page 20. Photopoint 60: Parakylia Station, September 1971. A mature specimen is shown on the edge of a clayey flat which receives run-off from adjacent calcareous rises. A seedling 80cms high is discernible on the left of the scale post. Trees at the rear are *A. burkittii* and *A. aneura*. Ground cover near the trees is bushes of *Ptilotus obovatus*, with *Bassia* spp. and composites in the foreground flat.

Soil: About 10cms sand overlies clay loam near trees.

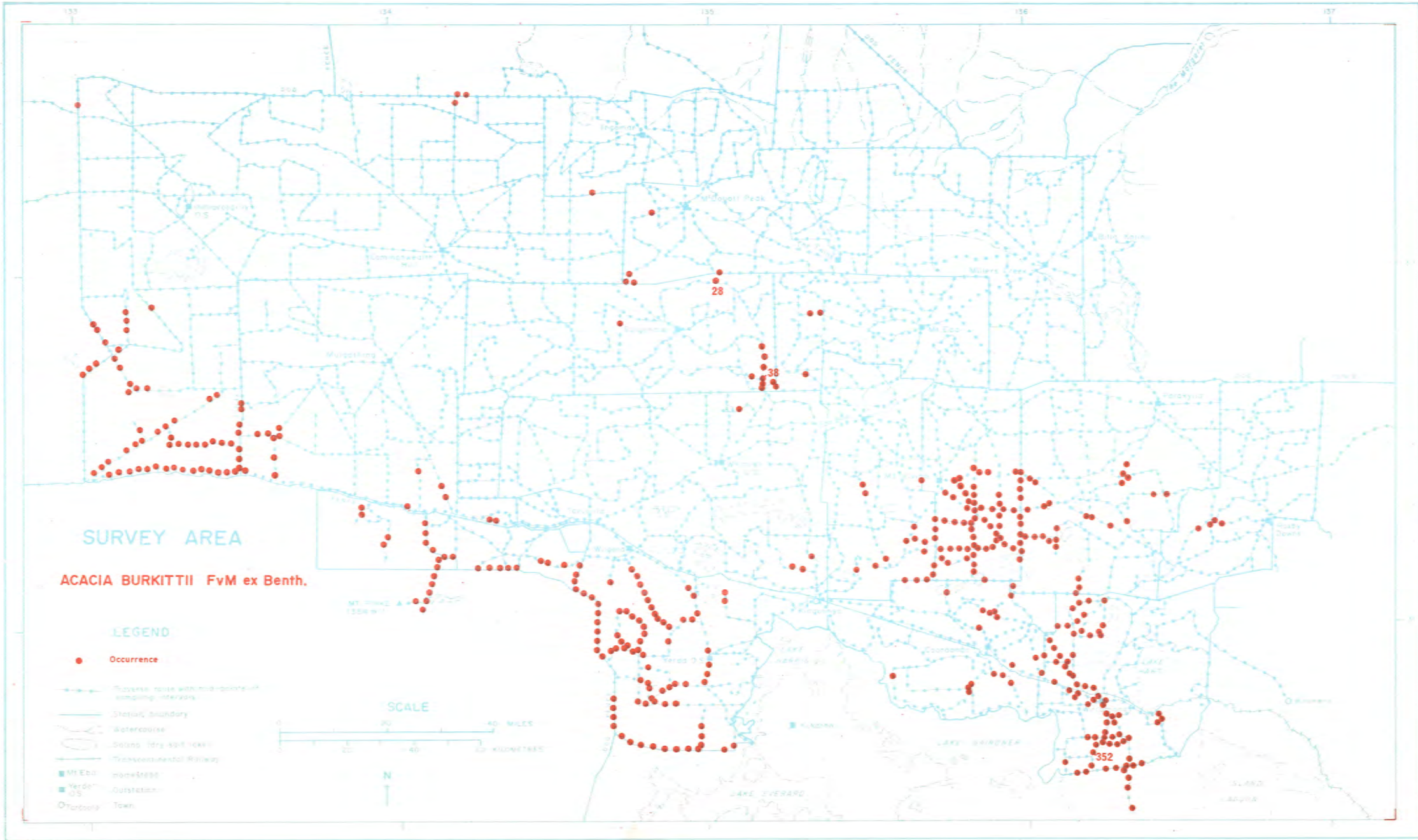
Grazing Pressure: Light.

Rainfall: 6.0" (152mm).

Page 21. Distribution Map: Occurrence.

Comments: The taxonomy of this species is not well known. Black (1952) does not record the occurrence of the species in this area, although he notes its occurrence from Eyre Peninsula eastward to New South Wales. However the closely related species *Acacia randelliana* Fitzg. which he considers may be a variety of the same species, occurs in the survey area, and westward to Western Australia. No specimens of this plant were collected in the area, however. It would seem that all specimens collected in this region belong to *A. burkittii*.
Acacia burkittii occurs most commonly on sand dunes receiving more than 6" (152mm) average annual rainfall. It also occurs in drier areas, but only on kopi near claypans, or near flats receiving run-off from adjacent rises. Contrary to evidence produced by M.D. Crisp on the Koonamore Vegetation Reserve (pers. comm., 1971), regeneration of this species was commonly observed in all areas of its occurrence, even near long-established stock watering points.





MAP 6 - ACACIA CALCICOLA Forde & Ising.

Page 23, Photopoint 16: Bon Bon Station, May 1971. A mature plant 4m high is shown with *Acacia aneura*. The sparse ground cover is dead *Bassia* spp. and ephemeral grasses.

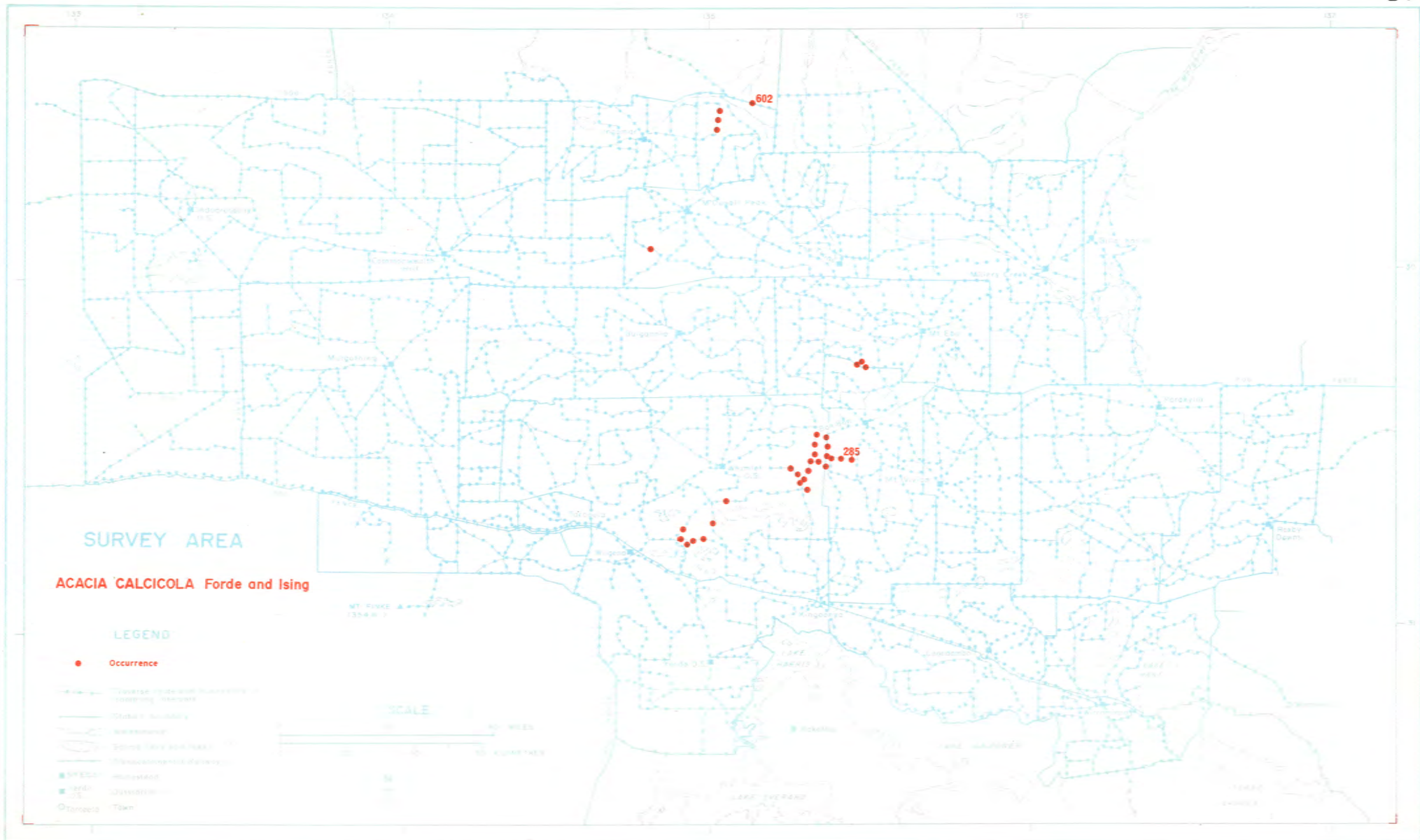
Soil: Deep calcareous clay-loam.

Grazing Pressure: Light - Moderate.

Rainfall: 5.6" (142mm).

Comments: Forde and Ising (1958) described this species as resembling stunted Myall, and occurring in areas where no other trees were present. Its distribution has been mapped by Jessup (1951) as *Acacia gilesiana* and by Boomsma, apparently with *A. sowdenii*. In the survey area it does occur where no other trees or shrubs are present, and, like *A. sowdenii*, tends to occur as a character plant (it was rated as such over two intervals). It was found on all soil types, but was most common on rocky slopes of "breakaways", usually in clayey soils. Factors influencing its distribution, which extends sporadically through northern South Australia, north-western New South Wales and southern Northern Territory, are not known.





SURVEY AREA

ACACIA CALCICOLA Forde and Ising

LEGEND

- Occurrence
- Road
- River
- Lake
- Mountain
- Township
- County
- State
- Town



MAP 7 - ACACIA COLLETIOIDES Benth. "Wait-a-While"

Page 26. Photopoint 48: Wirraminna Station, October 1971. A mature plant is shown on a broad sandy rise near a small depression. The large tree on the right is *Casuarina cristata* (Blackoak) and other trees are *Acacia aneura*. The ground cover is the dried off weed *Brassica tournfortii* (Wild turnip).

Soil: Deep sand, with clay increasing at depth.
 Grazing Pressure: Light - Moderate.
 Rainfall: 7.5" (190mm).

Page 27. Distribution Map: Occurrence.

Comments: This species is restricted to southern dunefields where rainfall exceeds 7 inches (178mm). The variety *A. colletioides* var. *nyssophylla*, identified by B. Maslin of the Perth Herbarium, is not previously recorded for this State. Although of similar appearance to the common variety, it occurs in a radically different habitat, namely the shale slopes of the Stuart Range residuals, in a rainfall of less than 5" (128mm).

The distribution shown for *A. colletioides* var. *collettioides* is near its westernmost known occurrence (Ooldea), while it occurs eastwards - through the southern semi-arid areas of South Australia and New South Wales. Regeneration of the species, which is unpalatable to stock, was not seen.



MAP 8 - ACACIA KEMPEANA "Witchetty Bush".

Page 29. Photopoint 77: Commonwealth Hill Station, September 1971. Two mature plants are shown in an overgrazed stand of *Kochia sedifolia* (Bluebush). Trees at the rear are *Acacia aneura*. The ground cover is *Stipa nitida* (Spear grass), ephemeral composites and *Bassia* spp.

Soil: Shallow calcareous loam over calcrete.

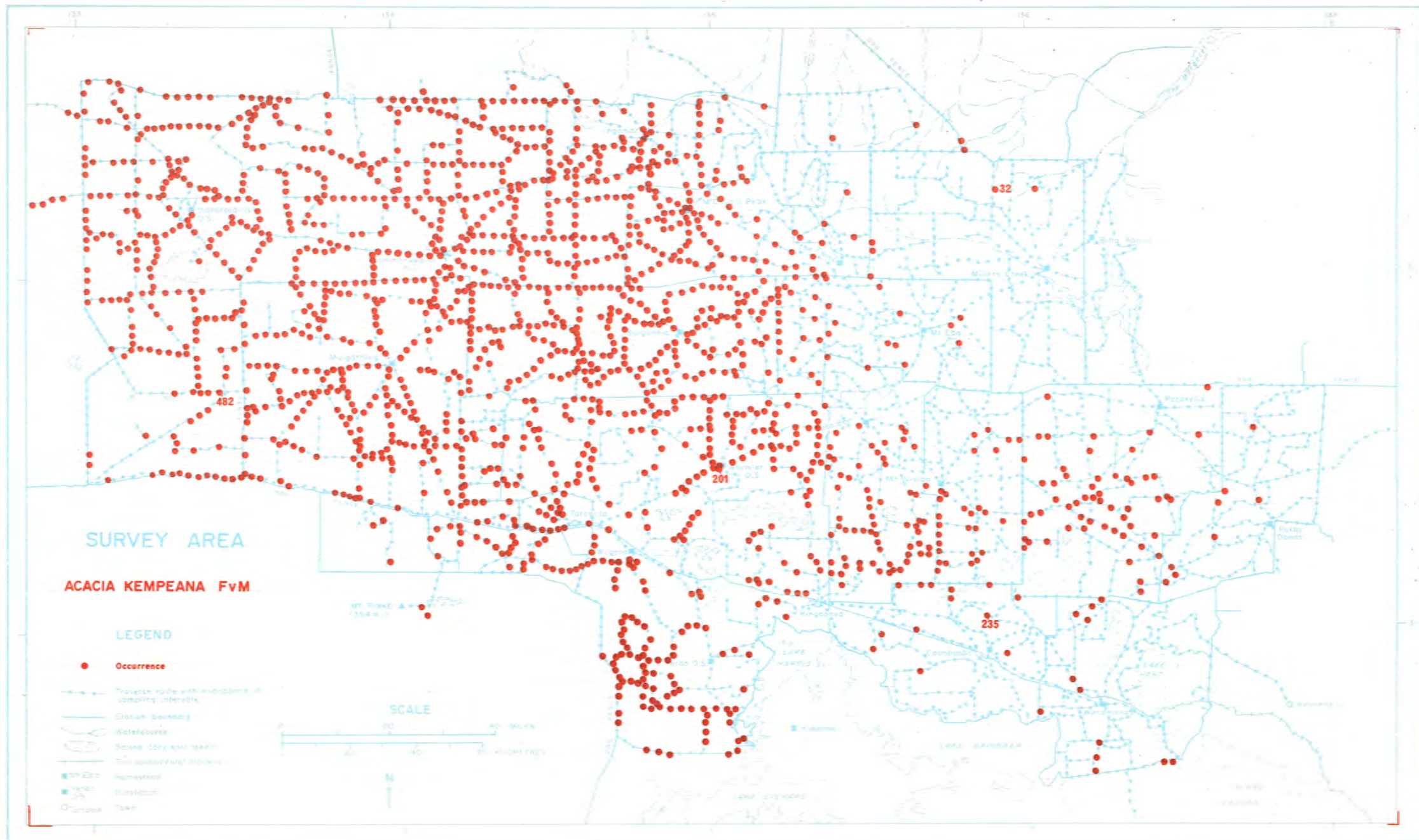
Grazing Pressure: Heavy.

Rainfall: 6.4" (164mm).

Page 30. Distribution map: Occurrence.

Comments: This species is characteristically restricted to chenopod shrublands on shallow calcareous soils, although it is sometimes found in the swales of sand ridges. It was noticeably rarer in the eastern part of the area, in keeping with its main recorded occurrence which is from north-western South Australia to southern parts of the Northern Territory. Regeneration (page 12) was not often seen, although this plant was nowhere common, and typically only a few plants would be seen at any one time.





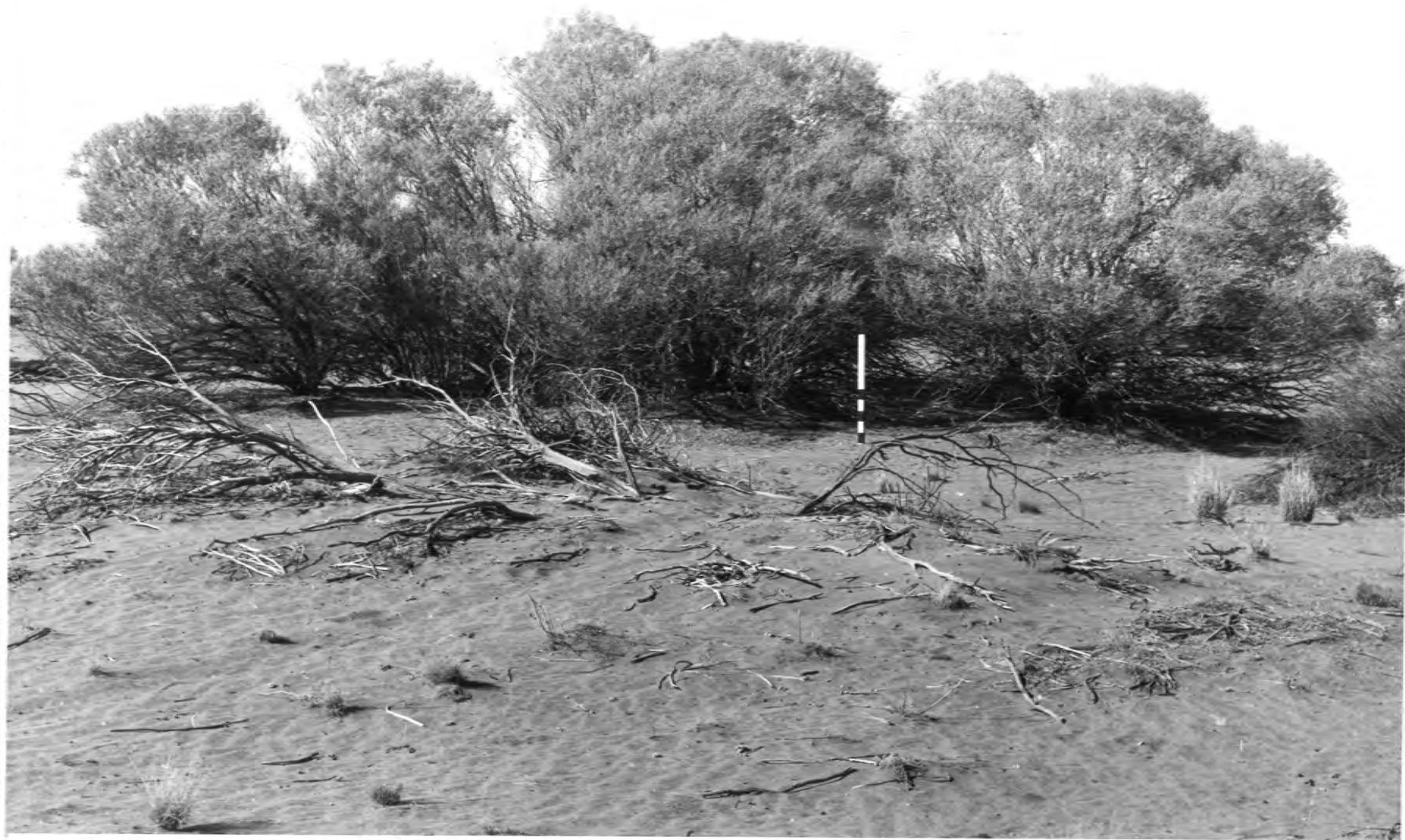
MAP 9. - ACACIA LIGULATA A. Cunn. ex Benth.

Page 32. Photopoint 36: Ingomar Station, June 1971. A grove of young mature plants are shown on a bare and rather unstable sand dune. No other vegetation is present except for a few tussocks of *Eragrostis eriopoda*.

Soil: Deep sand.
 Grazing Pressure: Moderate.
 Rainfall: 5.7" (145mm).

Page 33. Distribution Map: Occurrence.

Comments: This species is reported to be a colonizer of drifting sand in arid areas (Ratcliffe, 1936). In this region it was observed to be restricted to the crests of higher sand ridges, low sand dunes, or unstable sandy areas near stock watering points. It was common in the west on sand over kopi dunes near claypans, while in the east it was a major component of the sandhill flora, as the more arid conditions there favoured sand drift. Although grazed by stock, seedlings, which grow rapidly, were often observed. The species has a wide distribution throughout central and southern Australia, in arid and sub-humid regions.



MAP 10. - ACACIA LINOPHYLLA Fitzg. "Sandhill Mulga".

Page 35. Photopoint 22: Bon Bon Station, June 1971. *Acacia linophylla* is shown in an arid woodland with *A. aneura* on low sandy rises. Ground cover is mainly dead ephemeral *Aristida* spp. The scale post is one metre high.

Soil: Deep sand.
 Grazing Pressure: Negligible by stock; rabbits present.
 Rainfall: 6.0" (152mm).

Page 36. Distribution Map: Occurrence and Character Plant Classes.

Comments: In common with *A. ligulata*, this species is also restricted to deep sandy areas or dunefields. Although it reaches its best development in the southern dunefields with more than 7" (178mm) rainfall it also occurs less commonly in the drier parts. Where heavy mortality of *Acacia aneura* had occurred (Map 4), this species appeared to be little affected. Stands were counted with up to 80 plants / ha, and in these areas it often occurs almost to the exclusion of other woody species. It is palatable to stock, and regeneration (page 14), was only observed in lightly stocked areas.

Jessup (1951) mapped this species with the morphologically similar *A. ramulosa* Fitzg. As these are both recorded for the survey area, it is possible that the map represents the combined distribution of both these species, although no specimens of *A. ramulosa* were collected. Both species occur throughout the arid southern and western parts of Australia.



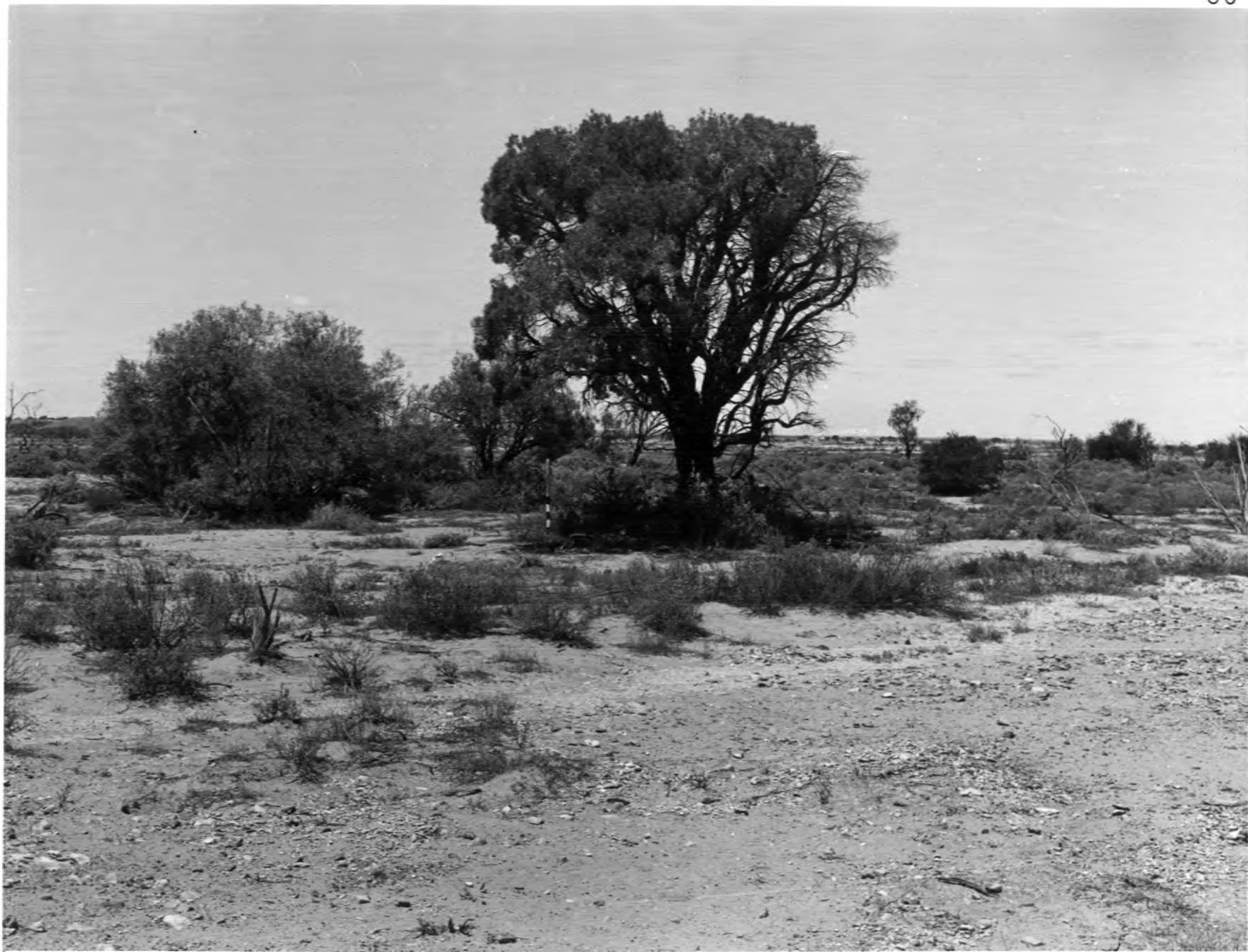
MAP 11 - ACACIA OSWALDII F.v.M.

Page 38. Photopoint 95: Stuart Range, Millers Creek Station, October 1971. A large specimen is shown in the centre of the photograph, while the compact rounded bush on the right in the middle distance is a young plant of the species about 2m high. Other shrubs and trees are *Heterodendrum oleaeifolium* (Bullock bush) on the left, *Acacia tetragonophylla* on the right at distance, and *Santalum lanceolatum* var. *angustifolium* behind the young *A. oswaldii*. Ground cover is composed of the chenopods *Atriplex vesicaria* (Saltbush), *Kochia astrotricha* (low Bluebush) and *Rhagodia spinescens*.

Soil: Deep coarse alluvium.
 Grazing Pressure: Negligible: note highly palatable *Heterodendrum* foliage near ground.
 Rainfall: 4.8" (122mm).

Page 39. Distribution Map: Occurrence.

Comments: This species has a sporadic distribution in all soil and vegetation types in the survey area. It is commonly seen as isolated spreading trees in chenopod shrublands, while in the densely wooded dunefields to the south of the area it is usually smaller, and often found growing under other trees (page 66). Individuals are often seen on disturbed ground where protected from stock, e.g. around dams and old abandoned wells. It is a fast grower, a specimen on Parakylia Station near a tank overflow (photopoint 59) having a stem 40cms in diameter after 25 years. Recorded distribution of this species is throughout the central and south-eastern portions of the arid and semi-arid zone of Australia, as far west as Ooldea. On evidence presented here, it probably occurs in the great Victoria Desert, but few collections have been made there.



MAPS 12-13. - ACACIA SOWDENII Maiden "Western Myall"

Page 43. Photopoint 20: Bon Bon Station, May 1971. A mature specimen 6m high is on the left hand side in the middle distance of the photograph, while seedlings 1m and 1.5m high are on the left and right respectively of the 1m scale post. Other trees are *A. aneura* and *A. sowdenii*, and are growing in a shrubland of *Kochia sedifolia* (Bluebush). The ground cover is mainly *Bassia* and *Kochia* spp.

Soil: Shallow, calcareous loam.

Grazing Pressure: Moderate.

Rainfall: 5.8" (148mm).

Page 44.

Photograph of extensive regeneration, Roxby Downs Station, September 1971. Mature trees are shown in the distance, while all other plants are young Myalls, 50cm to 2.5m in height. No other species are evident, ephemeral growth having been eaten off in this heavily grazed area. Most of the young Myalls do not appear to have been grazed by stock.

Soil: Shallow calcareous loam.

Grazing Pressure: Heavy.

Rainfall: 5.8" (148mm).

Page 45. Distribution Map: Occurrence and Character Plant classes.

Page 46. Distribution Map: Regeneration, two classes of abundance are shown.

Comments:

- (a) Occurrence: - As with *A. calcicola*, the distribution of this species has well defined limits. It is usually restricted to chenopod shrublands on shallow calcareous soils, or soils underlain by calcrete, but there appear to be other factors influencing its distribution which cannot be explained on the basis of published information presented here. Jessup (1951) suggested that the species is currently spreading

from centres of survival during a more arid period, and Crocker and Wood (1947) considered that one such centre was likely to be in the Gawler Ranges, just to the south. Individuals at the northern limits of its distribution were observed to be of an advanced age, and no regeneration was observed there. The distribution of character plant ratings for this species corresponds fairly well with Jessup's (Map 49). Because the plant is large and conspicuous, only about 4 trees / ha were necessary for a character plant rating. *A. sowdenii* occurs only west of the Flinders Range to the margins of the Nullarbor Plain, and north as far as Emu Junction (Pastoral Board, Adelaide, 1967, unpublished). Occurrences further north probably refer to *A. calcicola*.

(b)

Regeneration: - It can reasonably be said that no significant regeneration of this species is occurring in the survey area. Young plants, for which an upper height limit of 3m, was defined are conspicuous and distinctive. From regeneration of known age (A. Nicholson^{*}, pers. comm.) this height limit would include plants up to 40-50 years old.

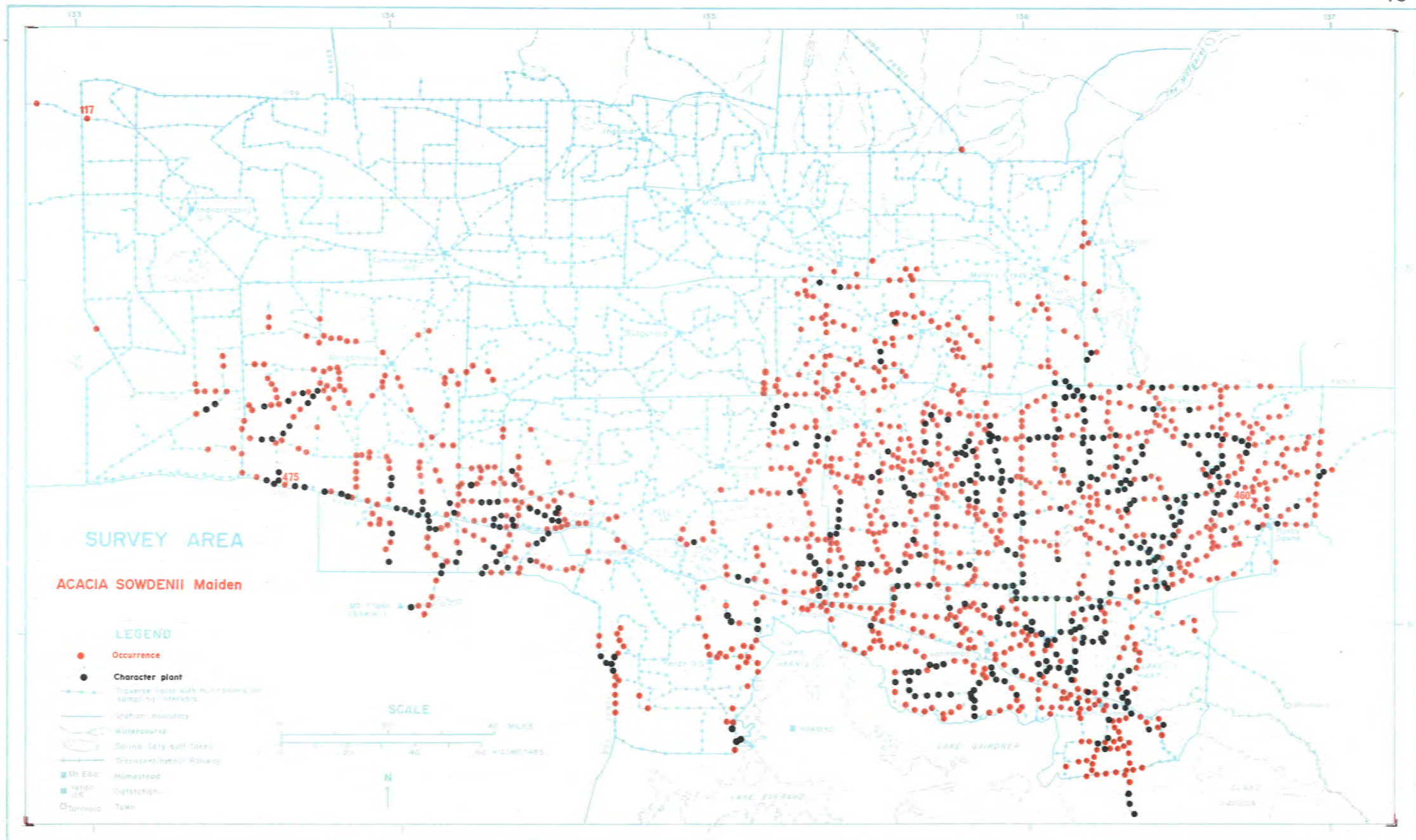
An indication of the reasons for the lack of regeneration can best be obtained by examination of the few places where extensive regeneration did occur. A factor in common with many of these was soil disturbance. Prolific regeneration was observed on heaps of soil and rubble in quarries used for the construction of a rocket range road near Koolymilka in 1949. Regeneration was also seen on the side of the Stuart Highway, and the road to Kokatha, and this was restricted to within 50m of the road surface. In the photograph on page 44 there has been soil drift due to overgrazing and trampling by stock. The regeneration on Yudnapinna Station in 1922 followed a fire (Crocker & Skewes, 1941), but it seems likely that some erosion may have occurred

* A. Nicholson, Owner/Manager, Middleback Station, Whyalla.

on the exposed soil surface, which facilitated germination. Surface leaf litter from under a mature tree, when covered with sand and watered in a pot, resulted in the germination of many Myalls. Zimmer (1944) noted that soil disturbance was necessary for regeneration of another arid zone species (*Callitris columellaris*). From the evidence presented here, several factors, acting singly or in combination would appear to be necessary for successful Myall regeneration. Most important among these are soil disturbance, fire and, presumably, adequate rainfall for the first few years. Further observations are needed to assess the effect of grazing, as the photograph on page 44 and observations of well-trimmed plants far from stock watering points (Jessup, 1951) present conflicting evidence.







MAP 14. - ACACIA TARCULENSIS Black "Granite Wattle"

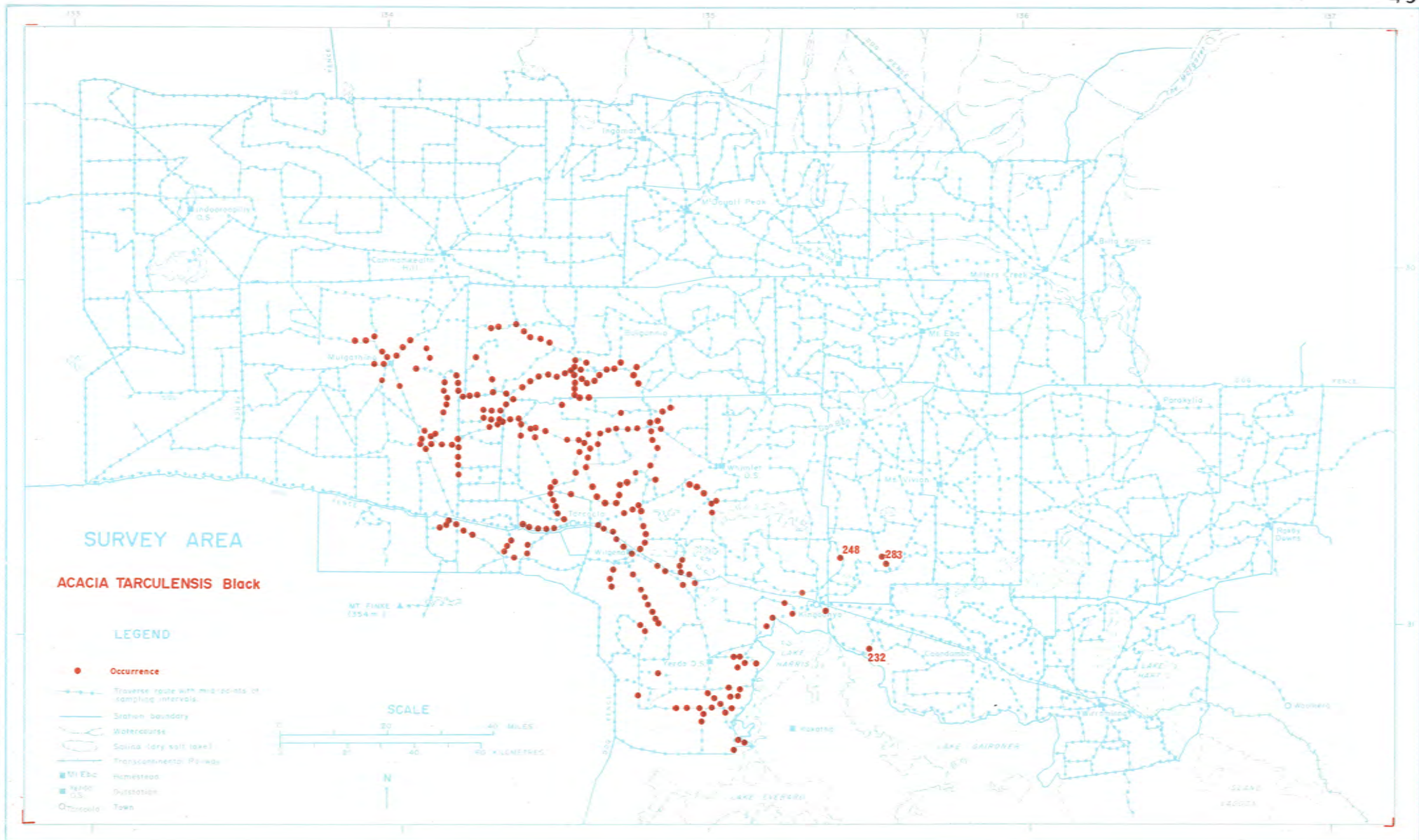
Page 48. Photopoint 44: Gibraltar Rocks, Wilgena Station, June 1971. Mature specimens of this shrub are shown in a granite outcrop. The shrubs at the rear amongst boulders are *A. tetragonophylla*. Ephemeral ground cover is *Helipterum moschatum* and *Erodium cygnorum*.

Soil: Decomposed granite, calcareous at depth.
 Grazing Pressure: Light by stock; rabbits abundant (note warrens in foreground).
 Rainfall: 6.5" (165mm).

Page 49. Distribution Map: Occurrence.

Comments: The map shown here represents the entire known distribution of this species apart from a recent collection in the Gawler Ranges. It was always found near outcrops of granite or porphyry. In the drier areas it becomes a stunted shrub, and is absent from outcrops in less than 6" (152mm) average annual rainfall. It is also absent from outcrops in the west of the area, even though the habitat would appear suitable, and no other species has displaced it. It is not palatable to stock, and seedlings were occasionally observed.





MAP 15 - ACACIA TETRAGONOPHYLLA F.v.M. "Dead Finish"

Page 51: Photopoint 73: Unoccupied country, just west of Commonwealth Hill Station, September 1971.

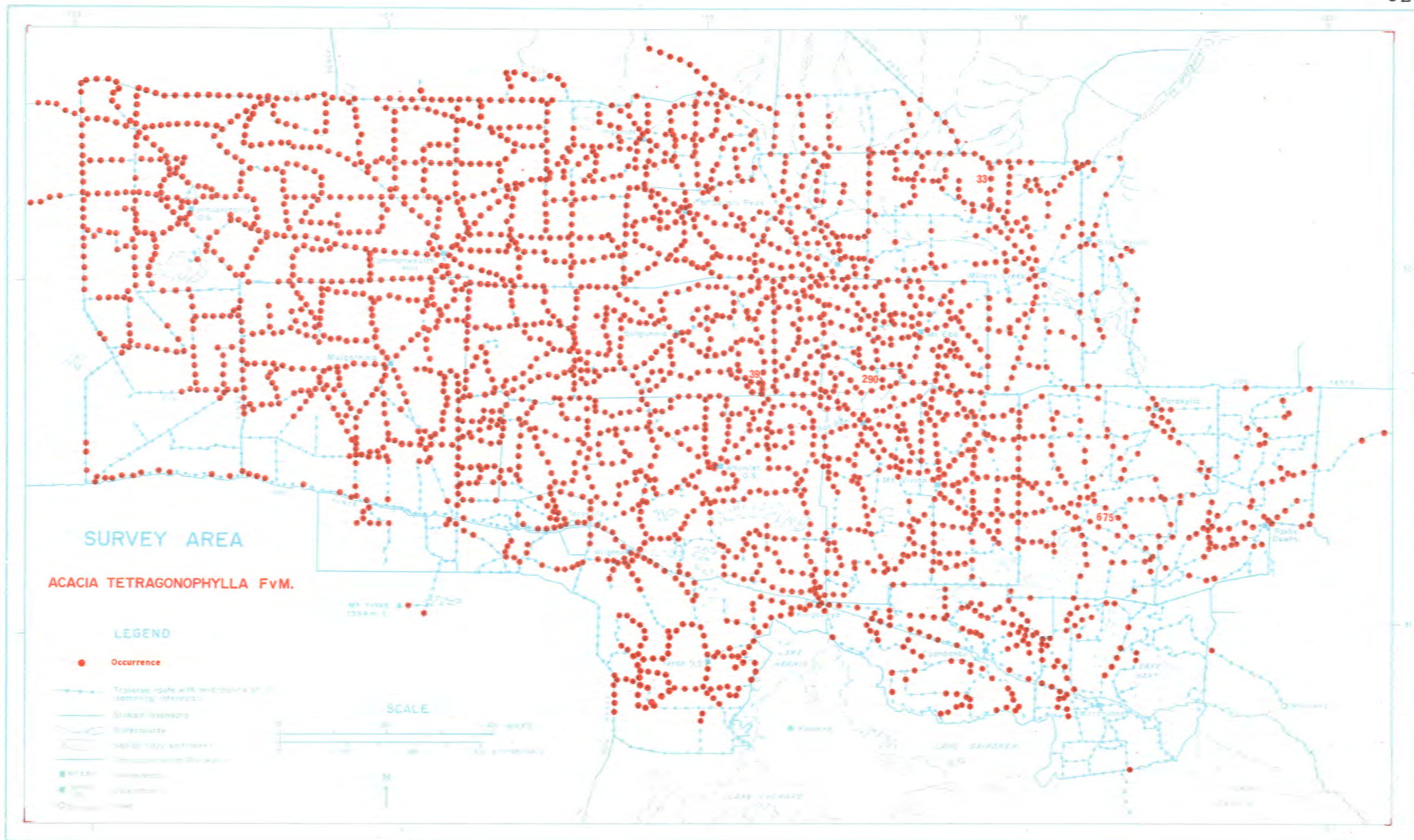
The photograph, looking north-west from the post, shows a large specimen in an area burnt out in 1967. Other shrubs are *Cassia nemophila* var. *platypoda* (right middle distance), *Eremophila sturtii* (near *A. tetragonophylla*) and *A. aneura* at rear and in left foreground. Ground cover is dead annual grasses and forbs.

Soil: Deep sand (80cms).
 Grazing Pressure: No stock; rabbits present.
 Rainfall: 6.8" (172mm).

Page 52. Distribution Map: Occurrence.

Comments: This species is well adapted to arid conditions and is almost ubiquitous in the study area. It ranges from the interdune flats in some of the southern dunefields to the limits of woody plant growth in the zone of lowest rainfall. It is most abundant on the clay loam flats near Mt. Eba, and Jessup (1951) recorded it as a co-dominant there. However it never occurred densely enough over the whole interval to be rated a character plant in this survey, and is rather inconspicuous when leafless (c.f. common name). It is the only woody plant seen to increase noticeably under grazing and this was particularly evident in "Mt. Eba" country. Regeneration was prolific along old vehicle tracks, or other disturbance, and in watercourses. It was often seen growing under sheep troughs and near tanks. Its distribution is widespread in southern arid Australia, although it is not commonly seen east of the Flinders Range.





MAP 16 - ACACIA VICTORIAE Benth.

Page 54. Photopoint 25: The Twins Station, June 1971. A large healthy specimen is shown in a depression or broad watercourse receiving run-on from adjacent areas. This specimen is larger than average for this region. Other woody shrubs in the foreground are *A. tetragonophylla* on the right of the scale post, and *Santalum spicatum* (Sandalwood) on the far right. Shrubs visible at the rear are *Heterodendrum oleaeifolium* and *Eremophila scoparia* (Broombush) on the left, and a young plant of *Santalum lanceolatum* var. *angustifolium* in the centre. Low shrubs are *Atriplex vesicaria* (nearly leafless), *Kochia astrotricha* and *K. aphylla* (Cottonbush).

Soil: 20cms of silty loam overlies calcrete and silcrete stones.

Grazing Pressure: Light; rabbits present.

Rainfall: 5.4" (137mm).

Page 55. Distribution Map: Occurrence.

Comments: Jessup (1951) noted that this species is fast-growing and regenerates rapidly from seed in this area. Its occurrence is largely restricted to the clay-loams of "Mt. Eba" country, and along watercourses in drier areas. Regeneration, although observed, was not prolific, and most plants seen were stunted shrubs 2-3metres in height. The isolated occurrences near Bulgunnia and Wirraminna Station homesteads probably result from the transport of seed by vehicles or stock.

A victoriae is widely distributed along watercourses in southern and central arid and semi-arid Australia.



MAP 17. - BOSSIAEA WALKERI F.v.M.

Page 57. Photopoint 82: Unoccupied country near the Dog Fence, south of Tarcoola, October 1971.

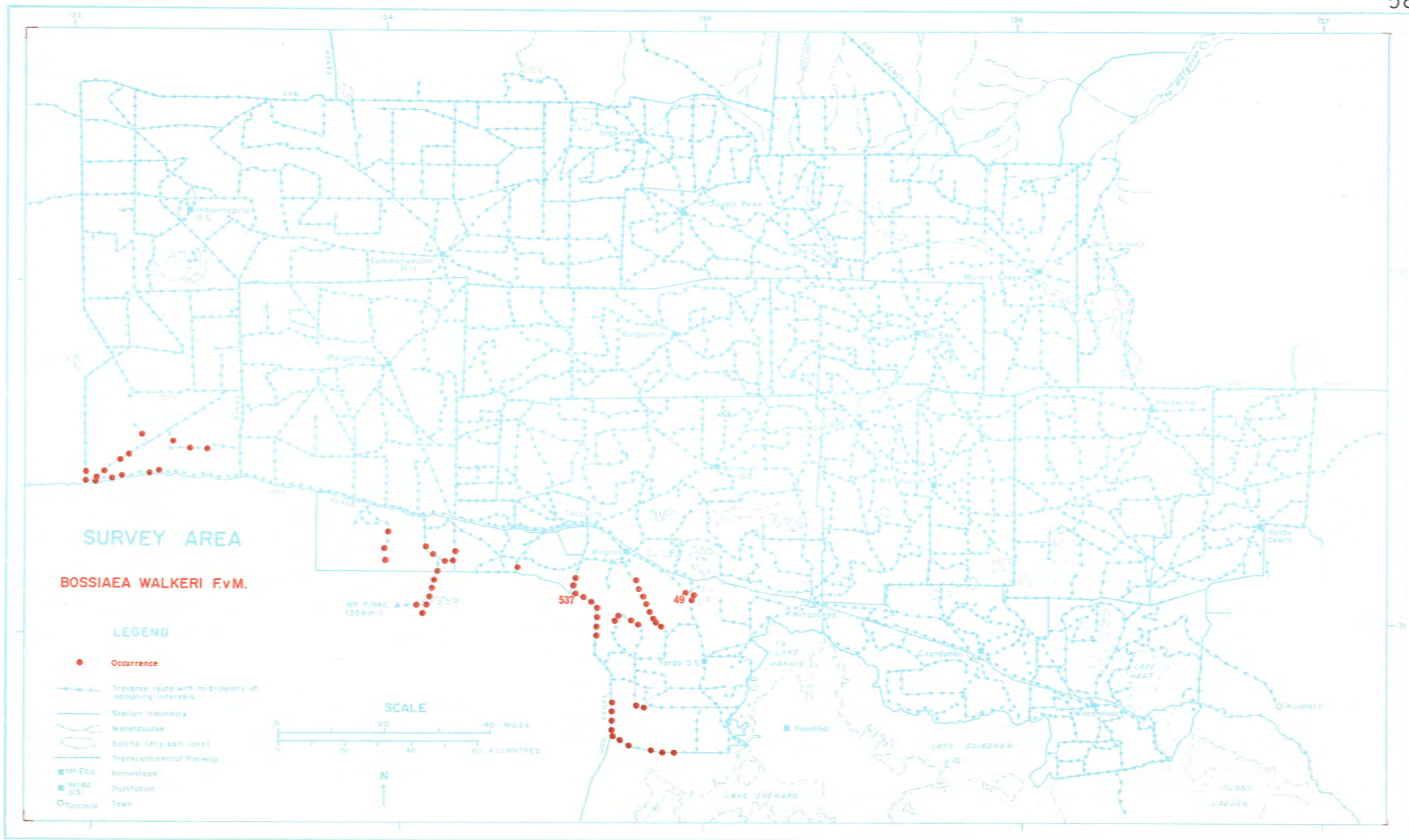
A single plant is shown, on the slopes of a high sand dune. Shrubs on the left and at the rear are *Cassia nemophila*, and trees are *Casuarina cristata*. The scattered herbaceous plants are *Ptilotus polystachyus*.

Soil: Deep sand.
 Grazing Pressure: Nil.
 Rainfall: 7.0" (178mm).

Page 58. Distribution Map: Occurrence.

Comments: This species is restricted to the higher sand ridges in the 7-8" (178-203mm) rainfall belt in the survey area. Typically it forms dense thickets on unstable crests and is thus a valuable sand binder. It probably spreads adventitious roots. *B. walkeri* has only been recorded from the semi-arid dunefields bordering the Nullarbor Plain, and this map illustrates its easternmost known occurrence.





MAPS 18-19. - CALLITRIS COLUMELLARIS F.v.M. "Cypress Pine"

Page 61. Photopoint 63: Roxby Downs Station, September 1971. One of the stands of extensive regeneration is shown. Two mature and two dead individuals appear on the low sand dune in the distance. All plants in this uneven aged stand of regeneration appear healthy, even those in the foreground on the clay flat. Other shrubs on the flat are *Cassia artemisioides*. Ground cover is *Bassia* spp., and the ephemeral grasses *Schismus barbatus* and *Stipa nitida* (Spear grass).

Soil: Stony clay-loam.

Grazing Pressure: Light.

Rainfall: 5.5" (140mm).

Page 62. Distribution Map: Occurrence and Character Plant classes.

Page 63. Distribution Map: Regeneration, two classes of seedling density are shown.

Comments: This species has an interesting and well defined distribution which cannot be correlated with any known environmental factor. In general it may be said that it only occurs on dunes which are otherwise relatively bare and unstable, in common with *Acacia ligulata* and *Dodonaea attenuata*. The location and extent of regeneration of this species provides an insight into possible requirements for establishment. Where regeneration was observed it had occurred extensively, seedlings often far outnumbering the mature trees there and extending out onto the gibber-covered interdune flat. This regeneration always occurred on drift or blowouts, and regeneration of all ages including seedlings 10cms or less in height, was evident in those areas examined. According to local opinion, this regeneration was first noticed 12-15 years ago, and it is of interest to note that this corresponds to a period of high stock numbers on the Station (Vol. I, Table 2).

Zimmer (1944) showed that regeneration of *Callitris* depended on soil disturbance, while the regrowth of *Callitris* in western New South Wales (Anon. 1969) was attributed to a run of years of above-average rainfall in the absence of fire. There were three years of rainfall above 10" (254mm) in 1947-50, but no significant above-average rainfall periods have been recorded on Roxby Downs since then. It therefore remains uncertain as to why regeneration has occurred so densely, and is continuing to occur, in isolated localities, when other seemingly identical sites fail to support even an occasional seedling.

In South Australia, this species is generally restricted to hillsides in the Flinders, Musgrave and Gawler Ranges, but it occurs widely on sandy soils in Northern and Eastern arid and semi-arid areas of Australia. Jessup (1951) mapped its distribution over his area, and there is good correlation of the major occurrence on his map with that presented here.



Page 66. Photopoint 42: Commonwealth Hill Station, September 1971. This specimen is shown on the sandy margins of a calcareous rise in the background on which more *C. cristata* trees are growing. The tree in the right hand foreground is *A. aneura*. Between the Blackoak and the scale post is an *Acacia oswaldii* in a typical habitat for this species. Bushes of *Kochia sedifolia* are visible on the rise, while ground cover in the foreground is chiefly *K. erioclada*, and *Atriplex vesicaria*, with a few perennial *Eragrostis* tussocks.

Soil: Sands of variable depth overlie calcrete and felspar.

Grazing Pressure: Light.

Rainfall: 6.3" (160mm).

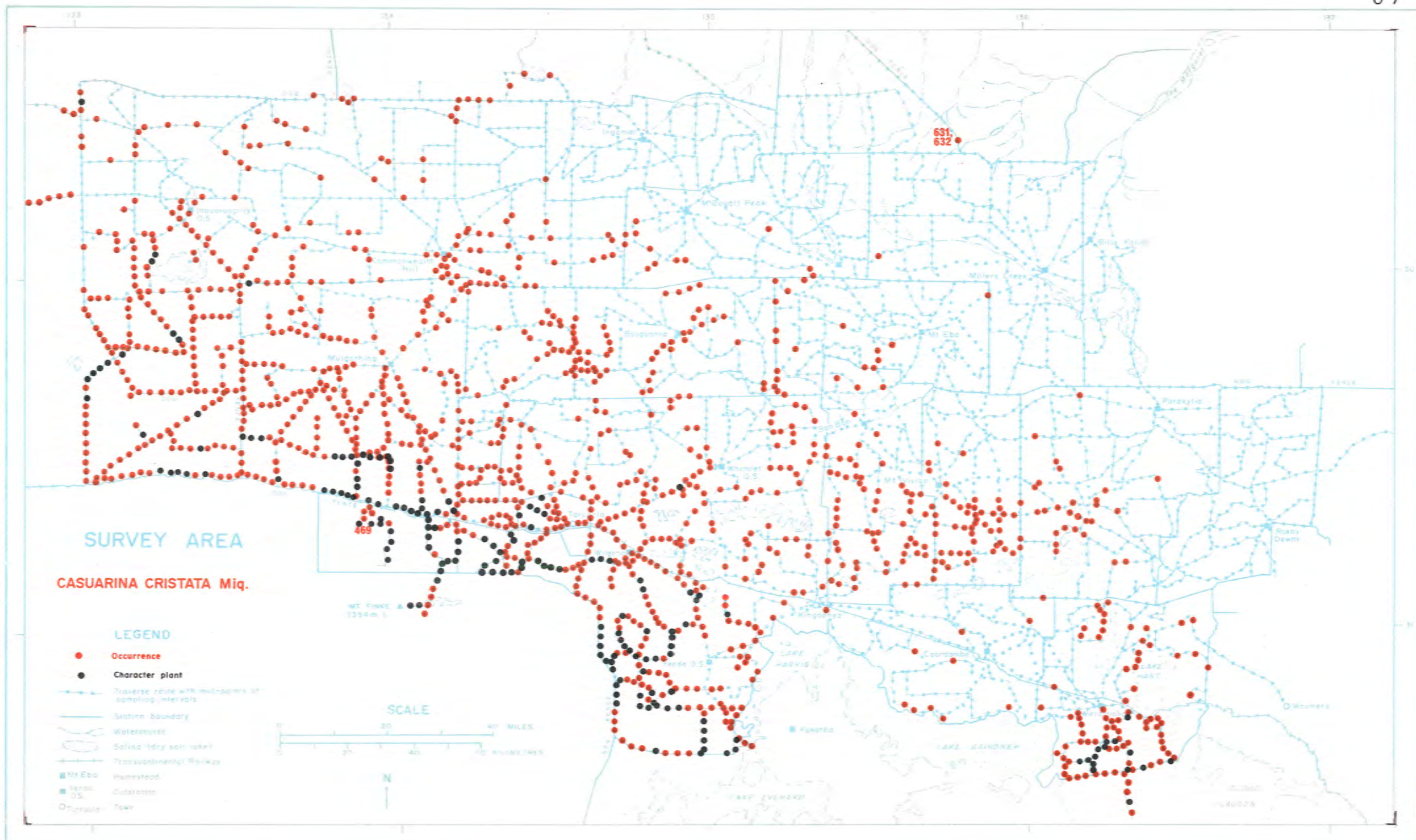
Page 67. Distribution Map: Occurrence and Character Plant classes.

Comments: The Blackoak community in this area is characterized by a low density (10-50 trees/ha) of large healthy individuals, mixed with other trees and shrubs, on the broader interdune flats and near claypans. This is in marked contrast with the dense moribund stands of up to 400 trees/ha with prolific root suckers observed for this species in a higher rainfall region further south (Barker, 1972). An explanation of this can be found in the observation that the largest trees are invariably found on deep sandy or sandy-loam soils, and uprooted specimens reveal an extensive root system penetrating 2-3m below the surface. Where it occurs on shallow calcareous soils, as in the case reported by Barker, it has a surface rooting system and is usually only a small tree 5-7m high.

Blackoak never occurred in areas in which *Kochia astrotricha* was present, possibly because of a low tolerance to soil salinity. This explains the gap in its distribution on Coondambo Station.

Although occurring as far north as the Musgrave Ranges, it is largely restricted to the southern arid and semi-arid regions of Australia. Thus the north-eastern limit of its occurrence is probably represented on the distribution map.





MAP 21. - CODONOCARPUS COTINIFOLIUS (Desf.) F.v.M. "Desert Poplar"

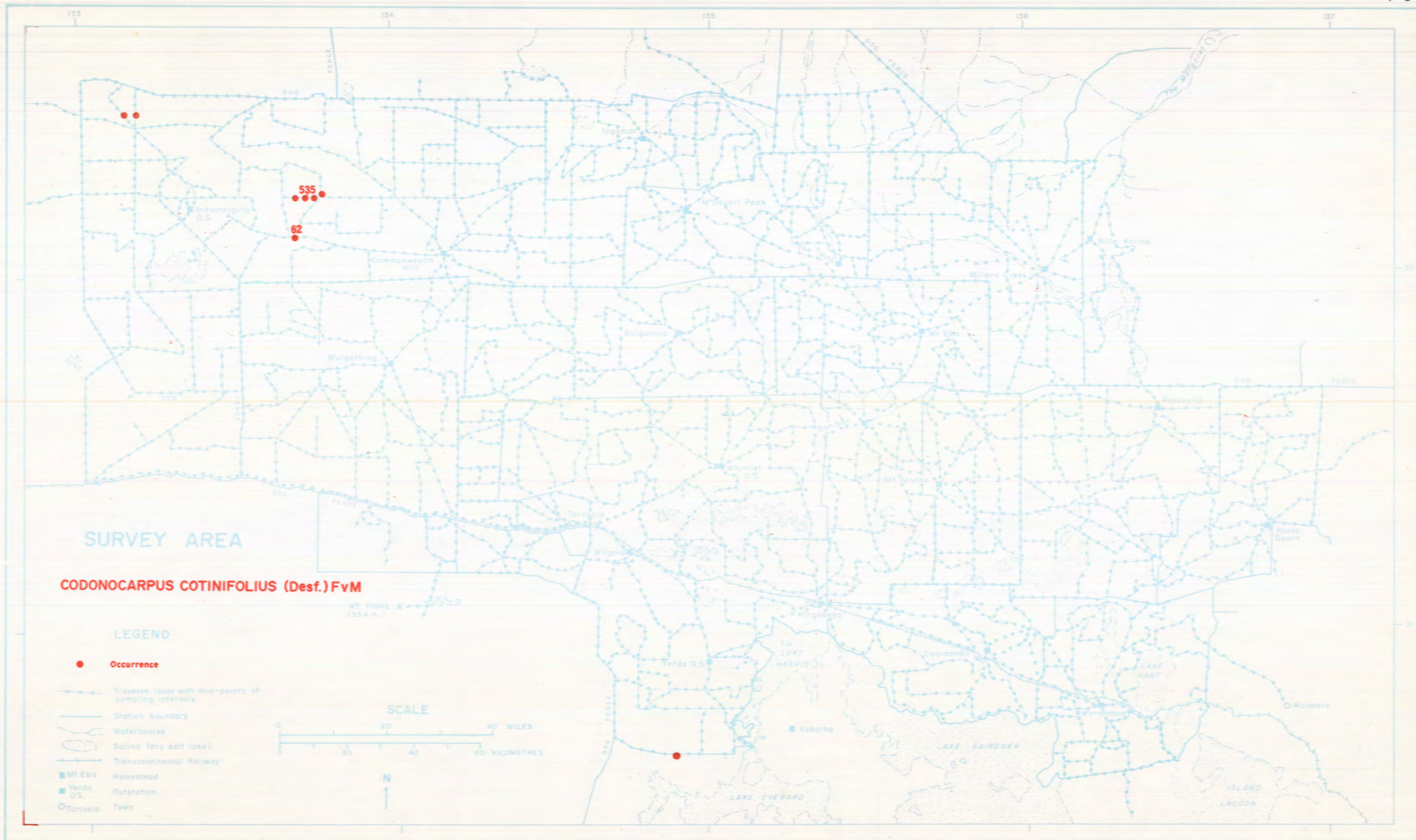
Page 69. Photopoint 3: Commonwealth Hill Station, October 1971. Several mature specimens are shown on a sandhill with *Acacia linophylla* (Sandhill Mulga). A seedling 1m high is just discernible in the right foreground growing among some dead timber. Ground cover is composed of tussocks of *Eragrostis eriopoda*, and scattered ephemeral composites.

Soil: Deep Sand.
 Grazing Pressure: Light.
 Rainfall: 6.5" (165mm).

Page 70. Distribution Map: Occurrence.

Comments: This species was rarely seen in the survey, though of conspicuous appearance. It always occurred on deep sand or dunes, and regeneration was seen in most of these occurrences. It occurs in scattered localities throughout the arid zone, but is scarcely ever common, and unlike most other trees there, is fast growing and short lived (Boomsma, 1972). The seeds are well adapted for wind dispersal hence permitting the establishment of widely scattered plants in suitable habitats.





MAP 22 - CRATYSTYLIS CONOCEPHALA (F.v.M.) S. Moore "Flowering Bluebush"

Page 72. Photopoint 19: Bon Bon Station, May 1971. This photograph shows two bushes of this species in *Acacia sowdenii* (Myall) woodland. Several more are in the middle distance on the extreme left, while all other shrubs are *Kochia sedifolia* (Bluebush), which it closely resembles. The tree on the extreme right hand side is *Casuarina cristata* (Blackoak).

Soil: Sandy loam overlies soft calcrete.
 Grazing Pressure: Negligible.
 Rainfall: 5.8" (148mm).

Page 73. Distribution Map: Occurrence.

Comments: In view of its close similarity to *Kochia sedifolia*, this species was included in the bush density survey forming the other part of this thesis (Chapter 5, Vol. I). It is also highly palatable to sheep, and in mixed chenopod shrubland containing this species, sheep will graze it to bare twigs before a noticeable effect on the others (e.g. *Atriplex vesicaria*), is produced. *C. conocephala* is usually found on the broader swales at the borders of dunefields, or on the deeper sandy-loam soils overlying calcrete, with more than 7" (178mm) average annual rainfall. The species is common in the southern margins of Australia's arid zone, and the distribution shown here represents its northern limits.



MAP 23 - DODONAEA ATTENUATA "Hopbush"

Page 75. Photopoint 45: Wilgena Station, October 1971. A group of young, mature and senescent plants are shown on the slope of a steep sandhill bordering a salina. A bush of *Kochia erioclada* is evident behind the scale post, while ground cover consists of dead ephemeral composites, and the weed *Brassica tournfortii* (Wild Turnip).

Soil: Deep sand.
 Grazing Pressure: Negligible.
 Rainfall: 6.5" (165mm).

Page 76. Distribution Map: Occurrence.

Comments: This species, in common with *Acacia ligulata*, is restricted to dunefields and disturbed sandy areas. It is often seen regenerating along the edges of graded roads and near stock watering points, where the largest specimens were seen (5-6m high). It is seldom grazed by stock even when other forage has been eaten out.

In the southern dunefields the species was only occasionally seen, while in the more arid dunefields in the east of the area, it occurred much more commonly. *D. attenuata* occurs extensively throughout the arid regions of Australia.



MAP 24. - ERAGROSTIS AUSTRALASICA (Steud.) Hubbard "Canegrass"

Page 78. Photopoint 32: Ingomar Station, June 1971. Several clumps of this perennial grass are shown,

in a small depression or "swamp" between sand dunes visible at the rear.

Acacia aneura is shown on these sand dunes. The canegrass here was flowering,

and a spike is visible just above the top of the scale post. The dried-off perennial grass in the foreground is probably *Eragrostis* sp.

Soil: Grey cracking clay (alluvial).

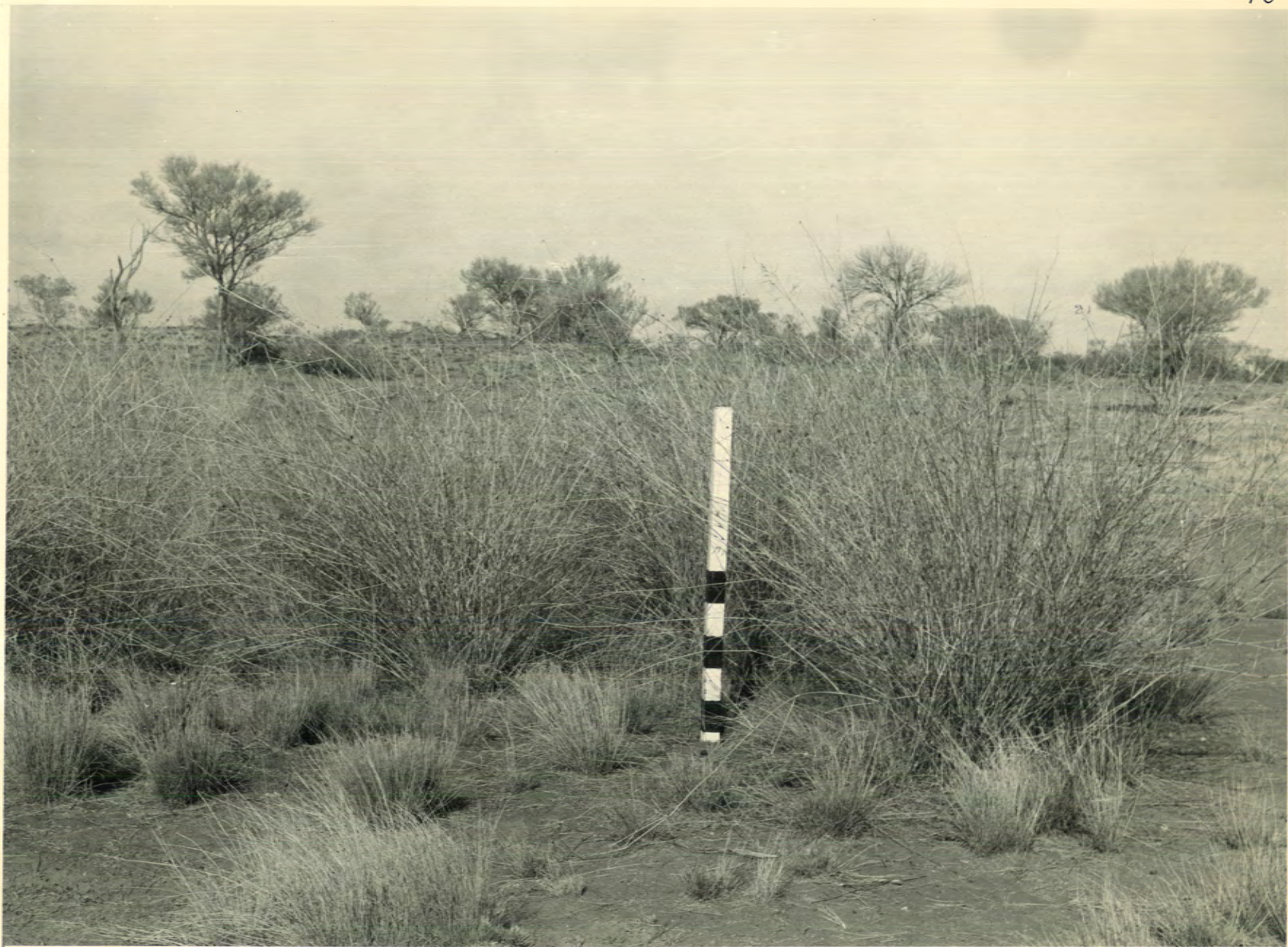
Grazing Pressure: Light - Moderate.

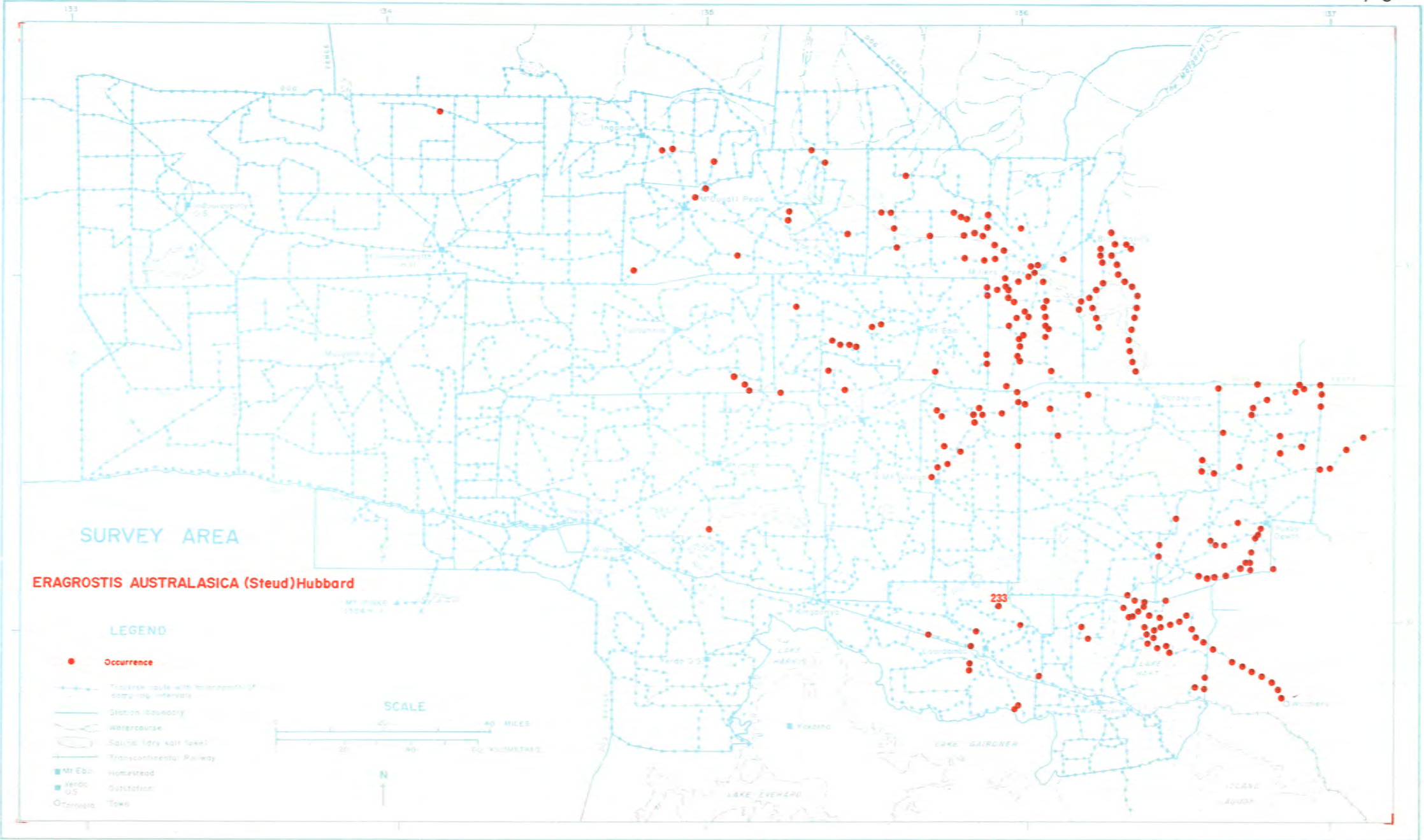
Rainfall: 5.6" (42mm).

Page 79. Distribution Map: Occurrence.

Comments:

Canegrass was restricted to depressions, or areas which are inundated after heavy rain. It was most common in the lower reaches of the Millers Creek watercourse and associated claypans, and on the Arcoona Plateau, where it occurred in the larger "crabholes" or gilgais and was the largest plant found there. It is recorded from these habitats throughout drier areas of southern and central Australia.





MAP 25 - EREMOPHILA LONGIFOLIA (R.Br.) F.v.M.

Page 81. Photopoint 97: Millers Creek Station, October 1971, looking south from the post. Three specimens are shown near a small watercourse in treeless "tableland" country. An *Acacia tetragonophylla* (Dead Finish) is in the watercourse on the right hand side. The perennial shrubs present are: *Acacia rhagodioides* (near *E. longifolia*), *A. vesicaria* (foreground) and *Solanum ellipticum* (right foreground). Other ground cover plants are *Bassia divaricata* and various annual and perennial grasses.

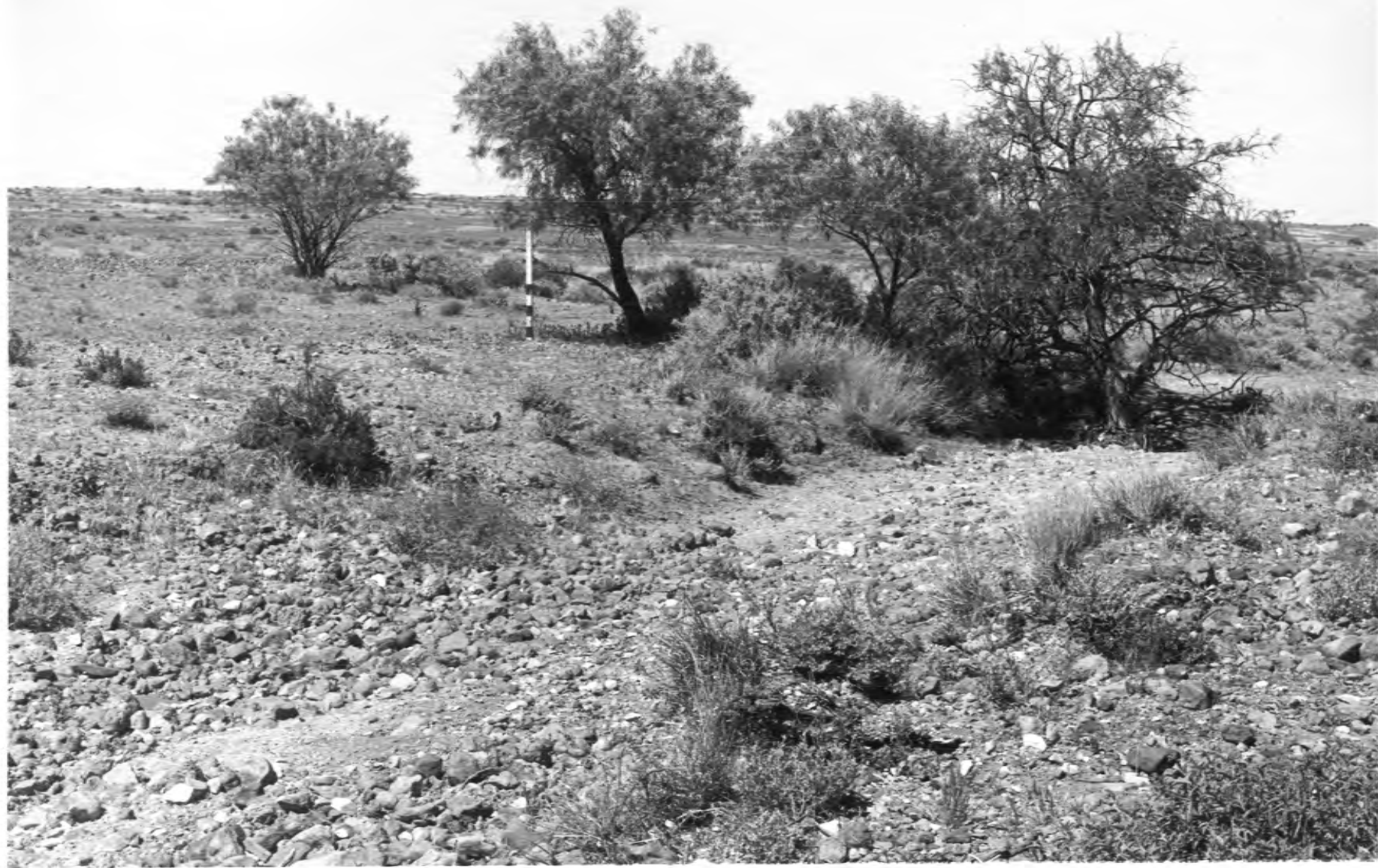
Soil: Coarse alluvium and stony clay.

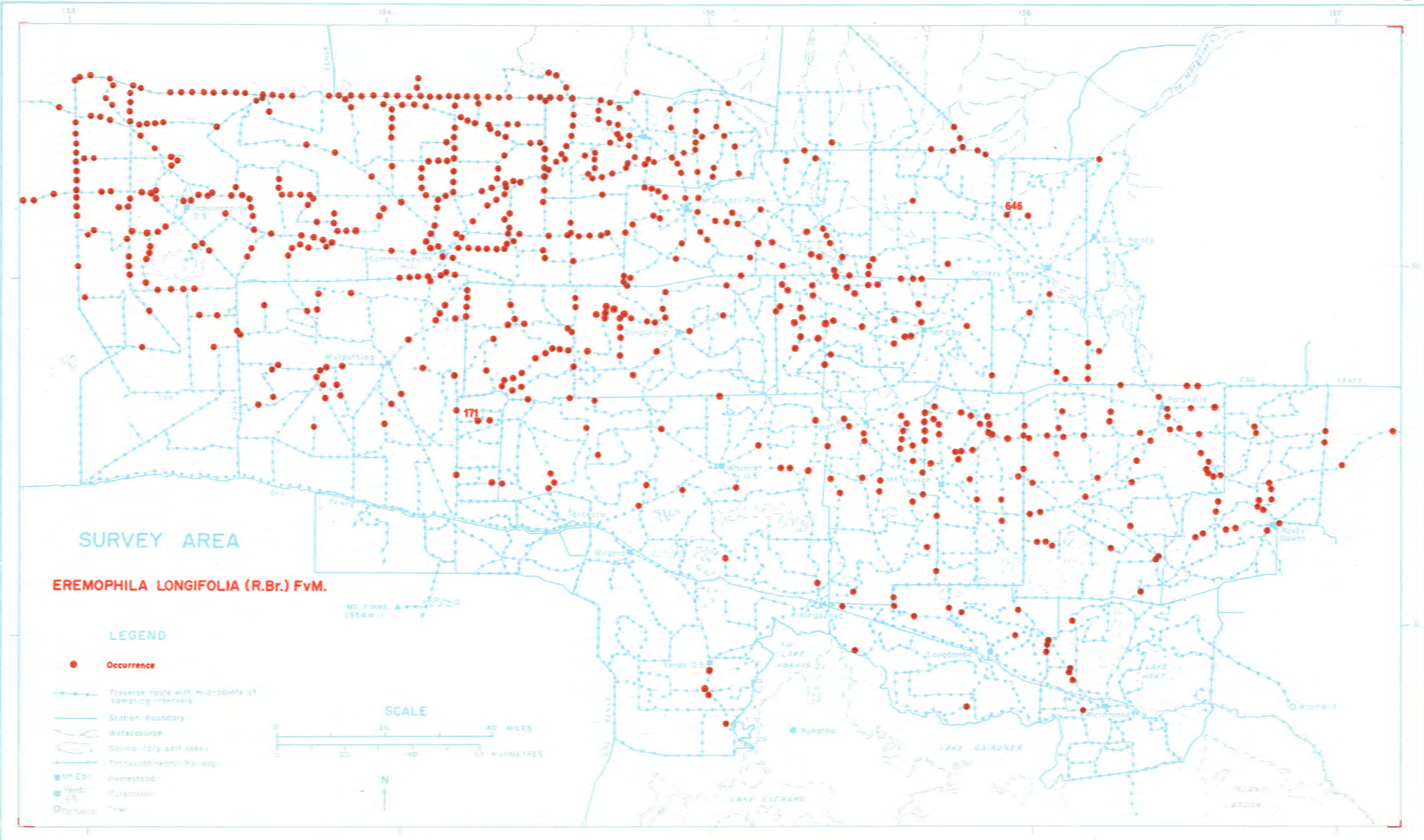
Grazing Pressure: Negligible now; has been light - moderate in the past.

Rainfall: 4.8" (122mm).

Page 82. Distribution Map: Occurrence.

Comments: Like *Acacia oswaldii*, this species was found in a wide range of habitats, and was only absent from the southern dunefields. It was most common in *Acacia aneura* woodlands on sandy soils, though it was nowhere common, only one or two bushes being seen at any one time. Occasionally it formed dense clumps, presumably by root suckering. The map suggests a northern distribution for the species, but it is recorded from most drier parts of Australia, and as far south as Adelaide.





MAP 26. - EREMOPHILA PAISLEYI F.v.M. (Narrow leaved form).

Page 84. Photopoint 17: Bon Bon Station, May 1971. Two specimens of this plant are shown in an *Acacia aneura* woodland. A collapsed specimen is visible in the middle distance. The scale post is 1 metre high. Shrubs, mostly dead, are *Kochia erioclada*. The sparse ground cover is dead ephemeral grass, probably *Schismus barbatus*.

Soil: 10cms of sandy loam overlies silty clay.

Grazing Pressure: Light.

Rainfall: 5.7" (145mm).

Page 85. Distribution Map: Occurrence.

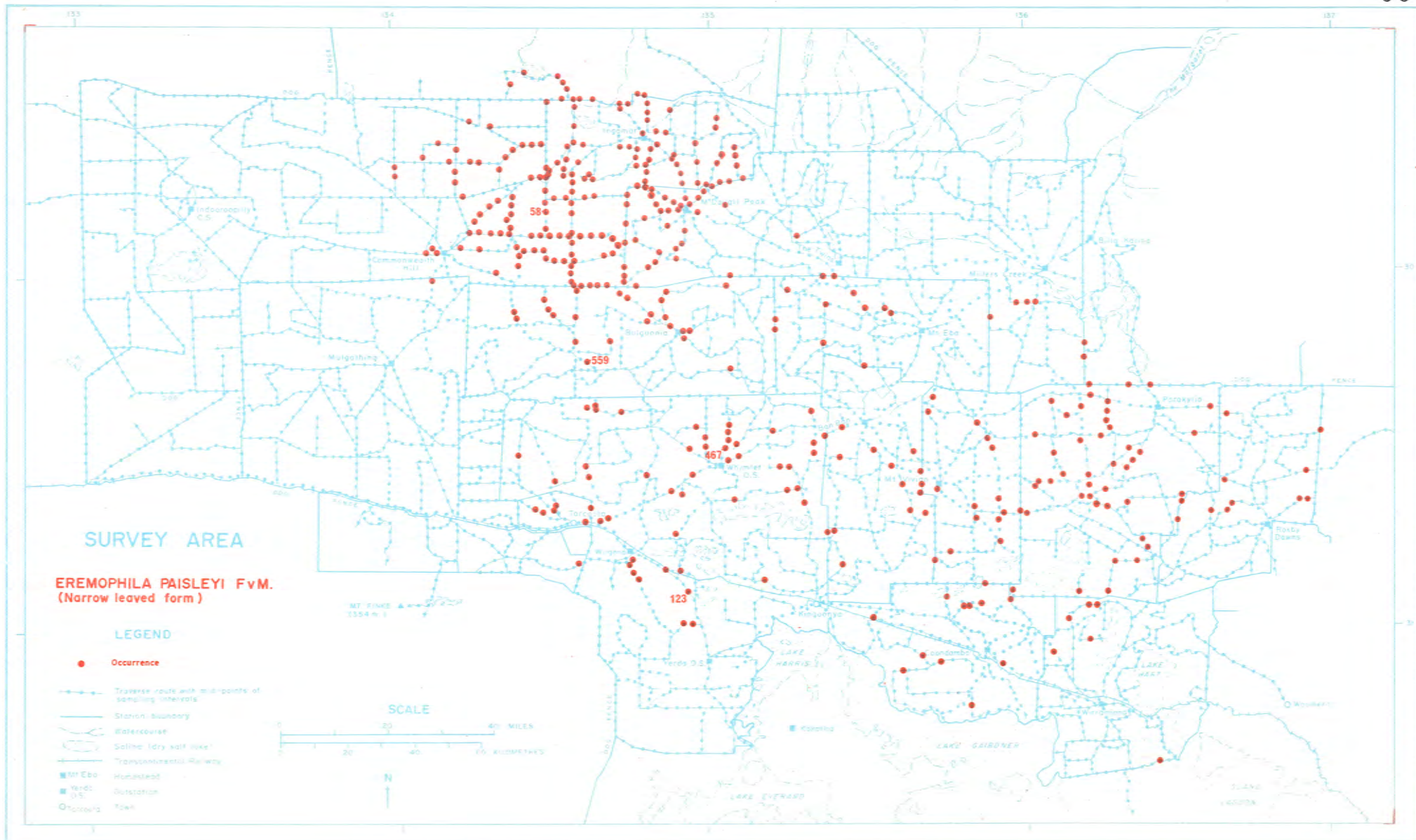
Comments: When this species was first selected for the survey, it was erroneously identified from available material as *Eremophila gibsonii* F.v.M. During the survey normal (broadleaved) specimens of *E. paisleyi* were seen and identified, but the species was not included because of its vegetative resemblance to *Cassia nemophila* var. *platypoda* with which it occurred. It was not until much later in the survey that specimens of the plant included here were positively identified as *E. paisleyi*.

In his original description, Mueller (1859) illustrated both the broad and narrow-leaved forms. As the broad-leaved form was not seen or collected in the area over which the narrow-leaved form was found (it was restricted to the southern dunefields), these should probably be given varietal or subspecific status. The narrow-leaved form occurs as scattered individuals in Mulga woodlands on heavier soils, and on shallow calcareous soils in chenopod shrublands. Its abundance in the

Ingomar - Commonwealth Hill area is unexplained, although a somewhat similar occurrence of *Hakea leucoptera*, *Grevillea nematophylla* and *Templetonia egena* was observed. This possibly reflects a more favourable environment provided by dunefields into which watercourses from the Stuart Range flood out after heavy rains.

The known distribution of *E. paisleyi* is from this area westwards to Western Australia, as well as from the Everard Range to southern parts of the Northern Territory.





MAP 27. - EREMOPHILA ROTUNDIFOLIA F.v.M.

Page 87. Photopoint 39: Ingomar Station, June, 1971. The photograph was taken on an ironstone outcrop in sandy country. Young (in front of scale post), mature (right of scale post), and senescent plants are shown. Trees in the background are *A. aneura* and dead ephemeral *Aristida* sp.

Soil: Sandy loam overlies rock.

Grazing Pressure: Light.

Rainfall: 5.6" (142mm).

Page 88. Distribution Map: Occurrence.

Comments: This species was most common on shallow calcareous soils, where it occurred with *Kochia sedifolia* in an arid shrubland community. Over a few intervals it occurred abundantly enough to be classed as a character plant. It occurred less abundantly on the "Mt. Eba" soils with calcrete at depth (usually with scattered *K. sedifolia*) and on shallow rocky soils. There were, however, large areas, even within these soil types, where it was absent, and the reasons for these gaps are not known. The map shows the southern half of its known distribution which extends sporadically to the far north of the State. It is unpalatable to stock and regeneration was fairly commonly observed.



MAP 28. - EREMOPHILA SCOPARIA (R.Br.) F.v.M. "Broombush"

Page 90. Photopoint 33: Ingomar Station, June 1971. The photograph shows a dense stand of this shrub, composed of young, mature and senescent individuals. In the slight depression at the rear, a few mature *Acacia aneura* trees are shown, with dense regeneration. *A. tetragonophylla* is also present there. In the foreground, two bushes of *Kochia* sp. are shown, with a ground cover of young *Bassia sclerolaenoides*.

Soil: Sandy loam with increasing clay at depth.

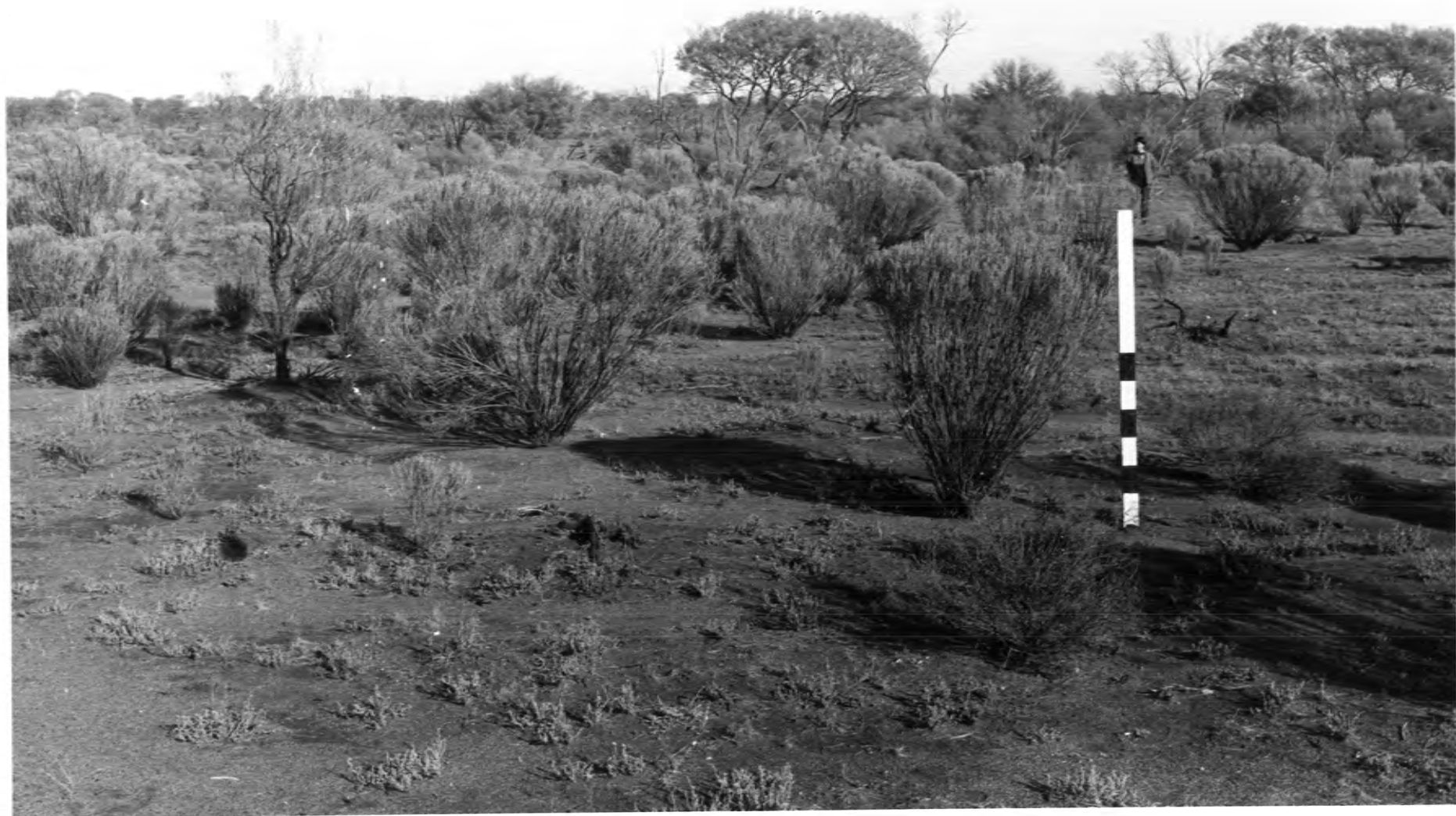
Grazing Pressure: Light.

Rainfall: 5.6" (142mm).

Page 91. Distribution Map: Occurrence.

Comments:

E. scoparia, like *Acacia oswaldii*, is apparently tolerant of a wide range of environmental conditions. It occurred on all soil types except dune sands, and in all areas with more than 5" (127mm) average annual rainfall. It is very unpalatable to stock, and was often seen regenerating freely in places grazed bare of other forage. This species has a somewhat variable external morphology in some localities, a distinctly less glaucous form occurring in the far West, while in the Stuart Range (Millers Creek Station), a distinct variant was found growing in watercourses. A specimen was identified as *E. cf. delisseri* F.v.M. which is closely related but not known from that region. The recorded distribution of *E. scoparia* is throughout the southern half of arid Australia.



Page 93. Photopoint 73: Unoccupied Crown lands just west of the Dog Fence, Commonwealth Hill Station, September 1971. The photograph was taken looking south-west from the post. Two plants of *E. sturtii* are shown growing together, with intertwined shrubs of *Rhagodia spinescens*. Just to the left of the clump is an *Acacia tetragonophylla*, and an isolated *Kochia sedifolia* (Bluebush) is growing in front of the scale post. Trees at the rear are *Acacia aneura* and *A. linophylla*, killed by a fire in 1967. The ground cover consists of a few tussocks of *Eragrostis eriopoda*, and dead ephemerals, chiefly composites and *Aristida* sp.

Soil: Deep sand overlies calcrete.

Grazing Pressure: Negligible.

Rainfall: 6.8" (172mm).

Page 94. Distribution Map: Occurrence.

Comments:

The distribution of this plant in the survey area bears no relation to known environmental variables. It occurs on both sandy-loam flats and deep sand on low dunes, and was only absent from shallow calcareous soils.

It could be argued that the map shows the typical picture of an invading species with limited dispersion of propagules. It is certainly true that the species is widespread in similar habitats and rainfall to the east of the area. It is also one of the chief components of scrub regrowth and invasion in a semi-arid region of New South Wales (Anon., 1969). However there was no indication of extensive regeneration of the plant near the margins of its distribution, and the few outliers shown all represented mature plants. Apart from a recent collection at Maralinga, it is not known from further west, although it was observed to be common 50km west of the survey area, and would appear to be invading from the north-west. It is common throughout the south-eastern portion of the Australian arid zone.



MAP 30. - EUCALYPTUS MICROTHECA F.v.M. "Coolabah", and
TRIODIA LANATA Black "Porcupine Grass"

Page 97. Photopoint 35: Mabel Creek Station near Ingomar boundary, June 1971. The specimen shown here is in a swale of sand dunes near the channels of the Carringallana Creek watercourse, and probably subject to inundation after heavy rains. The small shrubs surrounding it are *Cassia nemophila* var. *platypoda*, while the trees in the rear on the dune are *Acacia linophylla* and *A. aneura*. Perennial grass tussocks are *Eragrostis eriopoda*.

Soil: Deep sand.
 Grazing Pressure: Negligible.
 Rainfall: 5.6" (142mm).

Page 98. Near Photopoint 10: Mt. Vivian Station, May 1971. A community of *Triodia* is shown with a predominance of dead individuals (hummocks) in the foreground. The live hummocks are about 50cm high, with dead flowering stalks projecting 50-100cms above them. The shrub in the middle distance is *Acacia oswaldii*, with an *Acacia aneura* woodland in the background.

Soil: Deep sand.
 Grazing Pressure: Light.
 Rainfall: 6.0" (152mm).

Page 99. Distribution Map: *Eucalyptus microtheca* and *Triodia lanata*: Occurrence.

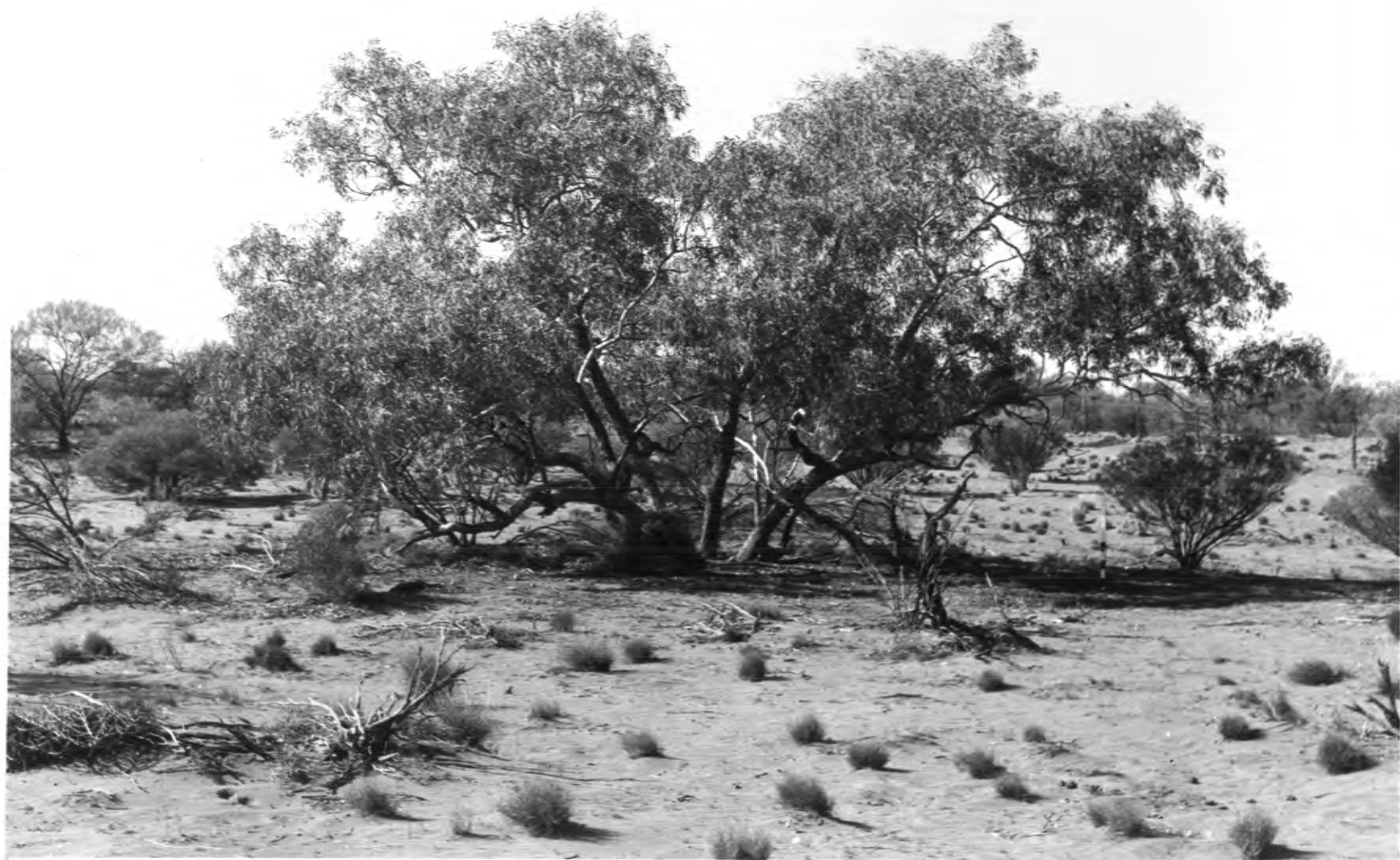
Comments:

- (a) *E. microtheca*: The coolabah is restricted to larger watercourses in the north of the survey area, and occurs further north throughout the central and northern regions of arid Australia. The map defines part of the southern margin of its distribution. It appears to be more drought resistant and salt tolerant than

E. camaldulensis Dehn. (River Red Gum). This latter species occurs on the larger watercourses further north, but only in their upper reaches, where stream flows are more frequent and soil less saline. Typically *E. microtheca* occupies the lower reaches of these streams (Jessup, 1951). At Lake Phillipson, it forms part of a vegetation zonation around the lake, just above the zone occupied by *Melaleuca lanceolata*. It occurs either as a mallee with several stems, or as a low tree with a single stem (Photopoint 37). Regeneration was seldom seen.

- (b) *Triodia lanata*: This species was only collected once, as illustrated. Because of the similarity of *Triodia* species, it is not at all certain that all occurrences marked are of this species. In fact, *T. lanata* was only previously known from one other locality, Minnipa on Eyre Peninsula, while both *T. basedowii* and *T. irritans* are widespread in arid areas. It would seem likely, then, that one or both species account for some of the other localities.

The main occurrence mapped was on the southern dunefields in semi-arid mallee, and a reconnaissance survey south of Mt. Finke revealed that *Triodia* species became rapidly more abundant and about 30km south formed a continuous ground cover. The occurrence on Mt. Vivian appears to be actively invading the *A. aneura* woodland. In contrast with the many dead plants in the foreground of the photograph, individuals towards the margins of the community show increased vigour (right hand side of photograph), and many seedlings and small hummocks were seen around the edges. *Triodia* species spread by seed or the production of adventitious roots beneath the hummock.





MAP 31. - EUCALYPTUS PYRIFORMIS "Ooldea Mallee"

Page 101. Photopoint 78: Commonwealth Hill Station, September 1971. The specimen shown is growing on one of the low sandy rises superimposed on a broad calcareous rise or low hill. It has a mature stem 10m high, two fallen stems, dead for different lengths of time, and several young sprouts to take their place, all from the same lignotuber. The associated shrubs are *Eremophila longifolia* and the low trees at the rear are *Acacia linophylla*. In the foreground is a leafless shrub of *Lycium australe*. The ground cover is of ephemeral composites, with tussocks of *Eragrostis eriopoda*.

Soil: Deep sand.
 Grazing Pressure: Light (Negligible before 1950).
 Rainfall: 6.5" (165mm).

Page 102. Distribution Map: Occurrence.

Comments: The plant mapped here has been named by Boomsma (1972) as *E. pyriformis* ssp. *youngiana* (F.v.M.) Boomsma. In the past this plant has been variously called *E. pyriformis* Turcz. and *E. youngiana* F.v.M.

The recorded occurrence of this subspecies is in scattered localities in the Graat Victoria Desert, north to the Birksgate Range, and around the Nullarbor Plain (e.g. at Ooldea). Sub-species *pyriformis* has only been collected in a semi-arid area west of Kalgoorlie, Western Australia. Apart from its occurrence in the southern dunefields and near Mt. Finke, it would appear that the other isolated occurrences are relict populations. No regeneration was seen, and all specimens were large, mature and probably very old, as they had large lignotubers up to 2m across. Stems arising from these live for a shorter time, and most plants had the remnants of many old stems decaying on the ground.

Most occurrences were on deep sand, where the plant assumed the proportions of a large somewhat straggly mallee; however it occurred abundantly on Mt. Finke, and specimens near the summit on skeletal soil over quartzite were reduced to a scrambling shrub less than a metre high.



MAP 32. - EUCALYPTUS TRANSCONTINENTALIS Maiden.

Page 105. Photopoint 12: Mt. Vivian Station, May 1971. Three trees are shown, the tallest of which is 7m high. The photograph was taken on a low sandy rise, and shows a flat in the background with scattered *Kochia sedifolia*. Behind that again is an arid *Acacia aneura* woodland. Ground cover is mostly dead, and consists of scattered bushes (foreground) of *Kochia triptera*, with *Bassia* spp. and ephemeral grasses (*Aristida* spp.)

Soil: Deep sand.
 Grazing Pressure: Light.
 Rainfall: 5.6" (142mm).

Page 106. Distribution Map: Occurrence and Character Plant classes.

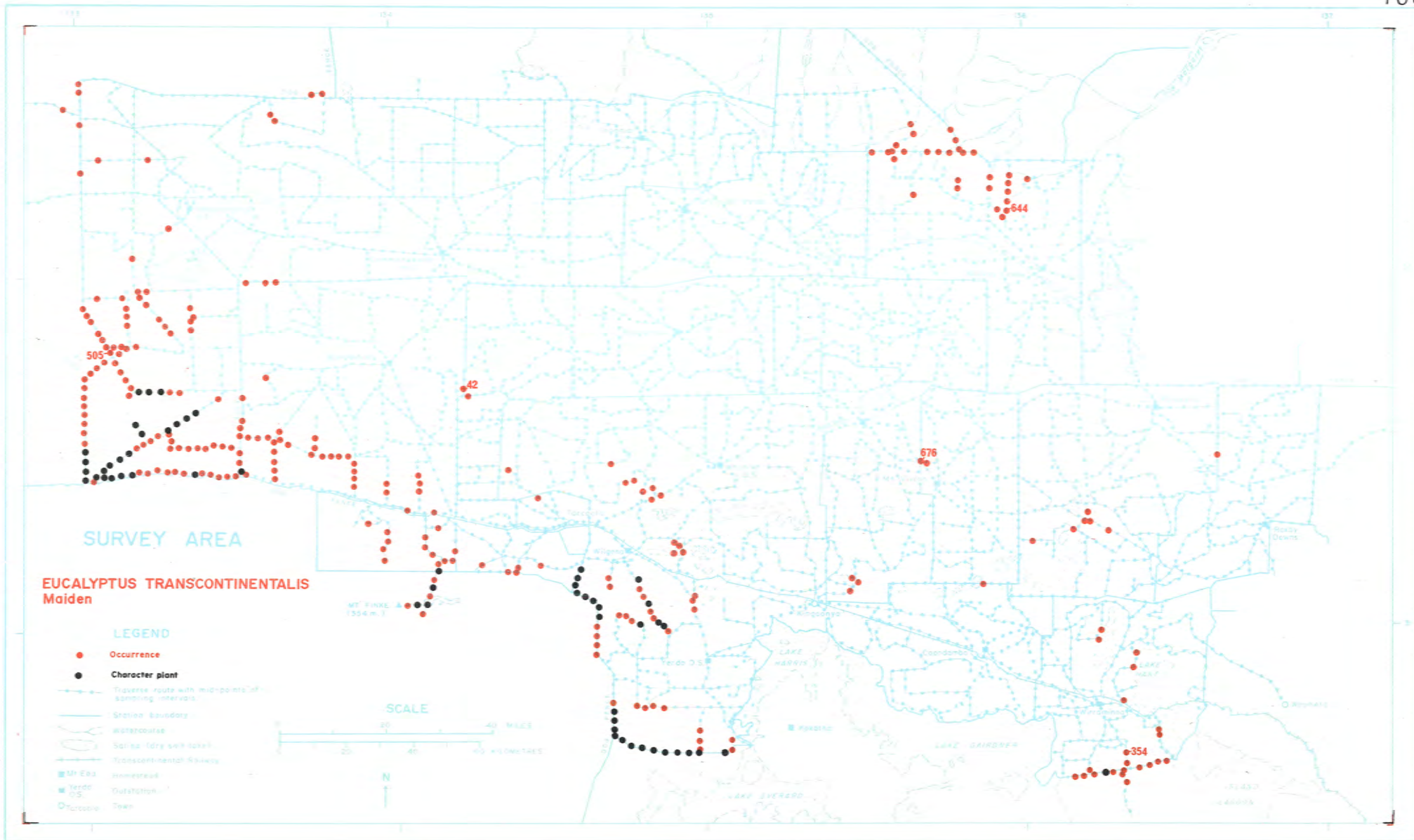
Comments: Jessup (1951) mapped the distribution of this species over his survey area as *E. oleosa* F.v.M. ex Miq. Herbarium collections from the present survey were identified by Mr. Boomsma as *E. transcontinentalis*, but close to *E. socialis* F.v.M. ex Miq. However his description of *E. socialis* (1972) in which he includes *E. transcontinentalis* in part, fits the description of most of the specimens collected, and it occurs over most of the State. Eichler (1965) regards *E. socialis* F.v.M. ex Miq. and *E. oleosa* var. *glauca* Maiden as synonyms of *E. transcontinentalis*.

As Boomsma himself mentions, it is clear that the taxonomy of this group, including *E. oleosa* and its many varieties, needs clarification. The criterion used for identification in this survey was that the buds and fruits resembled the *E. socialis* illustrated by Boomsma (1972). All specimens of mallee seen had this type except in the southern dunefields, where others, e.g. *E. concinna* and

E. oleosa var. *peeneri*? also occurred. Occurrence records refer to *E. transcontinentalis*, while the character plant classes refer to all *Eucalyptus* species mentioned in these comments. Character plant classes applied to all areas where the density was more than about 40 mallees / ha.

E. transcontinentalis had an unusual range of habitat. Although most abundant in the southern dunefields, it also occurred on kopi dunes around claypans, and occasionally on sandy areas elsewhere. Jessup regarded this species as being relict in these other (more arid) locations. The occurrences on the top or sides of otherwise treeless rocky hills or residuals (photopoint 87) certainly suggests this, and regeneration was only seen in watercourses in these more northern occurrences (photopoint 52). The species is recorded throughout the southern half of Australia in arid and semi-arid regions.





MAP 33. - GREVILLEA NEMATOPHYLLA F.v.M. "Water Bush"

Page 108. Photopoint 34: Ingomar Station, June 1971. Two young mature plants about 3m high are shown.

A seedling 40cm high is in the left foreground in front of a bush of *Eremophila duttonii*. Behind the *E. duttonii* is a juvenile plant of Mulga (*A. aneura*) 2-3m high. On the far right hand side are two bushes of *Cassia nemophila* var. *platypoda*. Other trees visible are *A. aneura*. Ground cover is the dead ephemeral grass *Aristida contorta*. A single *Atriplex vesicaria* (saltbush) 20cm high is visible to the right of the *E. duttonii*.

Soil: Deep sandy loam.

Grazing Pressure: Light and intermittent.

Rainfall: 5.8" (147mm).

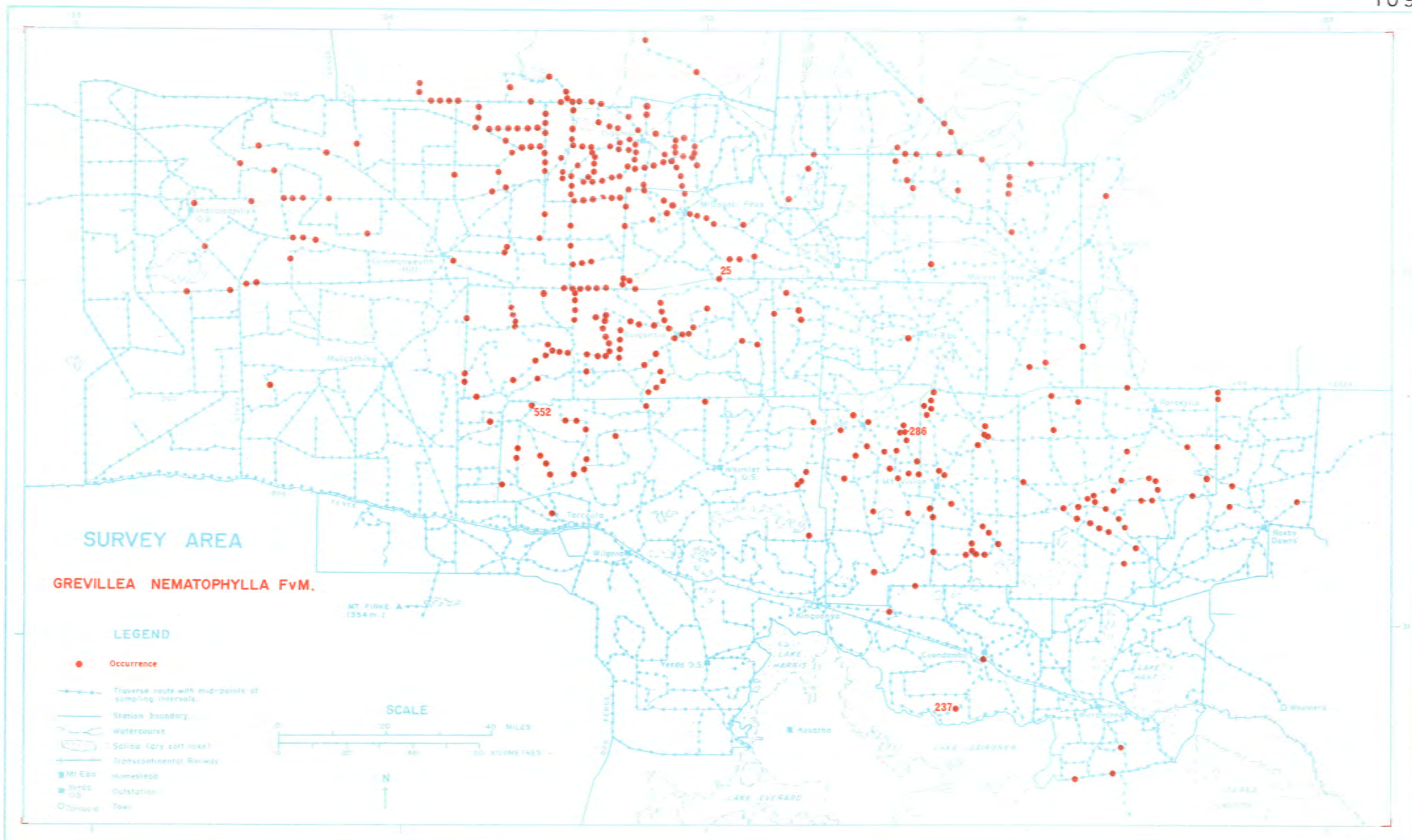
Page 109. Distribution Map: Occurrence.

Comments.

Boomsma (1972) remarks that this species occurs on most soil types. On this survey it was most abundant on sandy areas, or low sandy-loam rises in the more arid parts, but not in dunefields. In the Stuart Range it occurred on the gibber-covered shale slopes of the residuals, while the largest specimens (10m high) were seen as isolated occurrences on Wirraminna and Coondambo Stations, in sandy depressions. It was absent from the southern dunefields.

In South Australia this species is only recorded for the North-west, extending through the more southern arid parts of Western Australia. It is also recorded from the Western division of New South Wales. The natives obtained water from the roots of this plant.





MAP 34. - GREVILLEA STENOBOTRYA F.v.M. andACACIA SALICINA Lindl. "Broughton Willow"

Page 111. Photopoint 72: New Cattle Block; Commonwealth Hill Station, September, 1971. Several young and mature plants are shown in the foreground, the largest being 3m high. Other shrubs in the background are *Acacia linophylla* (Sandhill Mulga), while the Mallees are *Eucalyptus concinna* and *E. transcontinentalis*. The perennial ground cover includes large tussocks of *Eragrostis eriopoda*. The photograph shows the slope of a large sandhill bordering a small salina.

Soil: Deep sand.
 Grazing Pressure: Nil by stock; no rabbits evident.
 Rainfall: 8.0" (203mm).

Page 112. Distribution Map: Occurrence of *G. stenobotrya* and *A. salicina*.

Comments:

- (a) *Grevillea stenobotrya*: This species, which resembles *G. nematophylla*, was only seen in the area surveyed on the far west dunefields, but was observed quite frequently further west towards Maralinga. At Ooldea, Adamson and Osborn (1922) noted that it occurred as a co-dominant of the sandhill flora, while it has been collected in Western Australia from dunefields at a similar latitude. It would appear that this species probably occurs throughout the southern dunefields of the Great Victoria Desert. It has also been recorded near watercourses in the far north of South Australia, and into the Northern Territory, and presumably the more favourable water relations of these habitats enable it to colonize this more arid region.
- (b) *Acacia salicina*: Specimens of this large pendulous tree were only seen in some watercourses of the Stuart Range. Regeneration in the form of root suckers was usually observed. The species is always restricted to watercourses, and extends through the southern and central portions of Australia's arid and semi-arid zones.



MAP 35. - HAKEA LEUCOPTERA R.Br. "Needlebush"

Page 114. Photopoint 23: Ingomar Station, June 1971. A mature tree and seedlings of various heights up to 140_{cm} are shown. The compact growth of the seedlings and flat-topped appearance of the tree are characteristic of this species in the area. The leafless shrub in the foreground is *Lycium australe* ("Australian boxthorn"). Trees on the right and in the rear are *Acacia aneura* and a shrub of *Eremophila scoparia* is also shown on the right hand side. Ground cover is scattered grazed-off tussocks of *Eragrostis* sp.

Soil: Sandy loam with increasing clay at depth.
 Grazing Pressure: Heavy; by sheep and horses.
 Rainfall: 5.6" (142mm).

Page 115. Distribution Map: Occurrence.

Comments: In the survey area this species was characteristically found in the sandy country around claypans, or areas liable to inundation. It is apparently tolerant of a fairly high soil salt content.

It is a hardy adaptable species, and was found occasionally on all soil types except deep sands of the southern dunefields. It occurred at the limits of woody plant growth in the lowest rainfall zone. Seedlings are not palatable to stock, and regeneration was often seen. It occurs throughout the arid zone of Australia, and is one of the few trees to colonize such areas as the Simpson Desert (Crocker, 1946).



MAP 36. - HETERODENDRUM OLEAEFOLIUM Desf. "Bullock Bush"

Page 117. Photopoint 31: Ingomar - Commonwealth Hill Station boundary, June 1971. The photograph was taken in Ingomar Station, and shows two mature specimens at the northern limits of its occurrence in the survey area. These plants illustrate the typical form of this species, which varies between a low spreading tree and a small compact shrub as exemplified by the plant on the right hand side. They are growing in a community of *Acacia aneura* and *Kochia sedifolia*. Two shrubs of *Eremophila paisleyi* (narrow leaved form) are just visible on the left of the larger *H. oleaeifolium*.

Soil: 30cms of sandy loam overlies hard calcrete.
 Grazing Pressure: Moderate - Heavy; probably intermittent.
 Rainfall: 5.9" (150mm).

Page 118. Distribution Map: Occurrence.

Comments: The distribution of the Bullock bush in the survey area appears to be influenced more by latitude than by any other environmental factor. It was usually only seen as scattered trees at any one time, although it was most common in the southern dunefields. As its occurrence in the Stuart Range and vicinity was restricted to watercourses, it may only occur in such favourable habitats in more arid regions. Its known distribution extends from western New South Wales to Western Australia, at about this latitude, and also in the Central Australian ranges and in south-west Queensland. It is very palatable to all stock, and regeneration (from suckering) was only seen in unstocked areas.



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MAP 37. - MELALEUCA LANCEOLATA Otto "Moonah", "Dryland Teatree"

Page 120. Photopoint 18: Bon Bon Station, May 1971. A fringing zone of this species with a dense stand of *Atriplex vesicaria* (Bladder saltbush) is shown around a saline depression, in the middle of which samphires (*Arthrocnemum* and *Pachycornia* spp.) are growing. The scale post is 1 metre high. Other trees on sandy rises are *Acacia aneura*, and the only other plants visible are two tussocks of a grass (probably *Aristida* sp.) in the right foreground.

Soil: Deep sand overlies kopi.
 Grazing Pressure: Negligible.
 Rainfall: 5.8" (147mm).

Page 121. Distribution Map: Occurrence.

Comments: This species normally occurs in areas near the coast where it extends from Western Australia to New South Wales. It reaches its maximum development on saline or swampy soils overlying limestone and can stand full exposure to salt-laden winds on coastal sites. Presumably these qualities enable it to extend into the arid zone. In the survey area it was only found around depressions, swamps or the watercourses leading into them. Massive limestone or kopi was usually present. Prolific regeneration was observed where inundation had recently occurred. Apart from its coastal distribution, the species has been recorded from southern parts of the arid and semi-arid zone in South Australia, New South Wales and Victoria.



Page 123. Photopoint 21: Bon Bon Station, May 1971. Several plants are shown in a sandy depression which collects runoff from the adjacent Wallabyng Range. In the foreground is a scald or hardpan. The scattered ephemerals present are mostly dead *Aristida* sp. The scale post is 1 metre high.

Soil: 30cms of sandy clay hardpan overlies silty loam.
The hardpan is covered by about 30cms of sand under the shrubs.

Grazing Pressure: Light, but intermittent.

Rainfall: 6.0" (152mm).

Page 124. Distribution Map: Occurrence.

Comments: Like *M. lanceolata*, this species is also restricted to swamps, depressions or clay-pans liable to inundation. However it tends to favour heavier soils and is more tolerant of soil salinity. Also, it was never seen on kopi or massive limestone where water would drain away quickly. This accounts for the differences in distribution of the two species, for example the absence of *M. uncinata* from Roxby Downs, and of *M. lanceolata* from claypans and swamps on Ingomar and McDouall Peak Stations. On the latter Station it was observed (R. Rankin,* pers. comm. 1971) that regeneration of *M. uncinata* around the swamps there occurred after flooding at the high water mark. In many respects, specimens collected in the survey area differed from the *M. uncinata* collected in southern parts of the State. Except for leaf shape they were similar to *M. glomerata* F.v.M. However specimens of this species examined were distinctly different and came from the Flinders Range, and areas further north and west. The chief similarity of the two species was in the shape of the small globular fruit clusters. *M. uncinata* is recorded from many semi-arid and sub-humid districts in southern Australia, mostly growing in sand.

* R. Rankin - Owner / Manager, McDouall Peak Station.



MAP 39. - MYOPORUM PLATYCARPUM R.Br. "False Sandalwood"

Page 126. Photopoint 56: Parakylia Station, September, 1971. Mature trees are shown on the left hand side and in the middle centre distance. A seedling 2m high is near the scale post. Shrubs in the middle distance are chiefly *Kochia sedifolia* with some *Atriplex vesicaria* (foreground). Larger shrubs are flowering specimens of *Cassia nemophila* var. *coriacea*. Ground cover (dead) is *Bassia* spp. The photograph was taken from a limestone rise, and shows a woodland of *Acacia aneura* (Mulga) and *A. sowdenii* (Myall) at the rear.

Soil: 10cms of calcareous loam overlies 20cms of hard calcrete, with soft calcrete and gravelly loam at depth.

Grazing Pressure: Light.

Rainfall: 5.8" (147mm).

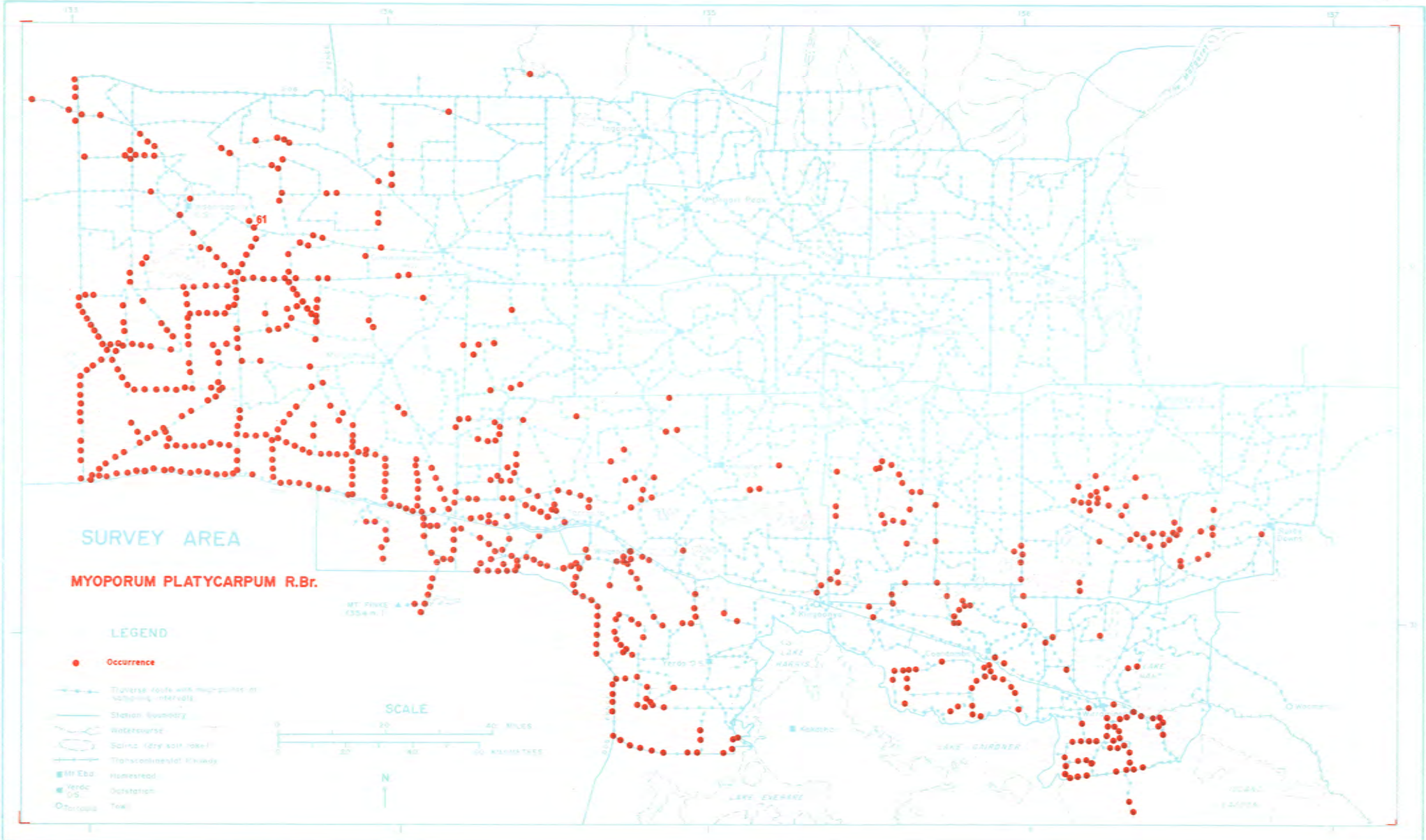
Page 127. Distribution Map: Occurrence.

Comments: This species reaches maximum development on calcareous soils in more southern arid districts. In the survey area it occurred throughout the southern dunefields, and also on shallow calcareous soils in *Kochia sedifolia* shrublands receiving more than about 6" (152mm) average annual rainfall. It was never found in depressions or other places with high soil salinity. Outliers of its distribution were found on kopi dunes near claypans.

Widespread death of this species was observed in drier parts of the north-west of the survey area, and regeneration was only seen in the better-watered parts, particularly in the southern dunefields. Death of this species has also been observed on the Koonamore Vegetation Reserve, although regeneration is occurring there.

M. platycarpum is widespread in the more southern arid and semi-arid parts of Australia and the map defines part of its northern limit.





SURVEY AREA

MYOPORUM PLATYCARPUM R.Br.

LEGEND

- Occurrence
- Traverse route with high-points at 4000m intervals
- Station boundary
- Watercourse
- Saline (dry salt lake)
- Tripartite road
- Mt. Eba
- Road
- Station
- Tank



MAP 40. - PITTOSPORUM PHYLLIRAEOIDES DC. "Weeping Pittosporum"

Page 129. Photopoint 28: The Twins Station, June 1971. A large specimen is shown growing in a broad watercourse from the Stuart Range. Another tree of the species is visible further up the watercourse. Both are infested with the parasite *Lysiana exocarpi* ssp. *exocarpi* (Mistletoe). This area has been heavily grazed in the past, and the drifting sandy soil is being held by the dead remains of *Atriplex vesicaria* and ephemerals.

Soil: Variable loose sand and alluvium overlies stony clay.
 Grazing Pressure: Moderate - Heavy but intermittent.
 Rainfall: 5.3" (135mm).

Page 130. Distribution Map: Occurrence.

Comments: The photograph illustrates a typical habitat of this species in the survey area. It was most common along watercourses and as isolated individuals in treeless tableland country, particularly on Millers Creek and Mt. Eba Stations. It also occurred commonly in the Stuart Range, on the slopes of low residuals, and along outwash channels to the limit of woody plant growth. It was less common in the southern dunefields, where it was typically smaller and occurred as dense clonal colonies. This species was very similar in appearance at a distance to *Santalum lanceolatum* (Map 42) and as it often occurred with this plant, checks were frequently made of doubtful specimens. In general *P. phylliraeoides* has a white trunk and bright green foliage, while *S. lanceolata* has a dark or fissured trunk and bluish-green foliage which is somewhat less dense. *P. phylliraeoides* occurs sparsely over most of arid Australia and in semi-arid southern districts as far south as Adelaide and the "Big Desert" in Victoria.



MAP 41. - SANTALUM ACUMINATUM (R.Br.) A.DC. "Quandong"

Page 132. Photopoint 65: Parakylia Station, September 1971. Three trees are shown in an *Acacia sowdenii* (Myall) woodland. These plants were fruiting heavily at the time. The ground cover is an ephemeral growth of *Zygophyllum* sp.

Soil: Calcareous stony loam.
 Grazing Pressure: Light and intermittent.
 Rainfall: 5.7" (145mm).

Page 133. Distribution Map: Occurrence.

Comments:

An effect of grazing is possibly illustrated by the distribution map of this species. The sudden fall-off of sightings on Roxby Downs cannot be correlated with any boundaries of environmental variables. However this Station has for many years carried substantial numbers of cattle, and these have probably been run in every paddock. Quandong was observed to be very palatable to cattle, and trees like the ones in the photograph can be reduced to twiggy stumps by these animals, as the branches are brittle and easily break off when pulled.

In general the species was restricted to sandhills in the west, but extended onto the deeper calcareous soils under Myall (*Acacia sowdenii*). Further north it was restricted to more favourable habitats, particularly in sandy watercourses and on kopi with *Melaleuca lanceolata*. The overall distribution of this species is throughout the southern parts of the arid and semi-arid zones. It also occurs in the Central Australian ranges in isolated places.



MAP 42. - SANTALUM LANCEOLATUM R.Br. var. ANGUSTIFOLIUM Benth. "Wild Plum."

Page 135. Photopoint 61: Roxby Downs Station, September, 1971. A mature tree and many seedlings or root suckers are shown near a small sandy watercourse. Other trees are *Acacia aneura* in the background, with a *Hakea leucoptera* on the right hand side in the foreground. The dense ground cover is fruiting plants of the weed *Brassica tournfortii*. Other shrubs are *Kochia erioclada*. Just to the left of the *S. lanceolatum* at the rear is a sand dune on which a mature *Callitris columellaris* is growing. The watercourse is between the photopoint post and the scale post.

Soil: Deep sand overlies clay.

Grazing Pressure: Light.

Rainfall: 5.5" (140mm).

Page 136. Distribution Map: Occurrence.

Comments: This small tree or shrub was generally restricted to "Mt. Eba" type soils (alkaline red earths), and to the largely treeless tableland soils of Millers Creek and The Twins Stations. It was fairly common in watercourses in the Stuart Range. On Ingomar and McDouall Peak Stations it occurred in swales of sandridges where these were superimposed on the soil types mentioned above. The species is widespread throughout central and northern parts of Australia's arid zone.



MAP 43. - SARCOSTEMMA AUSTRALE R.Br. "Tableland Caustic Bush"

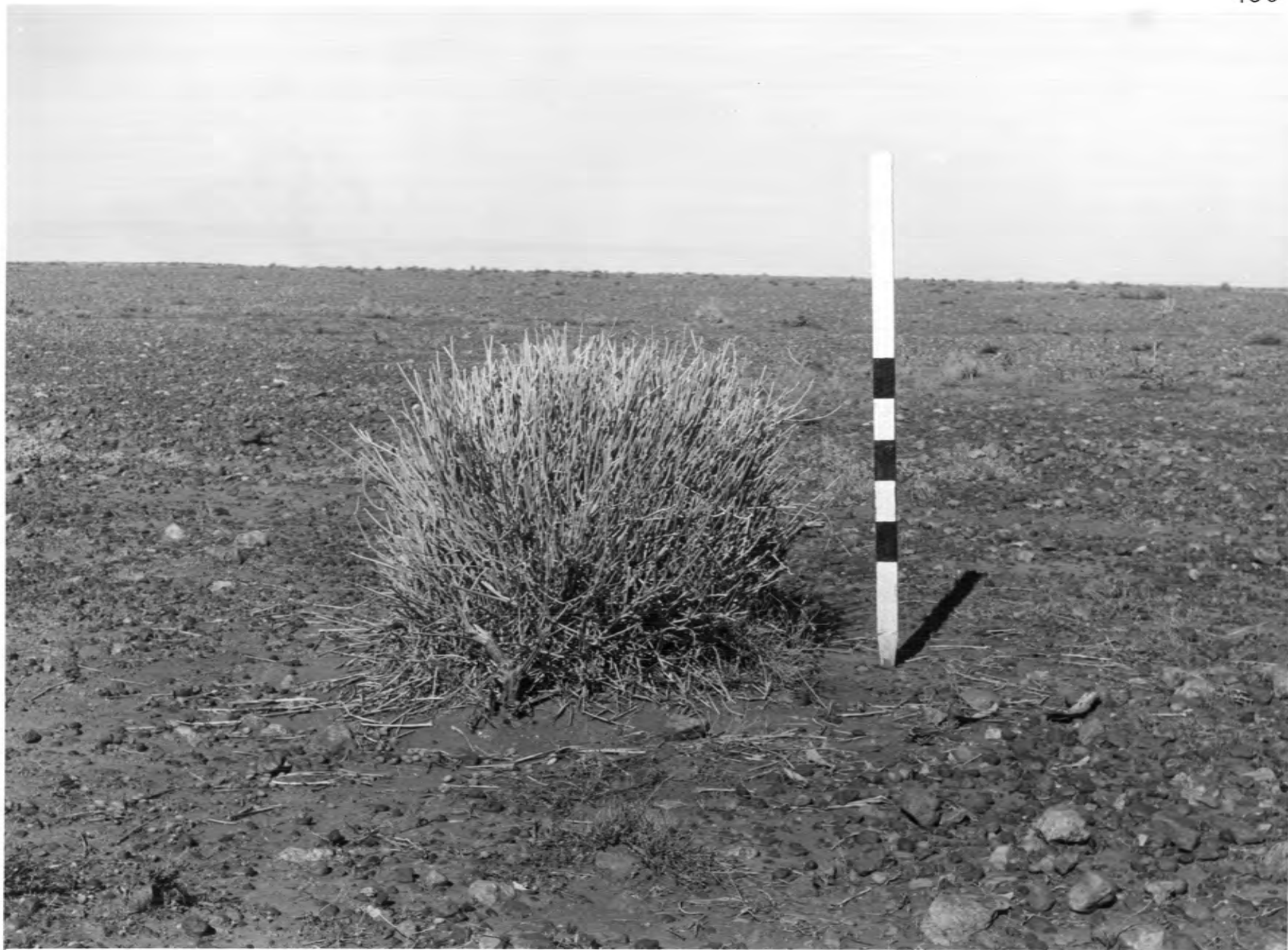
Page 138. Photopoint 27: The Twins Station, June 1971. A single plant is shown on a barren gibber-covered tableland which is the characteristic habitat of this species. The great number of fleshy stems arise from a common rootstock. The whitish ephemeral in small depressions at the rear is *Atriplex spongiosa*.

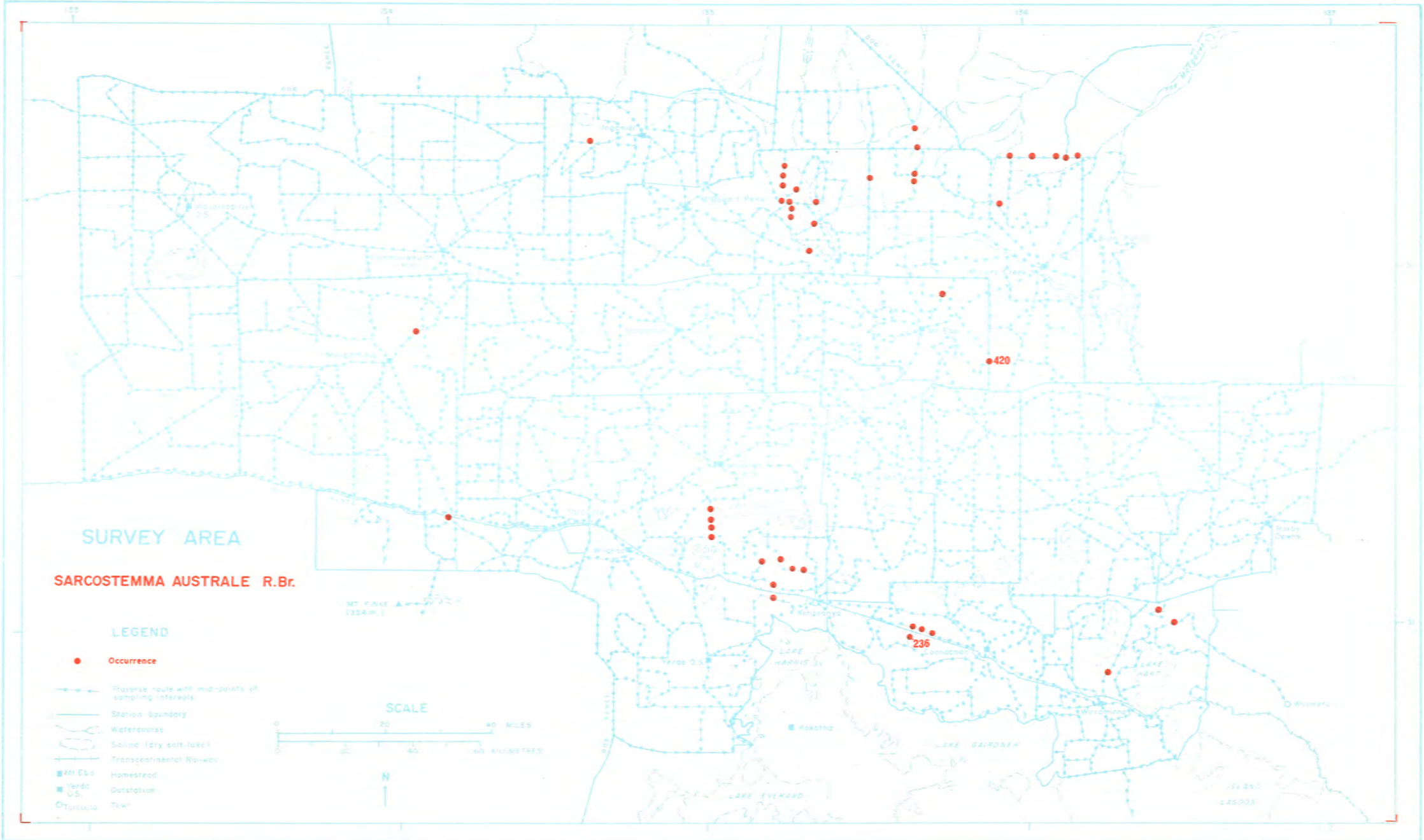
Soil: Stony clay loam.
 Grazing Pressure: Light - Moderate but intermittent.
 Rainfall: 5.3" (135mm).

Page 139. Distribution Map: Occurrence.

Comments: This species was only seen on treeless "tableland" soils except one specimen at Malbooma, which occurred on a granite outcrop. In the Stuart Range it was mostly seen on these soils on the tops of residuals. Regeneration if present was not seen, but this plant is most unpalatable to stock, and portions of the stem can take root when buried.

It is one of the very few leafless succulent plants native to arid regions of Australia. It occurs in suitable localities over most of the arid and semi-arid zones.





MAP 44. - TEMPLETONIA EGENA (F.v.M.) Benth.

Page 141. Photopoint 30: Ingomar Station, June 1971. A mature specimen 2.5m high is shown in a sandy *A. aneura* woodland. The multi-stemmed shrub on the left hand side in the middle distance is a young *Acacia linophylla* (Sandhill Mulga). The perennial grass is *Eragrostis eriopoda* (Woollybutt).

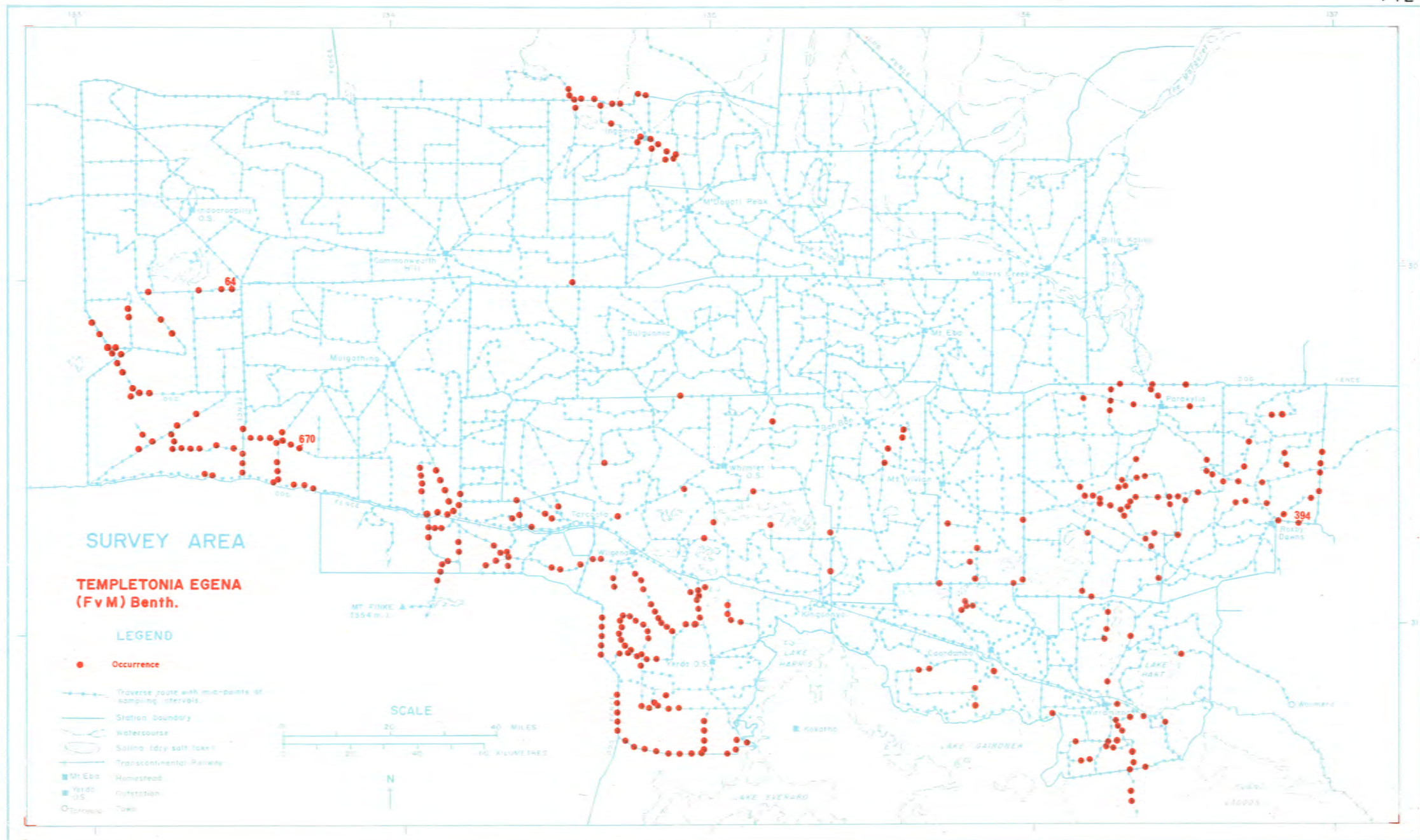
Soil: Deep sand.
 Grazing Pressure: Light - Moderate.
 Rainfall: 5.6" (142mm).

Page 142. Distribution Map: Occurrence.

Comments: In general this plant occurred in southern dunefields on the heavier soils of swales, or in peripheral sandy-loam flats and chenopod shrublands. In the west it was restricted to the southern parts, but in common with several other species it occurred in lower rainfall dunes further east. This could possibly be explained by a greater benefit being received from runoff from the hard clay interdune flats in these eastern dunefields. Certainly the isolated occurrence on Ingomar Station reflects the favourable habitat created by the inflow of large watercourses into sand-dune areas.

This species occurs throughout the arid zone of Australia, but in general is more common in the higher rainfall margins and in the semi-arid zones of the south and east.

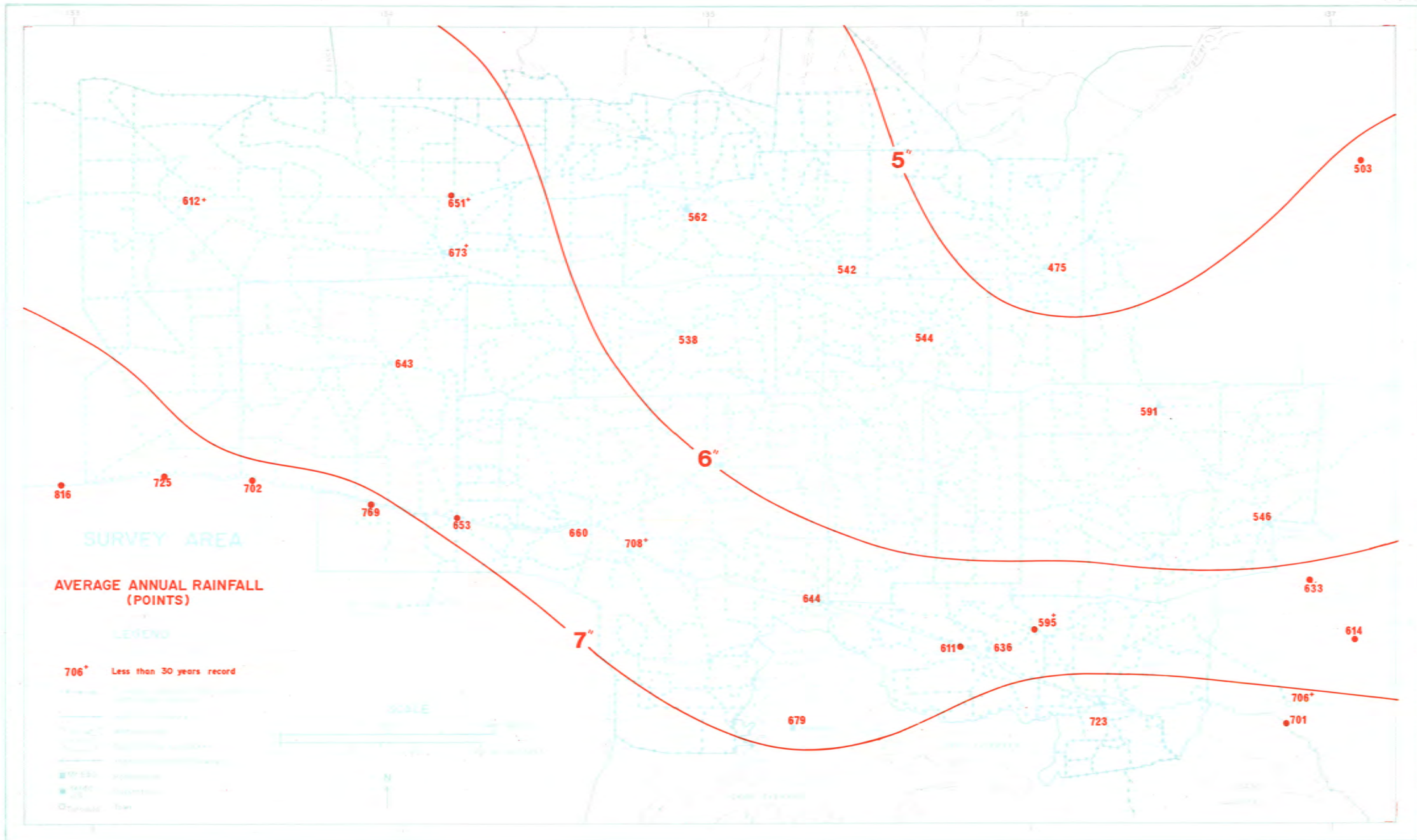




MAP 45 - AVERAGE ANNUAL RAINFALL.

Figures provided by courtesy of the Bureau of Meteorology and the Pastoral Board, Adelaide, for all years of record up to 1970. Isohyets, in inches, are approximate only. For comments on the reliability of these figures see Volume I, Chapter 2. Solid red circles indicate the position of Stations not shown on the base map. Metric equivalents and recording stations are given below.

Rainfall			Rainfall		
Points	Milli- metres	Recording Station.	Points	Milli- metres	Recording Station
433	110	Billa Kalina H.S.	643	163	Mulgathing H.S.
475	121	Millers Creek H.S.	644	164	Kingoonya
503	128	Stuart Creek H.S.	651	165	Comet O.S.
538	137	Bulgunnia H.S.	653	166	Malbooma R.S.
542	138	The Twins H.S.	660	168	Tarcoola
544	138	Mt. Eba H.S.	673	171	Commonwealth Hill H.S.
546	139	Roxby Downs H.S.	679	172	Kokatha H.S.
562	143	McDouall Peak H.S.	701	178	Pimba R.S.
591	150	Parakyliia H.S.	702	178	Wynbring R.S.
595	151	East Well O.S.	706	179	Woomera Aerodrome
611	155	Coondambo R.S.	708	180	Wilgena H.S.
612	155	Indooroopilly O.S.	723	184	Wirraminna H.S.
614	156	Arcoona H.S.	725	184	Mt. Christie R.S.
633	161	Purple Downs H.S.	769	195	Lyons (354 mile) R.S.
636	162	Coondambo H.S.	816	207	416 Mile R.S.

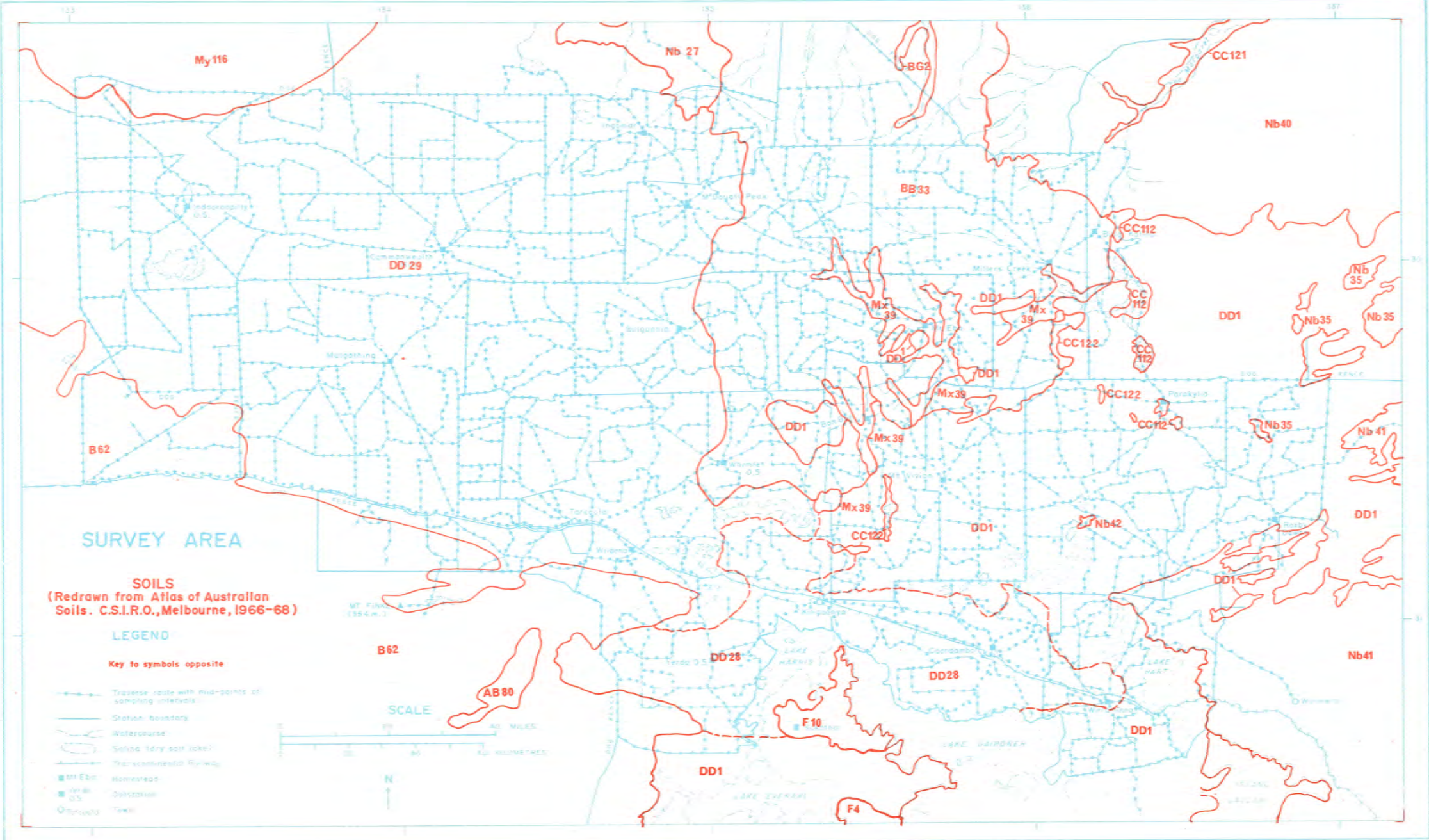


MAP 46 - SOILS

Redrawn from Northcote, K.H.: Atlas of Australian Soils, sheet 10, C.S.I.R.O.,
Melbourne 1966-68. Scale 1 : 2,000,000 or 1" = 31.57 miles.

Key to Symbols.

AB 80	--	Shallow red earthy sands underlain by calcrete at shallow depths (often less than 12 inches).
B 62	--	Siliceous sands.
BB 33	--	Shallow calcareous loamy soils.
EG 2	--	Deep calcareous loamy soils.
CC 112, 121-122	--	Deep grey self-mulching clays, between sandy or undescribed soils.
DD 1, 28- 29	--	Brown calcareous earths (with some shallow calcareous loams).
F 4, 10	--	Shallow dense loamy soils, with some brown sand on dunes, and covered with gibbers on rises.
Mx 39	--	Alkaline red earths in broad shallow valleys, with sandy-surfaced red duplex soils.
My 116	--	Neutral red earths between siliceous dunes.
NB 27, 35, 40-42	--	Crusty loamy soils with red clayey subsoils, and sporadically bleached subsoils.



SURVEY AREA

SOILS
(Redrawn from Atlas of Australian Soils. C.S.I.R.O., Melbourne, 1966-68)

LEGEND

Key to symbols opposite

- Traverse route with mid-points of sampling intervals
- Station boundary
- Watercourse
- Saline (dry salt lake)
- Trans-Australian Railway
- Homestead
- Station
- Town



B 62

AB 80

DD 1

F 10

F 4

DD 28

DD 28

DD 1

Nb 41

DD 1

Nb 42

DD 1

Mx 39

DD 1

Mx 39

DD 1

CC 122

DD 1

CC 112

CC 112

DD 1

Mx 39

DD 1

Mx 39

Nb 35

Nb 35

Nb 41

DD 1

Nb 35

Nb 35

DD 1

Nb 40

CC 121

BG 2

Nb 27

My 116

DD 29

B 62

Mt Fyfe (154 m.)

Indooregilly O.S.

Mt Douglas Peak

Wymlet O.S.

Wymlet O.S.

Wymlet O.S.

Wymlet O.S.

Wymlet O.S.

Wymlet O.S.

Wymlet O.S.

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Wymlet O.S.

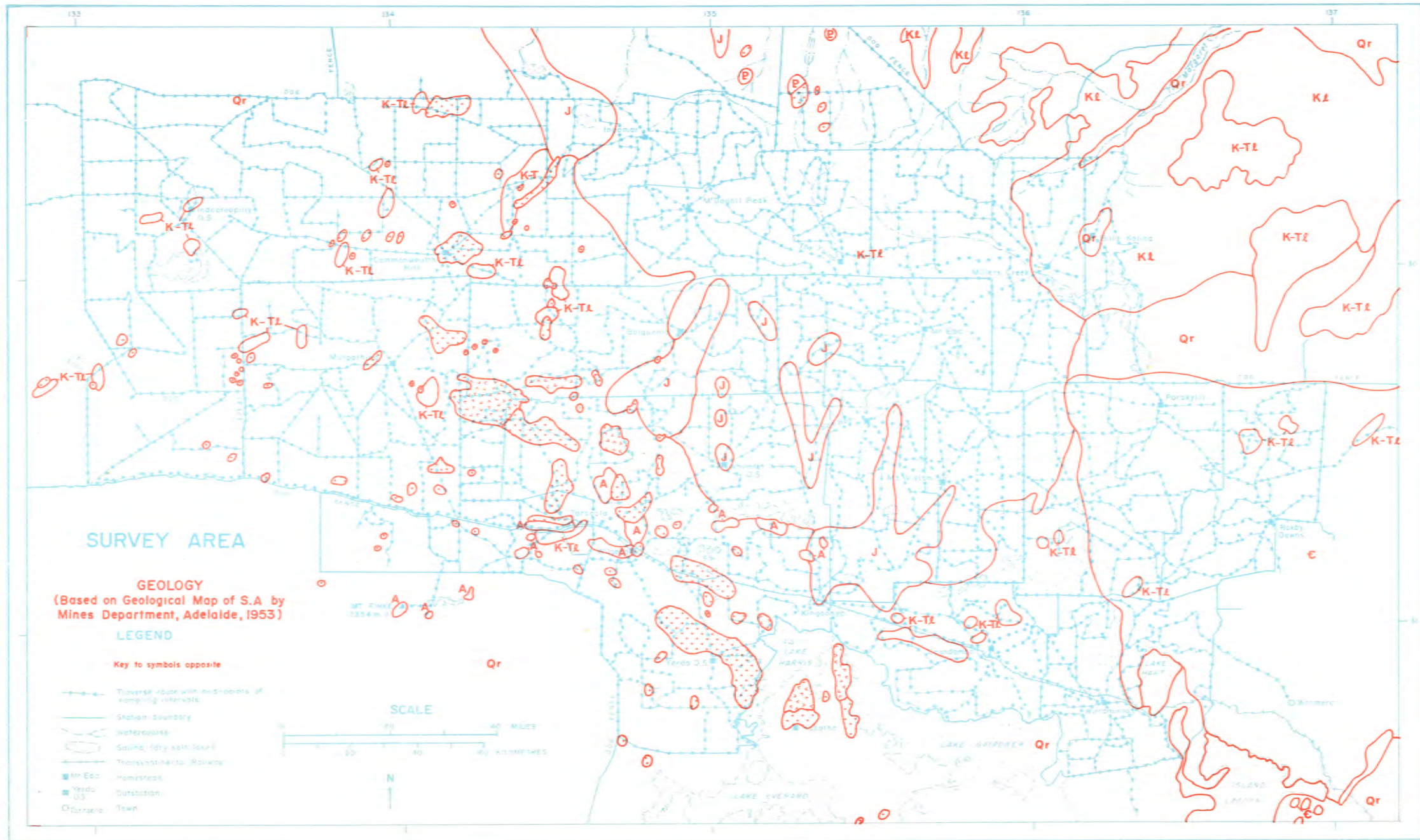
Wymlet O.S.

Wymlet O.S.

MAP 47. - GEOLOGY.

Based on "Geology of South Australia", Mines Department, Adelaide 1953, at 1" = 32 miles, with additional information by courtesy of G. Whitten (unpublished, Mines Department, Adelaide, 1959).

<u>Age</u>	<u>Key to Symbols</u>	<u>Symbol</u>	<u>Description.</u>
Quaternary (Recent)		Qr	Alluvial clays, sands and gravels; beach and desert dune sands; saline gypseous and calcareous swamp and lake clays, travertine.
Tertiary to Upper Cretaceous		K - Tl	A weathered zone and fossil soil development rather than a stratigraphic unit. White, pink and buff argillaceous, arenaceous and rudaceous sediments.
Lower Cretaceous		Kl	Bluish grey shale red clay with thin beds of limestone and erratic boulder horizons of glacial origin - bleached and silicified in parts. Marine fossils abundant.
Jurassic		J	Siliceous sand with some interbedded shale. Lignitic fragments abundant.
Ordovician to Cambrian		e	Biohermic limestones interbedded with slates, sandstones, and other dolomites.
Proterozoic		P	Stuartian series metamorphics - tillites, glacigenes and slates.
Archeozoic		A	Quartzites and remnant metasedimentary structures in high grade schist and gneiss.
Archeozoic		+ + + + + + + + +	Granites, charnokites and migmatitic granitizational complexes.
Archeozoic		< ^ v < ^ v ^ ^ v > ^ ^	Felspar and quartz porphyries.



MAP 48. - VEGETATION REGIONS

Re-drawn from Williams, R.J., Atlas of Australian Resources: Vegetation, C.S.I.R.O. 1955.

1 = 6,000,000, or 1" = 94.7 miles.

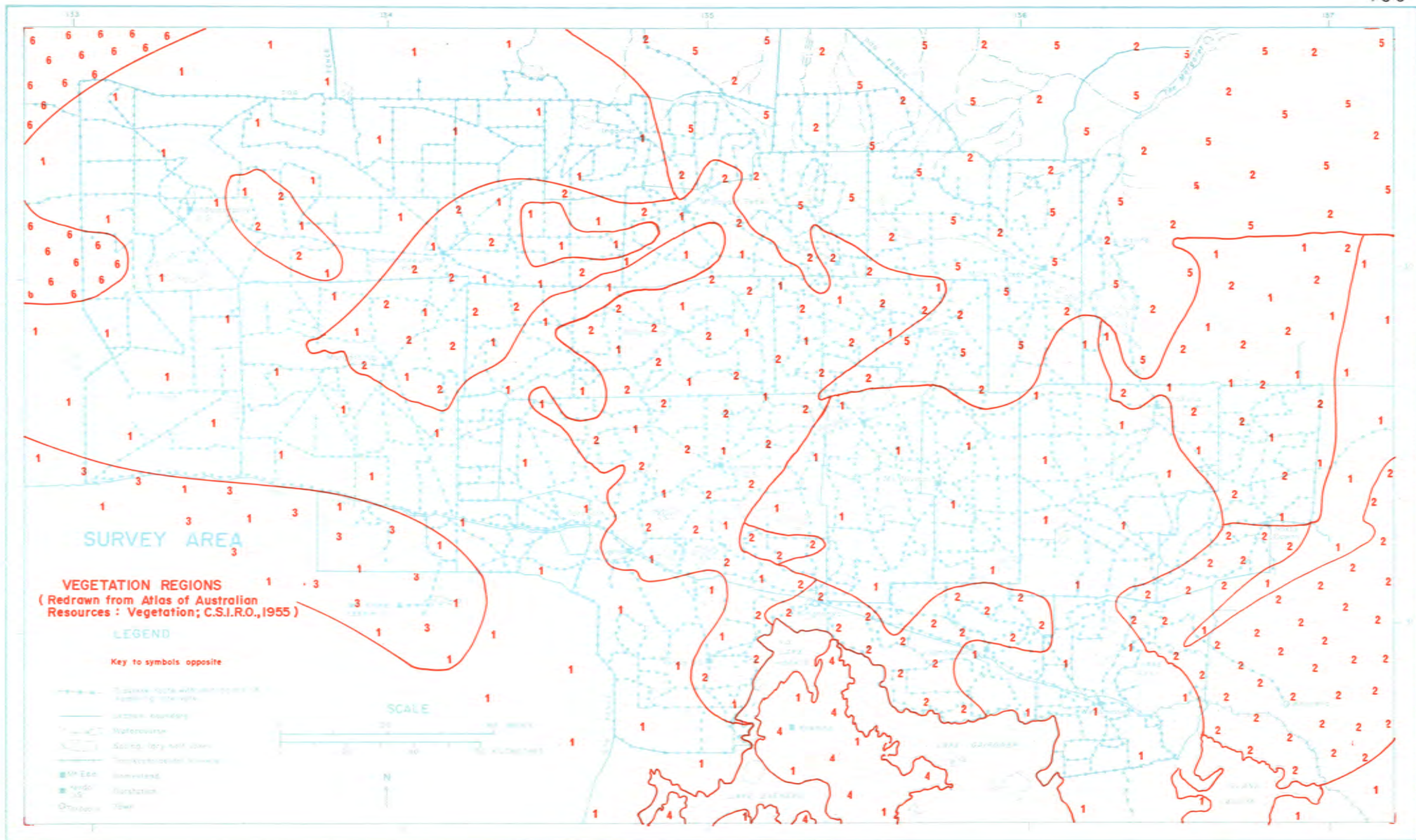
The alternative names are those given in Specht (1970) on the basis of life form, height and projective foliage cover of the tallest stratum (see Vol. I, Chapter 10).

Key to Symbols.Williams (1955)

1. Arid scrub.
2. Shrub steppe.
3. Semi-arid mallee.
4. Semi-arid tussock grassland.
5. Sand hill desert.

Specht (1970).

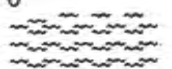
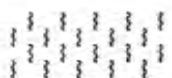

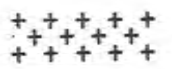


- Low woodland.
- Low shrubland.
- Grassy open-scrub.
- Tussock grassland.
- Desert complex.



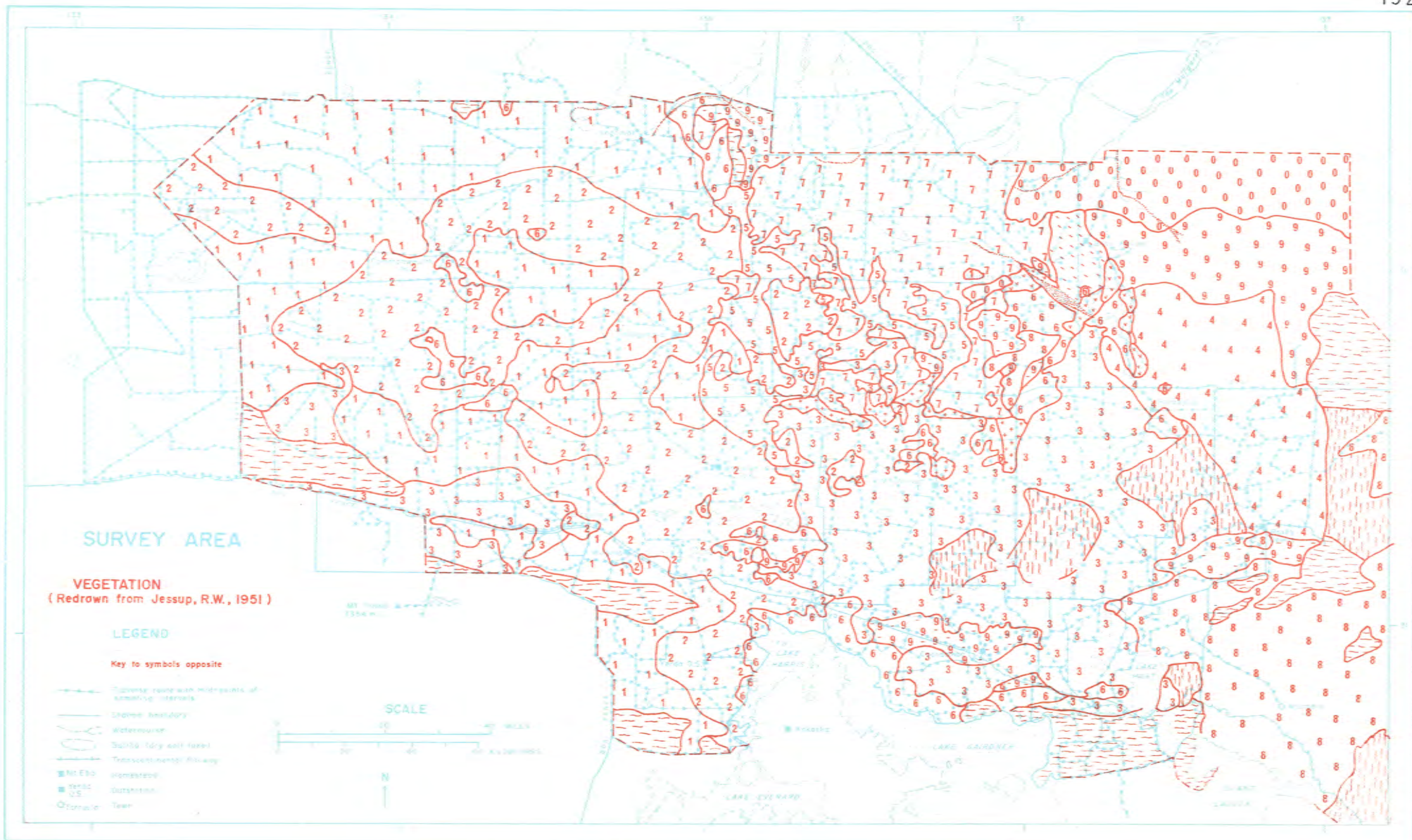
MAP 49. - VEGETATION.

Re-drawn from Jessup's (1951) vegetation map (original scale approx. 1" = 16 miles).

Key to Symbols.

1. *Acacia aneura* - *A. brachystachya* association.
2. *Acacia aneura* - *A. brachystachya* - *Kochia sedifolia* association complex.
3. *Acacia aneura* - *A. brachystachya* - *A. sowdenii* - *Kochia sedifolia* association complex.
4. *Acacia linophylla* - *A. ramulosa* - *A. brachystachya* - *Atriplex vesicaria* - *Kochia planifolia* association complex.
5. *Acacia aneura* - *A. brachystachya* - *A. tetragonophylla* - *Kochia planifolia* - *Bassia* spp. association complex.
6. *Atriplex vesicaria* - *Kochia planifolia* association.
7. *Kochia planifolia** association.
8. *Atriplex vesicaria* - *Ixiolaena leptolepis* association.
9. *Acacia linophylla* - *A. ramulosa* - *Atriplex vesicaria* - *Bassia* spp. association repetition.
- 9 - *Atriplex vesicaria* - *Bassia* spp. association,
- 0 *Atriplex rhagodioides* association.
-  *Acacia linophylla* - *A. ramulosa* - *A. aneura* - *A. brachystachya* association repetition.
-  *Acacia linophylla* - *A. ramulosa* - *A. aneura* - *A. brachystachya* - *A. sowdenii* - *K. sedifolia* association repetition.
-  *Kochia sedifolia* - *K. planifolia* - *Atriplex vesicaria* association.
-  *Kochia planifolia* - *Bassia* spp. association.
-  Cottonbush (*Kochia aphylla*) and Canegrass (*Eragrostis australasica*) swamps.
-  Coolabah (*Eucalyptus microtheca*) creeks.

* now *K. astrotricha*



MAP 50. - TOPOGRAPHY.

Based on the World Aeronautical Chart (3354) Tarcoola, 1970, 1 = 1,000,000 series (1" = 16 miles approx.)

All boundaries were drawn from information on this map; discrete boundaries often being only approximations of intergrading zones, except for claypan areas. AP, CP and OP are easily discernible on the rocket photographs in Volume I.

Key to symbols used.

- AP -- Arcoona plateau, which is a discrete topographical unit - an elevated, undulating, treeless, gibber-covered plain.
- CP -- Claypan areas - these are discrete regions occupied almost entirely by claypans or salt-lakes of varying size, together with associated kopi (gypsum) dunes and sand hills. Other claypans and salt-lakes occur throughout the area, but they are isolated.
- OP -- Outwash plains of the Lake Eyre basin - watercourses from the Stuart Range run in braided channels across flat gibber plains with little vegetation of any sort, and eventually join the Margaret and Warriners Creeks.
- Pl -- Plains with occasional low breakaways and calcareous rises. No organized drainage exists apart from short ill-defined watercourses terminating in a claypan or "swamp".
- Sh -- Dunefields, with or without interdune flats.
- S Ra -- Stuart Range - areas where the original land surface has been deeply dissected by watercourses leaving residuals (buttes) at the former level.

MAP 51. - PERMANENT PHOTOPOINT POSTS.

This map shows the location of all permanent photopoint posts set up in the survey area, and the direction to those outside it. These posts were set up as described in the text (Vol. I, Chapter 7). Where the photograph(s) taken did not turn out, or no photograph was taken, the post location number on the map is marked (+), and it is hoped that these points will be photographed in the near future.

The numbers correspond to the descriptions in field log book 4, pp. 146-188, with details recorded at the time of erection. A reference set of photographs and stereopairs from these points, together with the negatives, is housed in the Department of Botany, University of Adelaide, with similar records from the Koonamore Vegetation Reserve.

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