

6.—Notes on the Flora and Vegetation of the Nullarbor Plain at Forrest, W.A.

By E. R. L. Johnson* and A. M. Baird†

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Abstract

Brief collecting trips to Forrest in the centre of the Nullarbor Plain were made in 1930 and 1955, years in which above average rainfall had resulted in exceptionally rich development of the herbaceous flora. One hundred and five species of flowering plants were collected, of which twenty-two were introduced.

The flora is composed mainly of taxa which are common to the floras of the drier inland regions to the west and east of the Nullarbor Plain. A few only extend further to the south west and south east into regions with higher rainfall. Dominant families are Chenopodiaceae, Asteraceae and Poaceae which, in addition to having the largest number of species, more than half the total, also produce an abundance of individual plants. Introduced plants were not abundant and were found only near the railway line and aerodrome.

The representation of families is typical of the Eremaea and in contrast with that of the south western corner with its abundance of Myrtaceae, Proteaceae and Epacridaceae.

The vegetation is described under the headings: plain, depressions and tree belt. The greatest number of species was found in the "dongas", broad shallow depressions which had a few large shrubs usually *Acacia oswaldii*, *Eremophila longifolia* and *Pittosporum phylli-raeoides*; clumps of low perennials and a seasonal ground cover of grasses and herbaceous dicotyledons. On the main level of the Plain the open dwarf shrub community of *Kochia sedifolia*, the "bluebush" characteristic of the Nullarbor Plain, was seen in healthy condition in 1955, only in restricted areas. In many places old dead stems were all that remained, with the shorter lived *Bassia* forming the sparse ground cover. A belt of Myall trees (*Acacia sowndenii*), 14 miles north of Forrest, was in poor condition in 1955 with most of the trees dead.

The general impression in the area is of a perennial vegetation near the limit of tolerance of the arid climate, and unable to withstand the additional pressure of rabbit grazing.

Introduction

The Nullarbor Plain, that vast featureless stretch of country lying north of the Great Australian Bight (fig. 1) has been known since early days of exploration, and since 1917 has become familiar to the thousands of travellers on the trans-continental railway. Nevertheless there is no detailed botanical description of the central Nullarbor. It is an arid area with average annual rainfall between 6 and 7 inches (160 mms) and shade temperatures which may exceed 110°F in any of the summer months (but there is no shade on the Plain!). Geologically it forms part of the Eucla basin of horizontally bedded tertiary (Miocene) limestone and the soil is shallow, reddish calcareous loam.

* C/o State Herbarium of South Australia, North Terrace, Adelaide, S.A. 5000.

† Botany Dept., University of Western Australia, Nedlands, W.A. 6009.

Early explorers described it as a "dreary waste" and "stony waterless desert" and most of them were content to journey around its edges. However, Tate (1879), while searching for artesian water, went inland about 33 miles from Eucla and reached its southern part. He noted the sparseness of the vegetation and that species were few. Willis (1959), in an account of explorers and collectors in the Eucla region, mentions Delisser (1861 and 1865), Batt (1886-1896) and Kemsley (1952) as having collected plants from parts of the Plain. Willis with the Russell Grimwade expedition, 1954, collected between the head of the Bight and Madura. Anketell in 1901, when a member of Muirs Trans-Australian Railway Survey Team, collected 22 species (now in the Western Australian Herbarium). As localities were not attached to some of these, it is doubtful how many were found on the Plain.

In South Australia a number of collections have been made on the eastern edge of the Plain near Ooldea by Capt. A. S. White (Black 1917), Cannon (1921), Black (1921), Ising (1921), Adamson and Osborn (1922) and on the Plain at Hughes, 32 miles east of the Western Australian border, by Ising (1920). Adamson and Osborn described the vegetation of the Nullarbor Plain as shrub steppe with *Kochia sedifolia* and *Atriplex vesicaria* as the principal shrubs. They also described the vegetation of the "dongas", a term of South African origin which has been accepted in the literature and in local usage for depressions scattered throughout the Plain.

Forrest, lat. 30.5 S, long. 128.06 E, lies in the centre of the Plain and therefore, as far as the flora is concerned, should show a minimum of influence from surrounding regions. The authors visited this locality for 3 days in October, 1955, in the expectation of seeing the herbaceous vegetation in good condition after above average rains. An equally brief trip had been undertaken in 1930, so there was interest in comparing the vegetation 25 years later. The photographs and descriptions are of the vegetation as seen in 1955 except where the early visit is specified. Collecting was done within easy walking distance of the aerodrome and railway and on trips by truck north and south of the line which gave a cross section nearly 30 miles long (sketch map, fig. 2).

The first impression of the vast flat Plain stretching unbroken to the horizon is unforgettable. The flatness is, however, relative and in detail the Plain is undulating and with widely scattered depressions of varying extent and depth. Several of these were visited and also a belt of trees about 14 miles north.

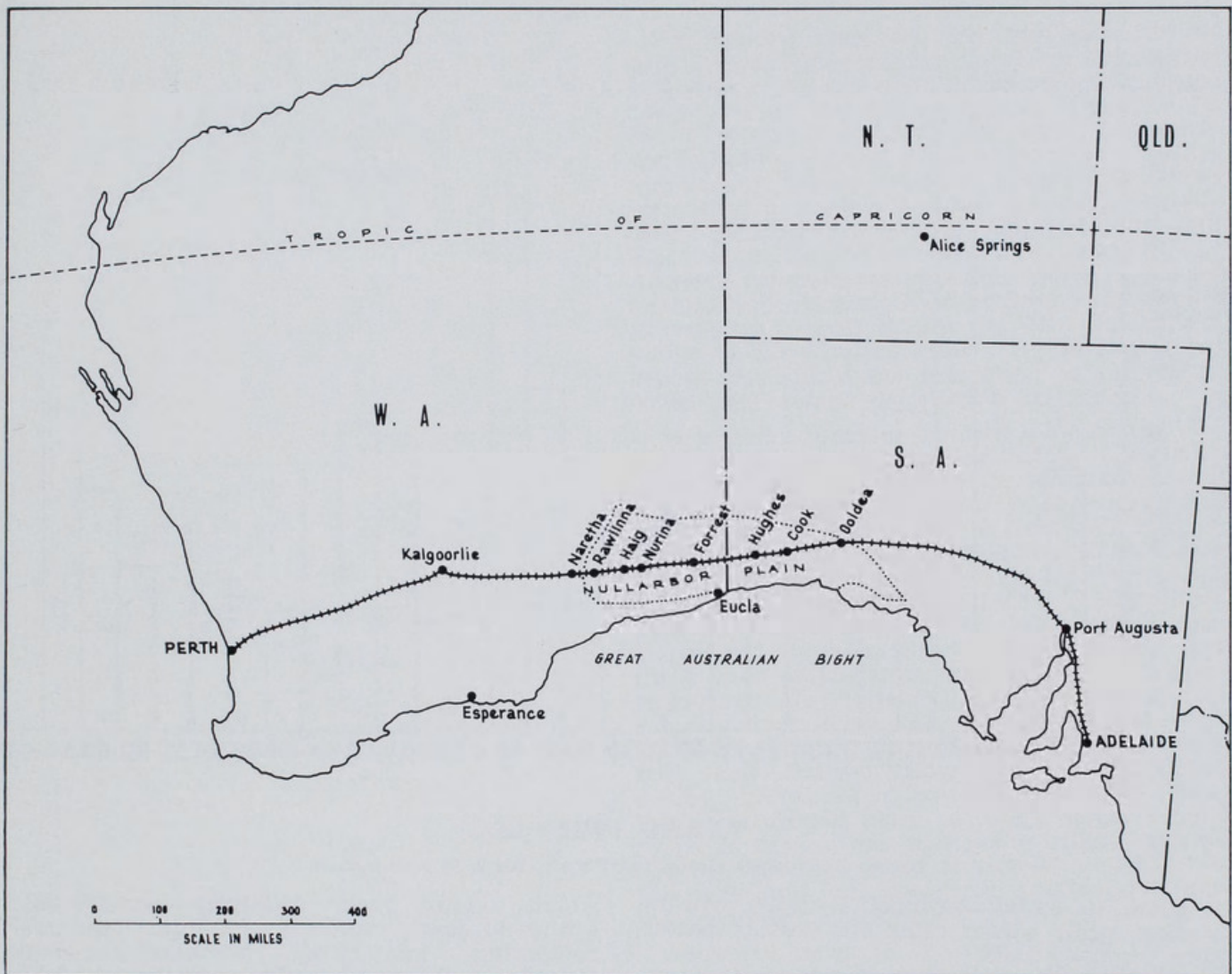
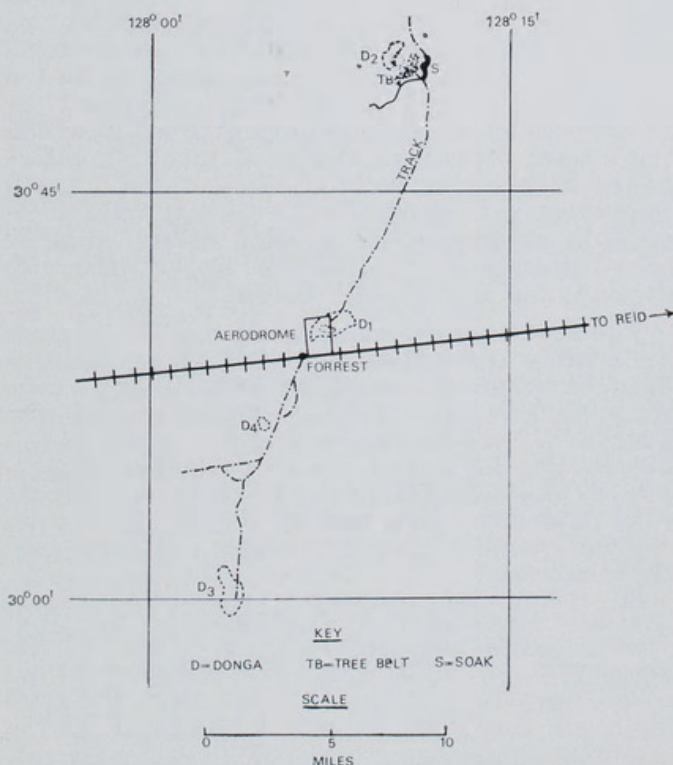


Figure 1.—Map showing the location of the Nullarbor Plain, Forrest and some other stations along the transcontinental railway.



Rainfall

Annual rainfall for the 30 years between 1925 and 1955 (fig. 3) demonstrates the great variability; totals in this period ranging from 2 to 16½ inches. The published average for 50 years to 1965 is 6.5 inches. The average monthly rainfall is almost the same for each month of the year (fig. 4) but this indicates only that rain may fall in any month; the actual falls in any one year are very unevenly distributed.

The seasonal distribution and the way in which the rain falls is important to the vegetation not only for germination and maintenance of growth but also in the location of available moisture. Heavy downpours on dry ground mean run off and accumulation at lower levels; dongas may become lakes. After 6 inches of rain in February, 1930, a lake 3 miles across formed 13 miles west of Forrest and persisted for several weeks. Repeated light falls with little or no run off are of greater benefit to the higher levels of the Plain with its bluebush community. In general, summer rains tend

Figure 2.—Sketch showing tracks running N and S and approximate position of localities visited in relation to the railway line and aerodrome.

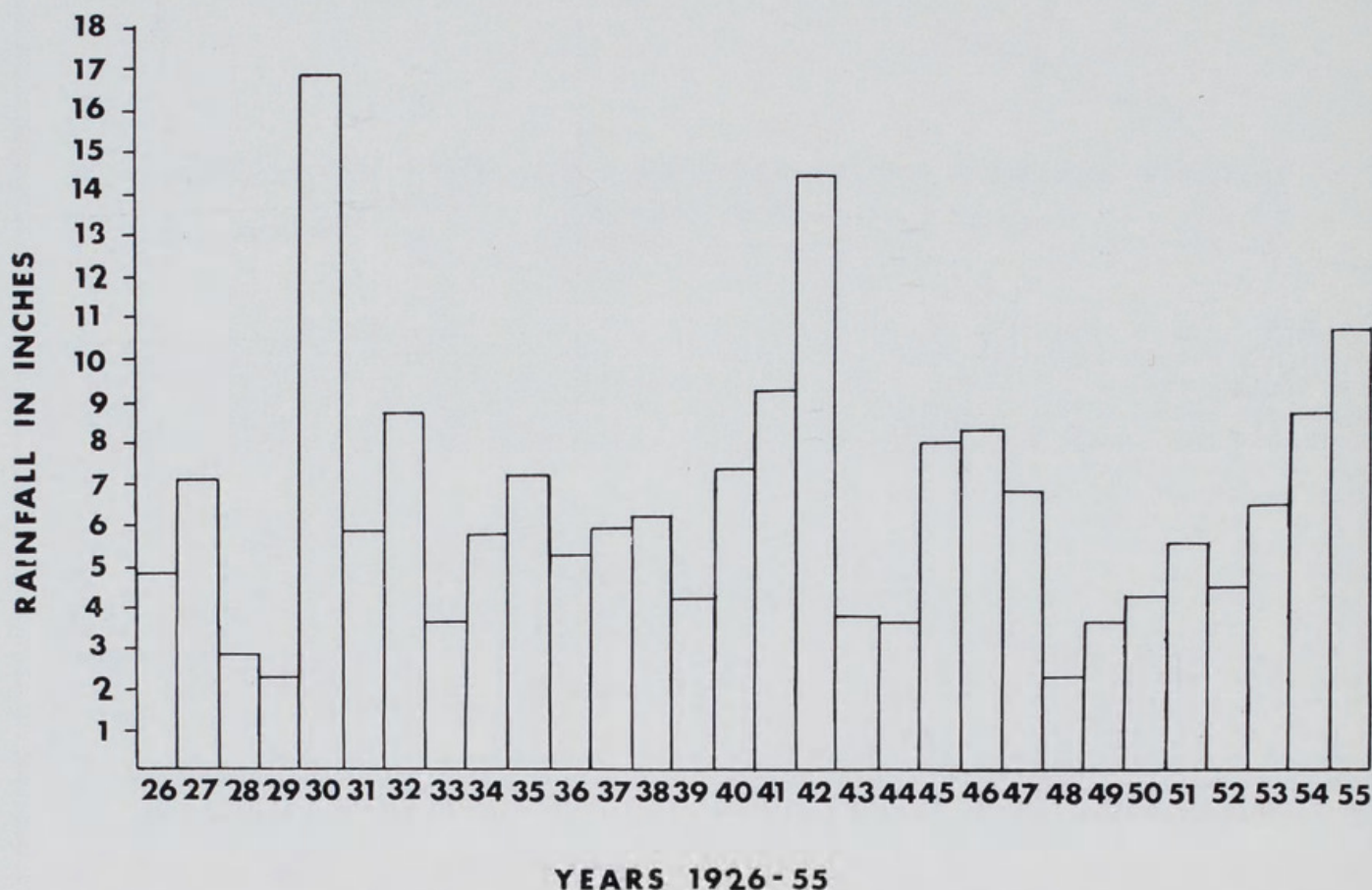


Figure 3.—Annual rainfall at Forrest for a 30 year period.

to come in heavy downpours, often causing flooding, while winter rains are usually lighter, more frequent falls.

For the years in which collections were made, 1955 can be seen as the second year of above average rain after a period of drought and 1930 as a quite exceptional high after a long and extreme drought.

Vegetation

Plain. The higher levels of the Plain carry the characteristic shrub steppe with the bluebush *Kochia sedifolia* as the dominant and almost the only perennial. The condition of the bluebush varied in different areas and over much of the Plain all that remained were long persistent dead stems. One such area (fig. 6A) was examined about 1-2 miles to the N.E. of the airport beyond a big donga. The plain here appeared to be the same in all directions as far as the eye could see except towards the donga. The soil was shallow reddish loam over travertine limestone which outcropped and lay in broken fragments on the ground. Lichens encrusted the rock (fig. 5 & fig. 6A) and also occurred on some of the bare ground. No living bluebushes were found; the dead bushes, as by notebook in figure 6A, showed the pattern of the original bluebush steppe. There was a marked tendency for concentration of annuals against these old plants. The ground cover was relatively sparse with bassias particularly *Bassia patentiuspis* and *B. uniflora* predominating (fig. 6A). Several different periods of origin were indicated by their differences in size

which ranged from relatively woody small bushes to single stemmed seedlings. Two small composites *Angianthus brachypappus* and *Gnephosis skirrophora* also contributed to the ground cover.

Other areas of high plain were seen on the trips to the north and south. To the north there were two areas where the bluebushes had compact foliage and few projecting dead stems (fig. 6B). *Angianthus* in full bloom formed a conspicuous ground cover. The track going for 12 miles south of the line crossed areas in which there were very open stands of bluebush intermixed with sparse tufts of *Stipa nitida*. Again *Bassia* spp and *Angianthus* were the main components of the sparse ground cover. Similar mixed stands of *Kochia* and *Stipa* were also seen beyond the 12 mile donga.

The dongas. Shrubs or small trees show from a distance the presence of a donga. In this flatness anything more than 3 feet high is conspicuous on the skyline. Vegetation of the dongas varies with size, depth and depth of soil but species of *Acacia*, *Eremophila* and *Pittosporum phylliraeoides* are the usual tall shrubs with patches of perennial chenopods other than *Kochia sedifolia* and, after rain, a lush herbaceous growth.

Three big dongas were examined. The first (D₁ on species list) at the N.E. corner of the aerodrome was more thoroughly examined than other dongas. A line was taken from the high plain on the N.E. towards the hangar and a series of photographs taken and specimens col-

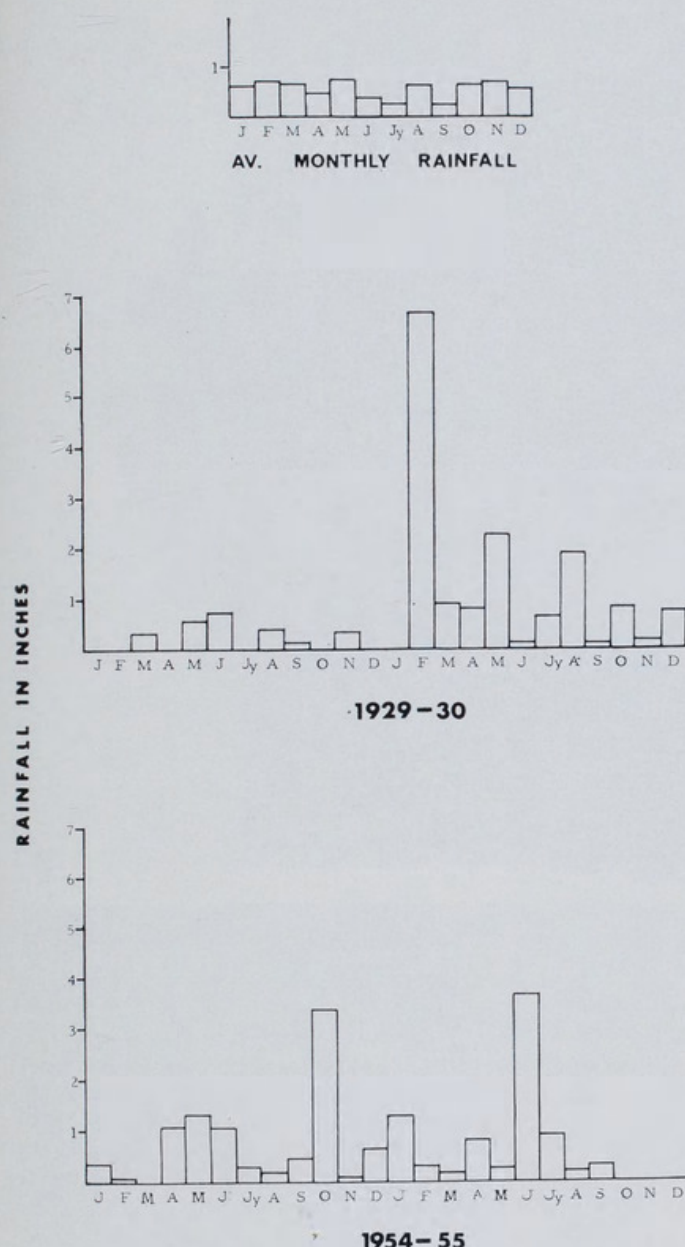


Figure 4.—Monthly rainfall for the years 1929-30 and 1954-55 and the average monthly rainfall.

lected along the transect with side detours where variations were noticed. A long, very gradual slope with sparse vegetation and much bare ground led down from the plain of Figure 6A already described. *Bassia* spp and *Salsola kali*, patchily distributed, were the main plants. Old rabbit burrows were numerous. Spreading from the mouths of some of these were big patches of *Tetragonia eremaea* showing vivid green in contrast to the prevailing grey of the *bassias*. Further down the slope dried and cracked mud showed where water had been lying. An adjacent low level area had a relatively rich cover of bushes up to 2 feet high of the perennial *Atriplex cryptocarpa* with some plants of *Lavatera*, *Nicotiana* and *Lycium*. Herbaceous dicotyledons: the slender straggly climber *Convolvulus erubescens*, the legume *Psoralea cinerea* and some composites and crucifers were scattered but principally in the shelter of the perennials throughout the lower levels of the donga.

The central area (fig. 7A) was grass-covered with several big spreading clumps of *Eremophila longifolia* and a few small *Pittosporum*. The grass cover was of the tufted grasses *Stipa nitida*, *Stipa* sp. and *Danthonia caespitosa*. Towards the periphery of the grass and beyond were a number of *Acacia oswaldii* bushes. Wherever seen these had a broad squat compact silhouette easily distinguishable at a distance. Many of them were heavily infested with the mistletoe *Amyema preissii*; all showed rabbit pruning. Several had old bushes of *Atriplex rhagodioides* growing up in their shelter (fig. 7B). No isolated plants of the *Atriplex* occurred, presumably because only within the protection of the *Acacia* could they escape destruction by rabbits.

At 12 miles south of the rail a big donga (D_3) had a rather richer vegetation. *Grevillea nematophylla*, not found in D_1 , occurred both as trees and shrubby re-growth. *Acacia oswaldii* was in much more vigorous condition than in the airport donga and seemed free of mistletoe. There were a few small shrubs of *Eremophila maculata* as well as the taller *E. longifolia*. *Enchylaena tomentosa* was growing in the shelter of a *Pittosporum* and *Grevillea* and there were extensive colonies of *Atriplex cryptocarpa*. The herbaceous cover was of the same species as in the first donga but more luxuriant, the ground was moist to the touch and moss occurred under some of the bushes. A few plants of *Clanthus formosus* (Sturt Pea) were found here. A small donga 4 miles south of the railway had many rabbit burrows. *Zygophyllum* spp were relatively abundant on the bare mud with dwarf composites and there was a dense colony of *Atriplex cryptocarpa*.

About 15 miles to the north of Forrest and adjacent to the 14 mile tree belt another big donga (D_2) was visited briefly and some kodachromes taken and specimens collected. Large shrubs present were as in other dongas; *Acacia oswaldii*, *A. tetragonophylla*, *Eremophila longifolia*, *Pittosporum phylliraeoides*, and a few old trees of *Grevillea nematophylla*, one with an eagle's nest. Near the centre of the donga a big spreading clump of *Grevillea* (Fig. 7D) with abundant new growth and silvery dissected leaves contrasted with the heavy dark brownish leaves of *Acacia oswaldii* and the yellowish weeping foliage of the *Pittosporum*. In the shelter of this and other big shrubs were dense growths of trailing herbaceous species as listed for other dongas. Most of the herbaceous species were well past their maximum flowering and in fruit but with enough flowers left on some plants to enable identification. *Bassias* were present more or less throughout the donga. Large flat areas were grass-covered with the previously found species of *Stipa* and *Danthonia*, also *Eragrostis dielsii* var *pitzelii* in a big patch covering a depression within the donga.

Apart from the dongas with trees and shrubs there are extensive flat areas at slightly lower level than the high plain and where the soil is deeper without the exposed travertine. These are more or less bare in dry years but carry a luxuriant cover of grasses after heavy rains. One such stretch, shown in colour plate (fig. 9A) was crossed about 7 miles north of the air-

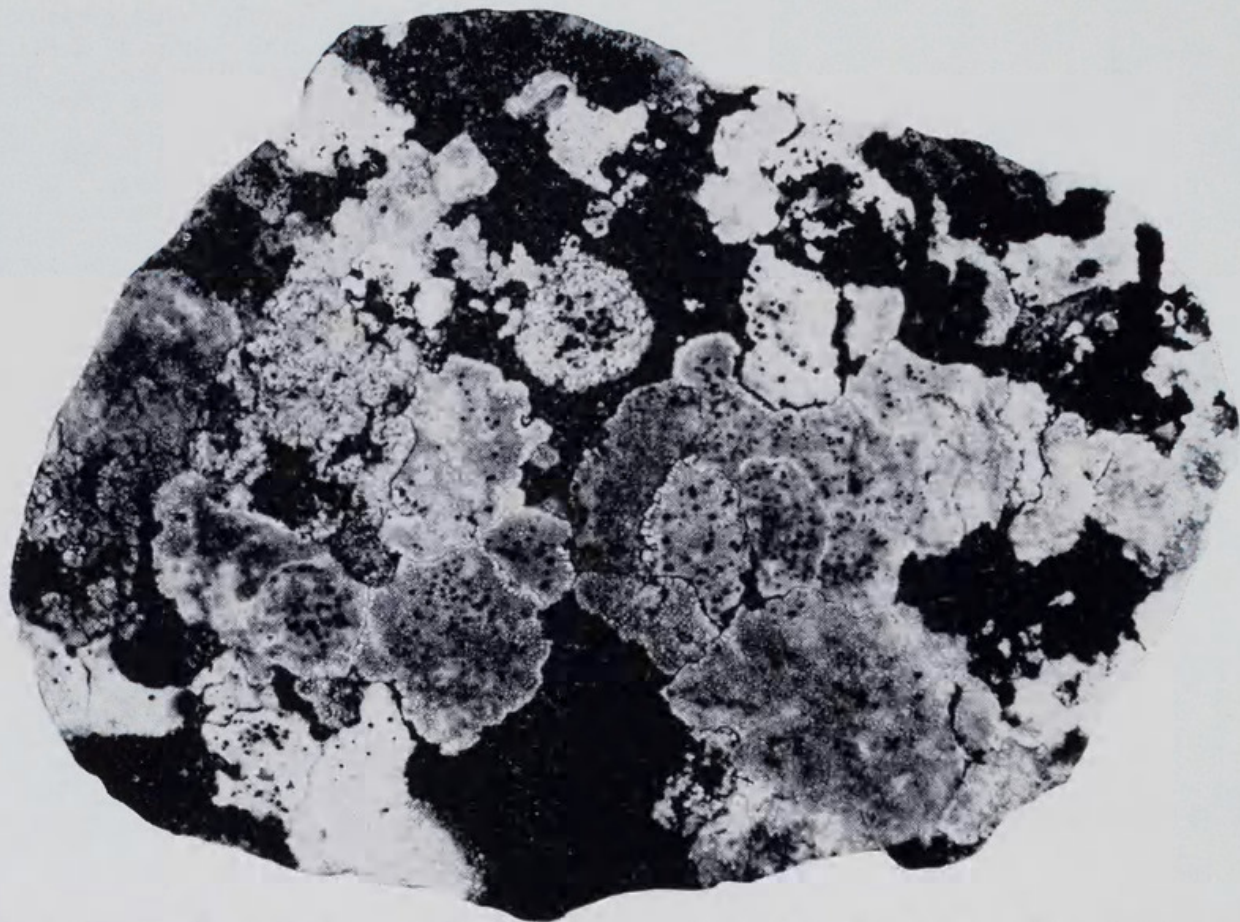


Figure 5.—A piece of flat lichen-encrusted limestone from the surface of the plain. The conspicuous species is *Buellia subalbula*.

port, extending continuously for about $1\frac{1}{2}$ miles with further broken patches. This grass community was made up of the same two species of *Stipa* and one *Danthonia* as found in the dongas. No detailed examination of the area was made.

Although the three grasses were found together in most of the grassed areas, there was a difference in their distribution. *Stipa nitida* appeared to be the most xerophytic as it was the only species where grass occurred as sparse tufts (fig. 6D) on the higher levels (fig. 7A). The unidentified *Stipa* with golden brown fruits, *Stipa* sp aff *fusca* was abundant in the deeper part of the dongas. The best growth of *Danthonia* was seen also at the lower levels and in the more favourable habitats near airport and line. An observation of interest was the seeds of *Stipa* and *Danthonia* lined up in the pattern of cracked dried mud where water had lain. The long hygroscopically twisting awns are particularly suited to driving the seeds, radicle end down, firmly into the cracks.

Minor depressions. A variety of smaller irregularities and depressions, into which water may drain and soil is deeper, form locally favourable habitats. Figure 7D, a photograph of broken ground about 5 miles west of Forrest, shows the greater size and abundance of plants in small depressions. One depression seen just south of the railway had a stand of *Atriplex hymenotheca* in flower. Four species of *Bassia* were also collected here. Slightly further east, on this rather stony irregular south side, other

depressions with annual saltbushes were found and two plants of *Kochia georgei*.

A stand of *Heterodendrum oleaeifolium* had been found in this area in 1930, the trees heavily infested with mistletoe and mostly in poor condition. In 1955 all except one were dead, two fallen and a few standing. There had been no regeneration.

Tree belt. About 14 miles north of the airport and covering 20-30 acres, is a belt of Myall (*Acacia sowdenii*), spreading trees 10-15 feet high. In 1955 the majority of these were dead or almost so (fig. 8A). This tree belt had been visited in 1930 when most trees were alive and looking healthy (fig. 8B) even though they had just recovered from a particularly severe drought. No young trees were seen in either year. One old semi-fallen tree, which had been photographed in 1930, was found again still alive and not very different 25 years later. Several eagles' nests were present both in 1930 and 1955. *Exocarpos aphyllus* found in 1930 was not seen in 1955. A few perennial saltbushes were growing close to trees. The ground cover was low and fairly sparse but with a variety of annual species (figs. 8A & C). *Helipterum floribundum*, in full bloom, was conspicuous and extended well beyond the limits of the trees but the plants were mostly only a few inches tall. *Cephalopterum drummondii* was present in smaller numbers. Other small composites were *Podolepis canescens*, *Helipterum tietkensii* and *H. tenellum*. *Zygophyllum iodocarpum* and *Z. ovatum* were

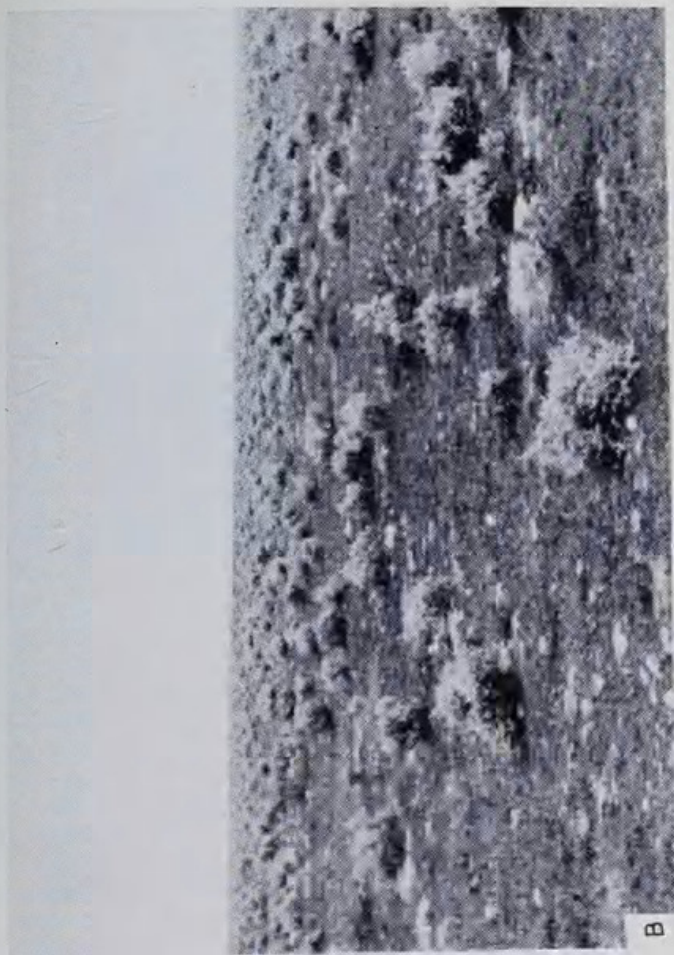


Figure 6.—A. A part of the plain to the east of donga 1 showing outcropping and fragmented limestone at the surface; absence of living bluebush and sparse cover of Bassias etc. B. Another part of the plain to the north where bluebush (*Kochia sedifolia*) was in healthy condition. C. A single plant showing partial recovery after drought. D. *Stipa nitida* in a slightly depressed area. The tufted habit is well shown in the foreground plants.

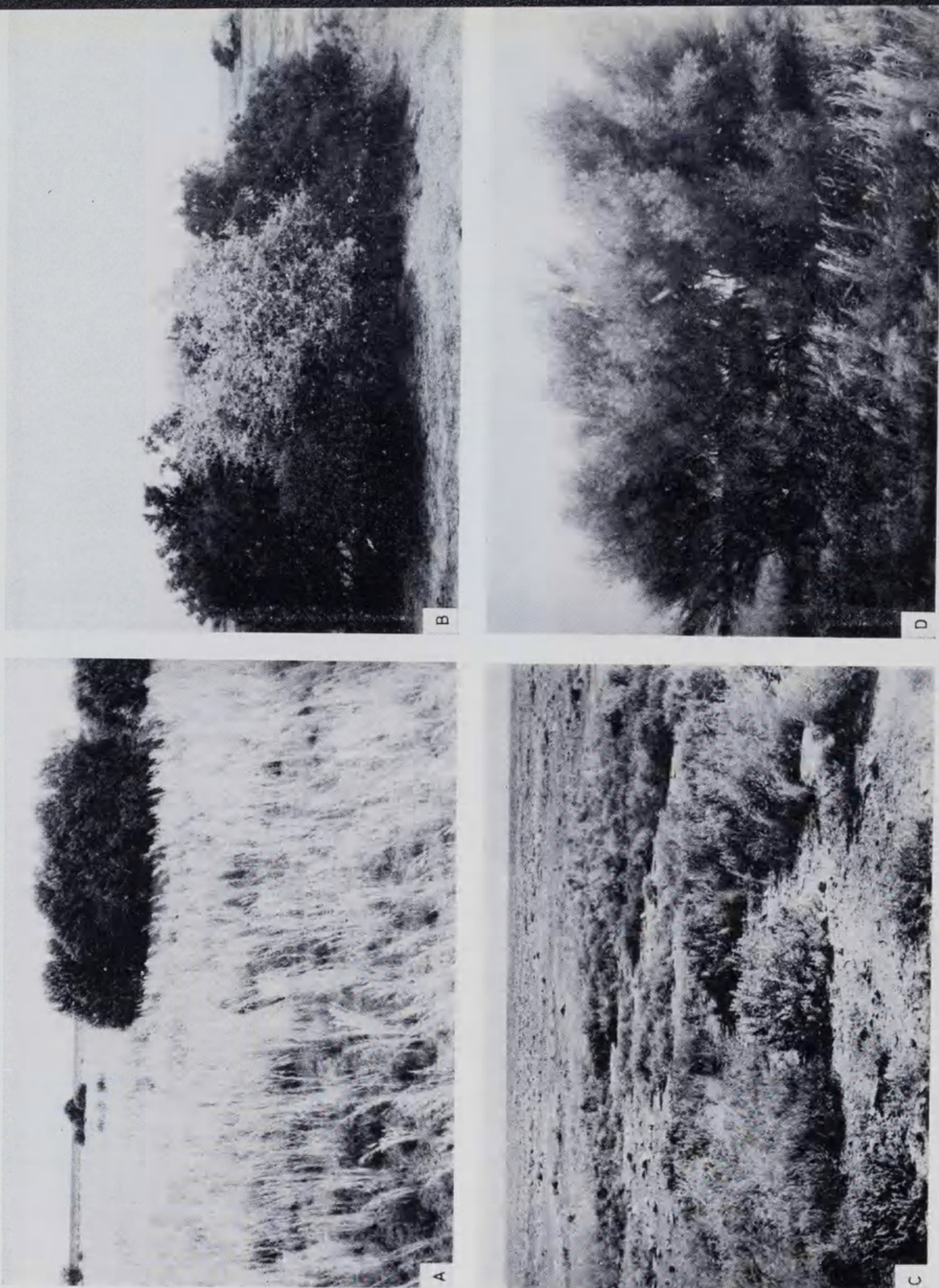


Figure 7.—The dongas. A. The grass covered area of donga D₁ with *Eremophila longifolia* (2 clumps) and a *Pittosporum phylliraeoides* in left distance. B. *Acacia oswaldii* with *Atriplex rhagodioides* both pruned by rabbits. C. More luxuriant growth in minor depressions—broken ground five miles west of Forrest. *Atriplex hymenotheca*, centre, *Atriplex cryptocarpa* grasses and other plants. Typical stony plain in the background. D. A clump of *Grevillea nematophylla* in the northern donga D₂.



Figure 8.—Tree belt and soak. A. General view of part of the 14 mile tree belt in 1955 showing most of the trees dead. B. View in 1930 shows the habit of the living Myall (*Acacia sowdenii*) and some dead trees. C. Detail of undergrowth in 1955, *Helipterum floribundum*, *Zygonhyllum* spp, grass. D. View of part of the soak in 1930; lush growth of *Helipterum tietkensii* in foreground, *Lavatera* etc. behind and the trees on right skyline.

abundant forming almost pure stands in places. *Salsola kali* was also abundant, as were the almost universal bassias, with scattered small tufts of *Stipa nitida*. A few small plants of *Nicotiana goodspeedii* were found. Concentration of plants against fallen logs and dead plants, and in slight depressions was very noticeable.

Tree belt soak. A particularly interesting area locally known as "the 14 mile soak" led into the tree belt, possibly marking an underground, or sunken, drainage system. A distinct edge was marked by a line of bushes—*Kochia*, *Lycium*, *Lavatera*—with, to the lower side, a lush growth, up to 24" tall (Colour plate fig. 9B) of the grass *Eragrostis setifolia*, and of *Helipterum tietkensisii*—a tall slender scented composite with abundant small silky heads. Further over was an area of bare and broken ground with old rabbit burrows, part stony, part rather "fluffy" soil, all extensively disturbed by rabbits and with a very patchy cover of the above mentioned grass and composite, sometimes mixed, more often in pure stands. Colour plate (fig. 9B) shows part of this soak.

Figure 8B of the area in 1930 shows the richness of the growth that year. Also in 1930 in a section of the depression further north was a luxuriant growth of *Trigonella suavis-sima*, which had not been seen anywhere else. This species was not found in 1955 but it is probable that that particular section of the depression was not reached.

The plain outside the depression was the most barren seen anywhere, no living bluebush or salt bush and practically no herbaceous plants—mostly bare eroded soil between old dead stumps—no doubt denuded by the rabbits which inhabited the "soak".

Disturbed areas. In the neighbourhood of the airport, near the station and along the railway line inevitably the ground has been considerably disturbed, and some of this disturbance provides habitats more favourable than on most of the Plain. Loosened soil, depressions, drainage channels and, in places, additional water and nitrogen benefit both introduced and native species. For instance a drain along the airport fence had a lush growth of *Danthonia*, *Atriplex hymenotheca*, *A. spongiosa*, *Salsola*, *Senecio* and other indigenous composites, the introduced *Sonchus* and several species of introduced crucifers. On disturbed muddy areas where water had collected three species of *Bassia*, *Atriplex spongiosa*, *A. hymenotheca*, two species of *Zygophyllum*, *Helipterum floribundum* and *Senecio lautus* were common and in general more robust than in undisturbed areas.

Introduced weeds were found only in the neighbourhood of line and airport. Some of these may have become naturalised but others are probably only of sporadic occurrence from seed dropped from trains, dependent on finding temporarily favourable niches and not long persistent. The difference in lists of introduced species from the two visits is in keeping with this suggestion. The native plants found on the two visits were essentially the same.

Comparison between 1955 and 1930

Rainfall in each of these years was abnormally high but the amount and distribution was very different as can be seen in Figure 3. 1955 was the second wet season after several dry years and the rain had been fairly evenly distributed with the heaviest falls in October, 1954, and June, 1955. 1930 had the highest total rainfall ever recorded at Forrest and over six inches, equal to the average annual total, fell in four days at the end of February. This occurred after the most severe drought recorded. Some of the differences in plant growth were undoubtedly related to these climatic differences. As seen in August, 1930, only six months after flooding rains, the perennials, *Eremophila* spp, *Acacia* spp, *Kochia sedifolia* and perennial species of *Atriplex* mostly had tufts of new foliage on old defoliated stems, many plants had not survived the drought. In October, 1955, most surviving perennials had abundant healthy foliage as the result of two successive favourable years.

On the other hand, the herbaceous vegetation was not nearly as dense and luxuriant in 1955 as it had been in 1930. This was particularly noticeable with *Helipterum floribundum* which had in 1930 formed complete cover in places and where the individual plants had been much taller. There is no doubt that the ground cover as a whole had been denser and the plants taller in 1930 but as the rainfall for the first half of the year had been almost twice as much this is no basis for suspecting any long term change in the herbaceous vegetation. It is interesting that the same herbaceous species were collected at each visit and had flowered about the same time in spite of the differences in total amount and distribution of the rain.

For the perennial cover both authors were satisfied that there had been a real deterioration. In the Myall belt most of the trees had died. Figures 8A and B show the difference although not taken from the same spot. Other 1955 photographs, too poor for publication, do include a tree recognisable as one photographed in 1930. No young trees had been seen in either year so it seems unlikely that the stand will recover. Regeneration from seed could have been expected in 1930 (16") and 1942 (14"). It seems likely that it was prevented by rabbits and that they are also responsible for at least some of the deterioration of the *Atriplex* and *Kochia*. Rabbits spread over the plain after wet seasons and no doubt as drought develops and the annuals disappear the grazing pressure on the perennials must be intense, before the unfortunate animals succumb. The absence of living bluebush near the railway line and on the plain near the "soak", both areas with numerous rabbit burrows, would support this.

With a perennial vegetation in precarious equilibrium with its environment where establishment of seedlings is always difficult, rabbits can destroy the seedlings before they are old enough to tolerate any grazing and so effectively prevent regeneration.

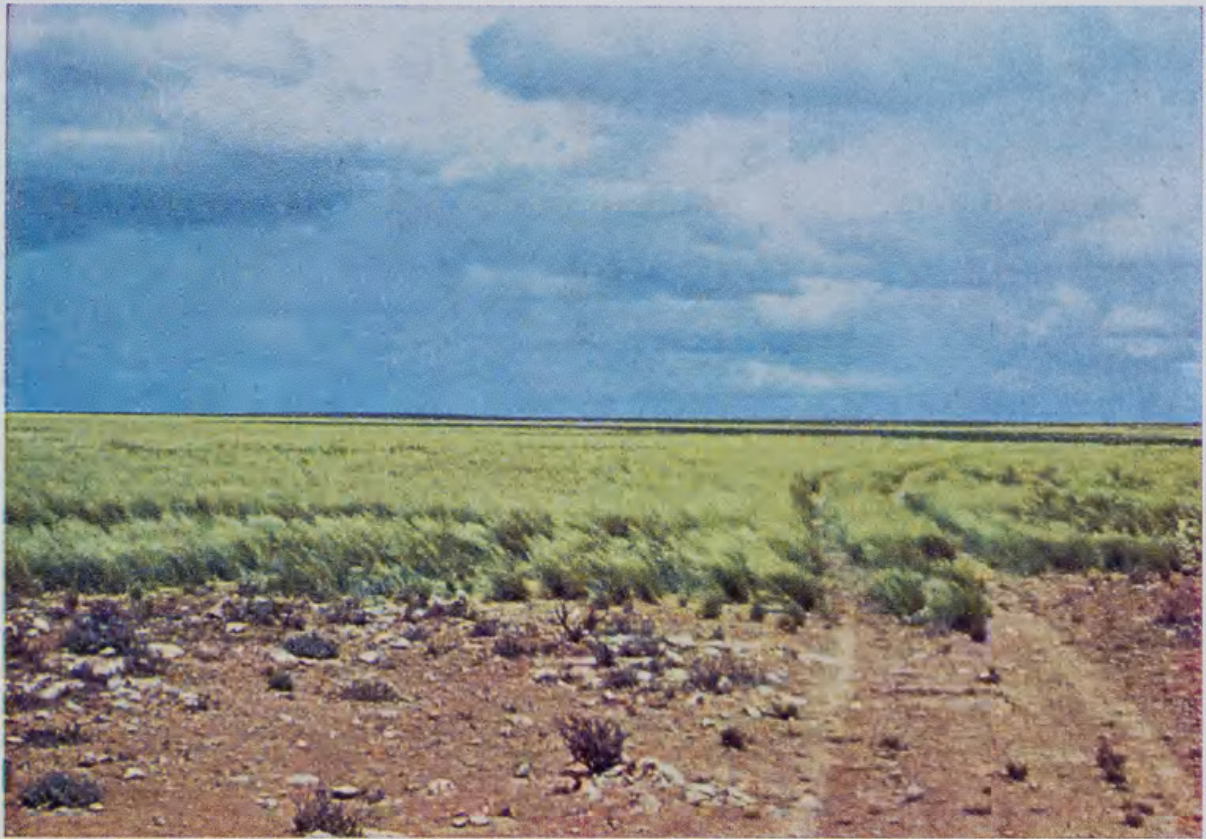


Figure 9.—Top. Grass community 7-8 miles north of Forrest, *Bassia* spp. in foreground. Bottom. Soak—*Helipterum tietkensis* in the depression, a large *Kochia sedifolia* plant on the rim.



Discussion

The plant communities seen at Forrest are typical of the central and western side of the Nullarbor Plain. The same bluebush association of the higher levels in many parts in very denuded condition, the flats with grass after rain, and the dongas of varying size can be seen from the train along the 165 miles between Forrest and Rawlinna.

The transition from the open dwarf shrubland of the Plain to the woodlands with Mallee Eucalypts, Acacia or Casuarina and an undergrowth of saltbush-bluebush or spinifex, occurs very gradually on the western side. The boundary of the Plain is usually put between Naretha and Rawlinna (fig. 1), but there is no clearly recognisable boundary for the vegetation; stands of shrubs and small trees become gradually more frequent from some miles east of Rawlinna, westward.

Although the Nullarbor Plain is distinctive in appearance and recognised as a geographical entity the vegetation consists of impoverished extensions of types found in slightly higher rainfall regions to the north east. The *Kochia-Atriplex* communities of northern South Australia and western New South Wales are described as having spaces between the bushes more or less equal to the diameter of the plants; on the Plain the spaces are vastly greater. The occasional belts of *Acacia sowdenii* could be considered outliers of the more extensive Myall formations outside the limits of the Plain and species of the dongas are mostly found in the surrounding shrub or woodland communities.

It seems probable that most of the perennial species are near the limit of their tolerance of low rainfall. The stress of the climate is shown in the number of plants dead after a prolonged drought and in the structure of the woody stems of shrubs. When plants recover after drought dead stems are left projecting, (fig. 6C) and the cambium has often been killed on one side of surviving stems resulting in uneven and deformed growth.

With an average annual rainfall of only 6½ inches the Nullarbor Plain could be classed as desert and as with most desert areas perennial species are few and annuals form the greater percentage of the flora. Nevertheless the concept of tiny ephemerals appearing, flowering, fruiting and dying in a few weeks as known for some deserts does not seem to apply here, except for very few species. The grasses, bassias and annual saltbushes and at least some of the herbaceous composites and legumes, which form the bulk of the herbaceous vegetation, may last for many months and even more than a year under favourable conditions. The annual everlasting *Helipterum floribundum* and *Cephalopterum drummondii* and also *Goodenia pinnatifida* showed evidence of extended growth and in the 1955 specimens, of two distinct periods of growth and flowering. Local comment in October was that these and some legumes had been flowering for many weeks and photographs taken in early December showed everlastings still in flower. *Stipa nitida* is known to behave as a perennial under favourable conditions though more often as an annual in the drier

parts of its range. Perhaps the ability to shorten or lengthen the life span is one of the effective adaptations to variable rainfall.

The Chenopodiaceae, particularly *Atriplex* spp. have been shown to be particularly well adapted to the absorption of moisture through the leaves and it is probable that dew plays an important part in extending the effectiveness of light falls of rain. Heavy dews and occasional fogs are known on the Plain and more knowledge of their contribution to the survival of grasses and other species would be valuable. The place of dew in the survival of rabbits is suggested by the observation by local residents of rabbits lined up along the train line in early morning licking the dew from the rails.

A three day visit to a region does not allow study of the ecology beyond recognition of species and types of communities, but it does suggest possibilities for investigations by someone living in the area. Within the dongas there is great variation in the shrubs and ground cover associated with minor differences in habitat. McCrumb (unpublished teachers thesis) at Reid made some useful observations on depths of soil associated with plant communities and on growth habits of certain species.

Some detailed observation on the percentage recovery of *Kochia* and *Atriplex* after drought and conditions necessary for their replacement by seedlings would be valuable. Is it true that there is at the present time a real deterioration of the bluebush and saltbush communities as the authors suggest, and, if so, how far are rabbits responsible? Some long term studies of regeneration of species of *Acacia*, *Atriplex* and *Kochia*, *Heterodendrum*, *Stipa* which extend across the Nullarbor have been made in South Australia, particularly at Koonamore (Hall et al 1964; earlier papers are listed in this), but in regions much further east and in rather different habitats. There is need for ecological studies on the western side of the Plain.

Flora

Systematic representation. The number of Angiosperm taxa collected was 105 and their totals and relative numbers are given in Table I. Indigenous plants comprised the majority of the 27 families present. Among these 4 were prominent in both numbers of species and individuals, The Poaceae (7 sp. and 1 ssp.), Asteraceae (14 sp.), Chenopodiaceae (19 sp.) and Fabaceae (7 sp. and 1 ssp.) together contained half the genera and over half the species. The remaining 19 families were each represented by only 1 to 4 species. The vegetation was composed principally of large numbers of chenopods and grasses, with composites conspicuous in smaller areas. Legumes were

TABLE I.

	Families	Genera	Species	Sub-species	Varieties
Total	27	67	98	3	4
Indigenous	24	48	78	3	2
Introduced	9	20	20	0	2

usually found in the moister parts of the dongas, where *Lotus cruentus* and *Swainsona campestris* were locally massed. *Trigonella suavissima* formed an extensive and dense colony in one part of the soak.

Introduced plants were mostly few in number and not prominent among the luxuriant growth of saltbushes and grasses. Exceptions were tall robust plants of the Brassicaceae, a single flowering colony of *Asphodelus fistulosus*, large plants of the two varieties of *Medicago polymorpha* and the grasses *Lophochloa pumila* and *Schismus barbatus*. Only 4 of the 9 families were represented by more than one species. These were Poaceae (6 sp.), Brassicaceae (5 sp.), Boraginaceae (2 sp.) and Asteraceae (3 sp.).

Of the lower plants, 12 lichens and 1 moss (sterile and not identified) were found. No ferns were seen.

Geographical distribution. The range of a number of indigenous species cannot be determined until more field studies are made on the Plain and its surrounding areas.

On present evidence the Plain is the centre of distribution for only 3 species—*Atriplex cryptocarpa*, *Swainsona campestris* and *Calotis breviradiata*. Most of the others have a wide distribution, 67 out of 76 occurring both on its western and eastern sides throughout the more arid parts of Western Australia and South Australia. Some of them, such as *Pittosporum phylliraeoides*, *Salsola kali*, *Enchylaena tomentosa* and *Senecio lautus* are found in both coastal and Ereman areas.

To the east, 56 extend into western New South Wales and 48 are recorded from Central Australia. A few species have a still wider range and are found in the higher rainfall areas of south-western and south-eastern Australia. These are *Danthonia caespitosa*, *Oxalis corniculata*, *Euphorbia drummondii*, *Lavatera plebeia*, *Convolvulus erubescens*, *Plantago varia* and *Vittadinia triloba*.

The distribution of *Bassia paralleliscuspis* and *Erodium cygnorum* ssp. *glandulosum* is considered to be eastern, while that of *Erodium cygnorum* ssp. *cygnorum* is mainly western, though it has been recorded from northern South Australia (Carolin 1958).

The present known range of *Eragrostis dielsii* var. *pritzelii*, *Grevillea nematophylla* an undescribed var. and *Atriplex hymenotheca* is western. All three have been recorded from widely separated localities, so their range may be found to extend further east when more information is available.

All the introduced species had previously been recorded for Western Australia and South Australia. Twelve were collected in 1930 and fifteen in 1955. Ten of the latter were new records for Forrest (see in Annotated List).

Hordeum leporinum, *Lophochloa pumila*, *Schismus barbatus*, *Chenopodium murale*, *Papaver hybridum*, *Brassica* sp. and *Medicago polymorpha* var. *brevispina*, collected in 1930, were not found in 1955.

Annotated List of Species from Forrest

Specimens, after detailed examination, were compared with those available in the Tate Herbarium, Adelaide, the State Herbarium of South Australia, the Western Australian Herbarium, and a few in the National Herbarium of Victoria. Several specimens were not determined. For some others, where resemblances to particular species were found to be close, differences have been noted and the species determinations given are regarded as tentative. Nomenclature followed is that in Black's Flora of South Australia (2nd ed. 1943-1957) and its Supplement (Eichler, 1965). Collections are in the herbarium of the Botany Department, University of Western Australia (U.W.A.), and a duplicate set has been sent to the C.S.I.R.O. Herbarium, Canberra.

Localities are shown as under. Distances are approximate from the Forrest railway station.

P—plain

TB—tree belt, N 14 miles

S—soak, N 14 miles

R—disturbed soil near railway line and airport

D—dongas

D₁—NE 1 mile

D₂—N 15 miles

D₃—S 12 miles

D₄—S 5 miles

The months August and October refer to plants collected in August 1930 and October 1955 respectively. A species was abundant and in flower and fruit unless otherwise stated. An asterisk denotes an introduced species.

ANGIOSPERMAE POACEAE (= GRAMINEAE)

**Avena fatua* L. (R)—in fruit (Oct.).

**Bromus unioloides* H.B.K. (R)—near septic tank overflow, rare (Oct.).

Danthonia caespitosa Gaudich. (P D₁ D₂ S R)—often mixed with *Stipa*; variable in height \pm 30 cm. in moist places, small scattered tufts \pm 10 cm. on bare areas. (Aug. Oct.)

Eragrostis setifolia Nees (S)—mixed with *Helipterum tietkensis* to form a dense mass; \pm 30 cm. tall; smaller and less numerous in 1955 (Aug. Oct.).

Eragrostis dielsii Pilger (P S R)—small erect tufts in damp depressions (Aug. Oct.).

Eragrostis dielsii var. *pritzelii* Pilger (P D₂ R)—mat plant, on bare clay around aerodrome and on surface of donga among erect plants of a fairly dense ground flora. (Aug. Oct.)

This variety described by Pilger (1904) has since been recorded from some widely separated localities in Western Australia (Gardner 1952). The habit of the Forrest specimens was compact with numerous horizontally spreading culms without erect ones and they appeared distinct from the erect tufted plants of

E. dielsii which occurred near them by the aerodrome. Both erect and mat plants matched those of *E. dielsii* and its var. *pritzelii* in the W.A. Herbarium.

**Hordeum leporinum* Link (R)—rare (Aug.).

**Lolium perenne* L. (R)—rare (Oct.).

**Lophochloa pumila* (Desf.) Bor. (R)—(Aug.).

**Schismus barbatus* (L.) Thell. (R)—frequent; prostrate in the open, upright in shelter, ± 30 cm. tall (Aug.).

Stipa nitida Summerh. et Hubbard (P D₁ D₂ D₃ T B R)—Colonies prominent and extensive; plants 10-90 cm. tall, the larger in damp depressions and dongas, the smaller mostly with colonizers of bare areas (Aug. Oct.). There is no published record of this species for Western Australia. However eight specimens collected from the following localities in the Ereman Province since 1947 are in the W.A. Herbarium.¹ Kalgoorlie, S. T. Blake; Berrigarra, N. H. Speck; on Barwidgee Road, N. H. Speck; Agnew, T. E. H. Aplin; N. of Sandstone, Cundeelee Mission, E. of Cosmo Newbery, A. S. George; near Haig, D. W. Goodall.

Stipa eremophila Reader (P D₂ D₃ TB R)—scattered or in small groups; most abundant near aerodrome and railway (Aug. Oct.).

Stipa sp. (R) (No. 68, 1930)—rare, in shallow soil; grey colour; sheaths and leaves very villous; 20-40 cm. tall (Aug.). The colour of this grass gave it a distinctive appearance. It had long glumes (± 18 mm) with acute hyaline tips, long awns (6-7 cm.) and smooth dark brown lemmas with dense golden to dark brown silky hairs on their calli.

Stipa sp. (R) (No. 65a, 1955)—rather rare, in depressions; panicle narrow; fruits small, brown with fine awns, lemmas with whitish hairs (Oct.).

Stipa sp (D₁ D, R) Nos 17, 65b, 1955)—abundant in centre of dongas and near railway; 60-90 cm tall; fruits large, dark brown, lemmas hirsute (Oct.).

The last three specimens need further study.

Stipa species were found in all dongas examined and were predominant over most of the slightly lower areas of the plain.

LILIACEAE

**Asphodelus fistulosus* L. (R)—only a single colony (Aug.); scattered over a wider area; plants to 40 cm tall; most in fruit (Oct.).

PROTEACEAE

Grevillea nematophylla F. Muell. var. (D₂D₃)—shrubs, isolated or in groups; 2.5-4 m; foliage dense, silvery, leaves more or less erect, 6-18 cm long, divided into 3-7 terete, faintly grooved segments, 3-10 cm long, about 1 mm wide; racemes terminal, very young, 2 rudimentary flowers in axil of each bract; mature fruit similar to that of *G. nematophylla* (Oct.).

Differs from *G. nematophylla* in its divided leaves and the more erect position of its flowering axes which may be due to the immaturity of the inflorescence. Specimens with similar foliage are in the Tate Herbarium, Adelaide,

and the National Herbarium of Victoria. The Tate specimen, named *nematophylla*, was collected by Helms in December 1891 near Mt Churchman in W.A. The Victorian one, unnamed, was collected by Isaac Tyson in 1893 near the Middle Murchison River (W.A.) and sent to von Mueller.

SANTALACEAE

Exocarpos aphyllus R. Br. (TB)—3 small trees growing close to *Acacia sowdenii*; ± 2 m; in flower (Aug.).

LORANTHACEAE

Amyema preissii (Mig.) Tiegh. (D₁)—abundant on *Acacia oswaldii*; foliage bright green; in flower, fruits very young (Oct.).

Lysiana exocarpi (Behr) Tiegh. (P)—on *Heterodendrum oleaefolium*; fruit red, 8 mm long, ovoid (Aug.). Two forms were present on same host,

- (1) leaves mostly opposite, narrow linear, thick, flat, sub-acute or obtuse, 3.5-4.5 cm long, 3-4 mm broad, venation obscure;
- (2) leaves all opposite, thin, long; narrow, 2 mm broad. In leaf and fruit characters both forms are similar to those of subspecies of *exocarpi* described by Barlow (1963). These could not be determined as no flowers were found.

POLYGONACEAE

**Emex australis* Steinh. (R)—in fruit (Aug. Oct.).

CHENOPODIACEAE

Atriplex acutibractea Anderson (P R)—in damp depressions; erect, stiff, branched, ± 25 cm tall (Aug. Oct.).

Atriplex cryptocarpa Aellen (D₁ D₃ D₄)—shrub to 70-80 cm tall; in flower, heads small, axillary (Oct.). Dominant shrub in D₃, a small colony on one side of D₁.

Atriplex eichleri Aellen (R)—perennial on damp clay; branches lax, more or less prostrate, 15-40 cm long (Aug.). A new species described by Aellen (Eichler 1965) who found the type specimen of *Atriplex campanulata* var. *adnata* belonged to it.

Atriplex hymenotheca Moq. (P D₁ R)—perennial in damp depressions; profusely branched, ± 40 cm tall; leaves entire, a few toothed, to 2 cm long, obovate, scaly, subsessile; all plants examined except one dioecious; bracteoles rhomboidal, entire, the bladder-like appendages variable in size, sometimes absent (Aug. Oct.).

This species is regarded as a western one and has been united with *A. vesicaria* (Howard) Benth. as *A. hymenotheca* Moq. by Aellen (1938). However *vesicaria* is retained as a separate species by workers in Eastern Australia.

Atriplex rhagodioides F. Muell. (D₁)—shrubs to 1-1.5 m, growing in shelter of *Acacia oswaldii* (Oct.).

Atriplex spongiosa F. Muell (P R)—annual, erect to 30 cm, luxuriant growth where water had lodged, and small in shallow soil with less moisture (Aug. Oct.).

¹ Information from Mr R. D. Royce.

Atriplex sp. aff. *A. muelleri* Benth. (P)—erect, woody; old stems smooth; leaves 2-3.5 cm long, flat, toothed, mealy, narrowed into a petiole; only 2 very young flowers found, bracteoles united to just below the middle, entire, \pm rhomboidal; no fruits (Aug.).

Atriplex sp. (No. 17, 1930) (P R)—seedlings numerous, some old plants with regrowth from the woody bases; mature plants erect, stiff, to 30 cm; leaves 2-4 cm, obovate, apex pointed but some truncate, toothed, petiolate; monoecious; bracteoles united to near the middle, 3 or 5-toothed, the middle tooth deltoid, rather narrow, always longer than the lateral ones, the lower part of the bracteoles narrowed and hardened in the developing fruit into a small stipe-like base (Aug.).

The closest resemblance of these plants seems to be the South African species, *A. suberecta* Verdoorn.

Atriplex sp. (No. 83, 1930) (R)—prostrate, woody, stems \pm 15 cm; leaves small, 5-9 mm long, obovate, green above mealy below; monoecious; axillary clusters of very young male and female flowers, bracteoles shortly stalked, 3-toothed, the middle tooth longer and deltoid; no fruits developed (Aug.). The flowers and bracteoles of this specimen are similar to those of the preceding ones but it differs in habit and foliage.

Bassia obliquicuspis Anderson (P D₁)—on shallow limestone soil, also deeper soil in donga, with *Atriplex hymenotheca* and other *Bassia* spp.; plants small, compact, branching, 6-8 cm tall (Aug. Oct.).

Bassia paralleliscuspis Anderson (P)—rare except in one small area south of the line; plants soft, erect, branching, 6-20 cm tall; tomentum brownish; flowers and young fruits (Aug.).

Bassia patentiscuspis Anderson (P D₁ D₂ TB R)—colonizers; plants small, tomentum grey; fruits with 2 spines up to 6 mm long, acicular, glabrous except near base, some reddish distally (Aug. Oct.). Equal spines were rare and in a number of cases one spine was reduced to a tubercle. Variations in length occurred on a single plant. Ising (1964) says that more than half the specimens showing this type of variation in spine length have come from the Nullarbor Plain.

Bassia sclerolaenoides (F. Muell.) (P D₁ TB R)—rare in 1930, abundant and widespread in 1955; mainly on bare soil; \pm 15 cm tall (Aug. Oct.).

Bassia uniflora (R Br.) F. Muell. (D₁ TB)—frequent (Oct.).

Chenopodium cristatum (F. Muell.) F. Muell. (R)—in wet places; mat plants, 10-50 cm diam.; some with regrowth from centre; fruits young and mature (Aug.).

**Chenopodium murale* L. (R)—rare (Aug.).

Enchylaena tomentosa R. Br. (D₃)—in shelter of *Pittosporum phylliraeoides*; fruits orange (Oct.).

Kochia georgei Diels (P R)—occasional; in fruit (Aug. Oct.).

Kochia sedifolia F. Muell. (P)—absent from dongas; many plants appeared dead, a few showed regrowth; \pm 50 cm tall (Aug. Oct.).

Salsola kali L. (D₁ TB R)—colonizer; numerous seedlings, young and mature plants (Aug. Oct.).

AIZOACEAE

Tetragonia eremaea Osth. (P D₁ TB R)—prostrate, plants large on bare soil near rabbit burrows, smaller in other places; stems to 25 cm long (Aug. Oct.).

PAPAVERACEAE

**Papaver hybridum* L. (R)—rare; flowers and few fruits (Aug.).

BRASSICACEAE (= CRUCIFERAE)

Arabidella trisecta (F. Muell.) Schulz (P R)—scattered small shrubs; \pm 40 cm tall; absent from dongas (Aug. Oct.).

**Brassica* sp. aff. *B. tournefortii* Gouan. (R)—scattered, robust tall plants, to 60 cm; basal leaves, rosulate, large, 15-18 cm long including petioles, hispid, cauline leaves small, narrow-lanceolate, toothed; flowers pale yellow; fruits very young, 3-4 mm with beaks, cylindrical, single-veined (Aug.).

**Carrichtera annua* (L.) DC (R)—in drainage channels; up to 40 cm tall; flowers white, in fruit (Oct.).

Lepidium rotundum (Desv.) DC (P D₁ R)—15-30 cm tall (Aug. Oct.).

Phlegmatospermum cochlearinum (F. Muell.) O. E. Schulz (D₁ R)—plants to 25 cm tall at lower levels of donga, smaller and less frequent on slopes; clothing hairs 2-branched on short stipes or centrifixed; flowers yellow; fruit \pm elliptical, style short (1 mm), cotyledons accumbent, some oblique, few incumbent (Aug. Oct.).

**Rapistrum rugosum* (L.) All. (R)—plants to 40 cm; flowers yellow, fruiting (Oct.).

**Sisymbrium irio* L. (R)—(Aug. Oct.).

**Sisymbrium orientale* L. (R)—fruits immature (Aug.), few flowers, many fruits (Oct.).

PITTOSPORACEAE

Pittosporum phylliraeoides DC (P D₁ D₂ D₃)—scattered small trees, \pm 2 m tall; a few young plants; few flowers, fruits green or dehiscent (Aug. Oct.).

MIMOSACEAE

Acacia oswaldii F. Muell. (D₁ D₂ D₃ TB S)—shrubs, isolated or in groups in dongas or smaller depressions on plain; 2-3 m tall; dehiscent fruits and few buds (Aug.), buds, flowers and mature fruits (Oct.). In 1930 fruits (red) of one of the Loranthaceae were germinating on some of these shrubs and in 1955 those in a donga (D₁) were heavily parasitized by *Amyema preissii*.

Acacia sowdenii Maiden (TB)—trees scattered over 20-30 acres; 5-6 m tall; flowers in globular heads (Aug.) Flowers and young fruits on some with sparse foliage, others appeared dead in 1955 (Oct.).

Acacia tetragonophylla F. Muell. (P D₁ D₂) scattered shrubs; 1-2 m tall; flowers, no fruits (Aug.), few flowers numerous fruits (Oct.).

FABACEAE (= PAPILIONACEAE)

Clanthus formosus (G. Don) Ford et Vickery (D₃ S)—plants large, in flower (Aug.). Rare and small, only in one donga (Oct.).

Lotus cruentus Court (D₁ D₂)—in shelter of other plants; stems long, trailing (Oct.).

**Medicago polymorpha* var. *brevispina* (Benth.) Heyn (R)—occasional; plants large; spines on pod short (1 mm) both straight and hooked (Aug.).

**Medicago polymorpha* var. *vulgaris* (Benth.) Shinnars (R)—occasional; spines on pod long (Oct.).

Psoralea cinerea Lindl. (D₁ S)—growing luxuriantly under other plants in centre of donga; stems prostrate, long (Oct.); abundant with *Trigonella suavissima*, flowers young, no fruits (Aug.).

Swainsona campestris J. M. Black (P D₃)—in small damp depressions on plain, tends to be a scrambler in deeper soil of donga; flowering stems erect up to 40 cm, fruiting stems prostrate (Aug., Oct.).

Swainsona oliveri F. Muell. (R)—rather rare; colonizer; prostrate, stems to 15 cm; few buds, in fruit (Aug., Oct.).

Swainsona oroboides F. Muell. ex Benth. ssp. *oroboides* (P)—a single specimen in fruit (Oct.). The type of tomentum, leaf and fruit characters are similar to those described for this subspecies by Lee (1948).

Trigonella suavissima Lindl. (S)—native clover; plants up to 30 cm tall; formed a large dense mass in one part of the Soak (Aug.).

GERANIACEAE

Erodium aureum Carolin (TB R)—scattered in ground flora; plants small, \pm 10 cm tall (Oct.).

Erodium cygnorum Nees ssp. *cygnorum* (P)—(Aug.).

Erodium cygnorum ssp. *glandulosum* Carolin (P R)—(Aug.).

These subspecies, which occurred together in shallow depressions, were readily separated on leaf form and type of calyx tomentum. Subsequent examination showed this was not so in respect to two other characters, the shape of the staminal filament and the mericarp hairs. In the specimen referred to ssp. *cygnorum* the staminal filament, instead of being lanceolate-acuminate as figured by Carolin (1958), had broad-oblong wings, slightly narrowed near the top with a tooth at each lateral edge of the upper margin. It was also different from Carolin's figure of the filament of ssp. *glandulosum*. In the specimen referred to ssp. *glandulosum* the mericarp hairs were more like those of ssp. *cygnorum*, but not quite as sparse or divergent.

Because of these variations the distinction between the subspecies was not clear, a condition Carolin said tended to occur when their ranges overlapped. This is so in the Forrest region as the range of ssp. *glandulosum* is mainly eastern and that of ssp. *cygnorum* mainly western.

OXALIDACEAE

Oxalis corniculata L. (R)—rather rare; small, prostrate (Oct.).

ZYGOPHYLLACEAE

Zygophyllum iodocarpum F. Muell. (TB R)—frequent; common in ground flora under *Acacia sowdenii*, also on bare areas of disturbed ground (Aug., Oct.).

Zygophyllum ovatum Ewart et White (P D₃ TB R)—common; small, to 10 cm tall, often prostrate (Aug., Oct.).

EUPHORBIACEAE

Euphorbia drummondii Boiss. (D₃ R)—rare; prostrate on bare clay (Oct.).

SAPINDACEAE

Heterodendrum oleaeifolium Desf. (P)—scattered small trees up to 2 m tall; foliage sparse; parasitized by a narrow leaved form of *Lysiana exocarpi*. (Aug. 1930). In 1955 (Oct.) most trees were dead.

MALVACEAE

Lavatera plebeia Sims (P D₁ TB S R)—frequent; scattered shrubs up to 1 m tall (Aug., Oct.).

Sida cardiophylla F. Muell. (R)—rare, small shrub, low spreading; in bud (Aug.).

CONVOLVULACEAE

Convolvulus erubescens Sims (P D₁ R)—occasional in depressions on plain, abundant at lower levels of donga; mat plants, large, stems slender, trailing and twining up to 60 cm long (Aug., Oct.).

Convolvulus sp. (D₁)—a large bright green prostrate plant (Oct.). Differed from *C. erubescens* in its longer fruits and two sepals enlarged and spreading.

BORAGINACEAE

**Buglossoides arvensis* (Patersons Curse) (L.) Johnston (R)—rare (Aug., Oct.). Some plants were erect, up to 30 cm tall, with flat sessile leaves, obtuse, \pm 4 cm long by 6 mm wide. Others were more spreading, branching mainly near the base of the stem, with shorter, narrower, lanceolate or oblong leaves, 1.5 cm long by 2-3 mm wide.

**Echium lycopsis* L. (R)—rare (Oct.).

Omphalolappula concava (F. Muell.) Brand (R)—rare (Aug.).

SOLANACEAE

Lycium australe F. Muell. (P D₁ S)—occasional; no flowers or fruits in 1930, both present in 1955.

Nicotiana goodspeedii Wheeler (D₁ TB R)—frequent; small in ground flora, 15-40 cm tall in centre of donga, glabrous; flowers cream to pale yellow (Oct.).

Nicotiana suaveolens Lehm. (R)—among weeds near a septic tank Overflow; a single robust, glabrous plant (Oct.).

Nicotiana sp. (possibly *N. benthamiana* Domin) (TB)—this specimen was lost after the following notes were made.

Plants numerous at the edge of a depression near *Acacia sowdenii*; up to 1 m tall, most about 50 cm; glabrous, basal leaves very large, cordate blades up to 20 cm long narrowing into long petioles, cauline leaves \pm 10 cm not decurrent; flowers yellow, calyx lobes acute, divided nearly halfway to the base, hirsute, corolla tube \pm 20 mm, 2-3 times as long as the calyx, lobes short, obtuse, stamens 5, 4 attached higher on the tube than the 5th; capsule smooth, as long as the calyx, seeds pitted (Aug.).

MYOPORACEAE

Eremophila latrobei F. Muell. (P)—scattered shrubs, to 1.25 m tall; few or no leaves on lower branches, new growth at upper ends (Aug.).

Eremophila longifolia (R. Br.) F. Muell. (P D₁)—small trees up to 3 m tall; new growth at ends of branches (Aug. Oct.).

Eremophila maculata (Ker-Gawl.) F. Muell. (P D₃)—small shrub in soil pockets in stony areas, occasional in a donga (Aug. Oct.).

PLANTAGINACEAE

Plantago varia R. Br. (R)—plants small, 10-14 cm tall (Aug.).

CUCURBITACEAE

Cucumis sp. (D₁)—on bare clay; fruits only \pm 2 cm in diameter; other parts of plants dead (Oct.).

GOODENIACEAE

Goodenia pinnatifida Schldl. (P D₁D₂ R)—plants 15-40 cm tall, smaller ones on limestone among bluebushes, larger in deeper soil of dongas (Aug. Oct.).

ASTERACEAE (= COMPOSITAE)

Angianthus brachypappus F. Muell. (P D₁ R)—colonizers; mat plants to 30 cm in diameter (Aug. Oct.).

Brachycome ciliaris (Labill.) Less. var. *ciliaris* (TB)—scattered in ground flora under *Acacia sowdenii*; up to 25 cm tall, glabrous; leaves pinnatisect with 7 lobes; minute glandular pubescence on stems and leaves (Aug.).

Calotis breviradiata (Ising) G. L. Davis (D₁ D₃ R)—occasional; plants small up to 8 cm tall on the slopes of dongas, larger, 14-30 cm, in lower parts of dongas and drainage channels (Oct.). A species of the Nullarbor Plain (Davis 1952).

Calotis hispidula (F. Muell.) F. Muell. (R)—plants small 6-10 cm tall; leaves entire or toothed, sometimes both types on same plant (Aug.). Davis (loc. cit.) says that only entire-leaved forms have been seen from the Nullarbor Plain and Eucla areas.

**Centaurea melitensis* L. (R)—occasional (Oct.).

Cephalopterum drummondii A. Gray (P D₂ D₃ TB R)—plants massed and prominent over large areas or scattered, 14-25 cm tall (Aug. Oct.).

Gnephosis skirrophora (Sond.) Benth. (P TB R)—on shallow limestone soil among bluebushes, frequent in other habitats; plants low tufted, 10-15 cm tall (Aug. Oct.).

Helipterum floribundum DC (P D₁ TB S R)—scattered in small depressions among bluebushes, large conspicuous colonies on slopes and lower levels of dongas; plants 5-30 cm tall (Aug. Oct.).

Helipterum strictum (Lindl.) Benth. (P)—occasional; plants erect, profusely branched, to 25 cm tall (Aug.).

Helipterum tenellum Turcz. (D₃ TB)—occasional, scattered in ground flora under *Acacia sowdenii* and on bare clay areas; plants small, tufted (Oct.).

Helipterum tietkensis F. Muell. (D₃ TB S R)—in soak forming a large dense colony, plants up to 35 cm tall (1930), in other habitats scattered and smaller \pm 11 cm tall; heavily scented (Aug. Oct.).

Minuria leptophylla DC (P)—rare; plants small, freely branched, up to 15 cm tall (Aug.).

Podolepis canescens A. Cunn. ex DC (P TB R)—frequent on shallow soil, abundant on deeper soils; plants 12-30 cm tall (Aug. Oct.).

Senecio aff. *lautus* Forst. f. ex Willd. (P D₁)—occasional in shallow depressions on plain, abundant in donga; plants 25-30 cm tall (Aug. Oct.).

**Sonchus* sp. (R)—(Oct.).

Vittadinia triloba (Gaudich.) DC (P D₁ D₂)—rare among bluebushes, frequent in dongas, plants to 15 cm tall (Aug. Oct.) most in fruit in 1955.

**Xanthium spinosum* L. (R)—burr fruits near railway, (Oct.).

LICHENES

Aspicilia calcarea (L.) Mudd.

Buellia subalbula Nyl Müll. Arg.

Dermatocarpon compactum (Mess) Lettau.

Lecanora sphaerospora Müll. Arg.

These lichens were all found encrusting the surface of limestone fragments. *Buellia subalbula* (fig. 5) was the most abundant species.

Lecidea decipiens Arch.—encrusting soil.

Lecidea crystallifera Tayl.—sterile on soil.

Lecidea aff. *glauca* Tayl.—sterile on soil.

Diploschistes aff. *ocellatus* DC Norm.—sterile.

Chondropsis semiviridis Nyl (*Parmelia hypoxantha* Müll. Arg.)—loose on surface of ground under *Acacia sowdenii*.

Teloschistes chrysophthalmus (L.) Th. Fries—orange lichen on twigs of *Acacia sowdenii*.

Caloplaca aurantiaca (Lightf.) Th. Fries—encrusting dead wood.

Parmelia sp.—undeterminable sterile fragments.

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