RARE AND GEOGRAPHICALLY RESTRICTED PLANTS OF WESTERN AUSTRALIA

4.

WONGAN HILLS SPECIES

By Barbara L. Rye

Western Australian Wildlife Research Centre, P.O. Box 51,
Wanneroo, Western Australia, 6065.

November 1980

CONTENTS

Figures

Tables

Tables (continued)

Appendices

ABSTRACT

This report lists 25 rare or geographically restricted species for the Wongan Hills vicinity and a further species, *Grevillea dryandroides*, for the Wongan-Ballidu Shire. Field surveys to assess conservation status were conducted for 13 of these species, including 6 that had been gazetted as rare flora.

The following recommendations are made:

(1) that *Dryandra comosa* and *D. pulchella* be deleted from the gazetted rare flora.

(2) that *Daviesia euphorbioides* and 5 presently unnamed species be gazetted as soon as possible.

(3) that further studies be undertaken with priority given to *Stylidium coroniforme* and *Verticordia staminosa*, which both appear to be extremely rare in the Wongan Hills area, and to 6 other species which appear to be sufficiently rare for gazettal.

(4) that some inadequately protected land occupied by very rare species be acquired for nature reserves or fenced off.

(5) that all the rare species, especially *Stylidium coroniforme*, be established in cultivation.

INTRODUCTION

Wongan Hills township is situated in a wheat and sheep farming district, 143 km (air distance) north-east of Perth. Unlike most wheatbelt towns, it is surrounded by substantial areas of bushland. Within a 20 km radius of the town there are six nature reserves ranging from 20 to 1,235 ha in size, a large water catchment reserve, at least 500 ha of uncleared land on the Department of Agriculture Experimental Farm, and ca 1,300 ha of freehold land in the Wongan Hills range.

The region includes a great variety of habitats supporting a rich flora. The Wongan Hills range of lateritic mesas has a maximum elevation of 434 m above sea level and is believed to harbour at least 13 endemic plant species. Three of the endemics (*Dryandra comosa*, *D. pulchella* and *Stylidium coroniforme*) have been gazetted as rare under the Wildlife Conservation Act. Gazetted rare species also occupy granite outcrops (*Eucalyptus caesia* and *Verticordia staminosa*) and the mixed soil of low gravelly hillslopes (*Gastrolobium glaucum*). Other prominent habitats in the region are the yellow sandplains and the salt lakes.

The Wongan Hills vicinity contains many other species of a similar rarity to the 6 gazetted species. It was partly due to this notable concentration of rare species that the region was chosen for the present study. The study's aims were:

(1) to provide a complete list of the rare and geographically restricted species of the region; *

(2) to conduct field surveys of the rare species to assess their conservation status;

(3) to propose conservation measures for species that are not adequately protected.

While the abundance of rare species known from the Wongan Hills area may be partly attributed to the diversity of natural habitats and to the occurrence of endemics in the Wongan Hills range, it is also due to the greater amount of information available for the area than for other wheatbelt farming districts. The Western Australian Naturalists' Club has made a study of the Wongan Hills range and some immediately adjacent land. Many of its findings are published in a valuable booklet (Kenneally 1977) outlining the history, climate, geology, vegetation and fauna of the area. However, this does not provide details of the conservation status of the rare plants.

As in many other regions of Western Australia, the bushland areas of Wongan Hills are being subjected to increasing pressure to be used for mining and agricultural purposes. Gravel and yellow sand are being excavated in some areas and exploratory drilling is planned in

---

* The definitions of rarity and geographical restriction used here (see Table 1) are those adopted by the Western Australian Wildlife Authority.

parts of the Wongan Hills range. Most of the range is privately owned but has not been cleared because of the difficulty in farming it. However, some parts of the range are grazed by livestock and some could feasibly be cleared for farming. Conservation priorities therefore need to be established for the region sithout delay.

METHODS

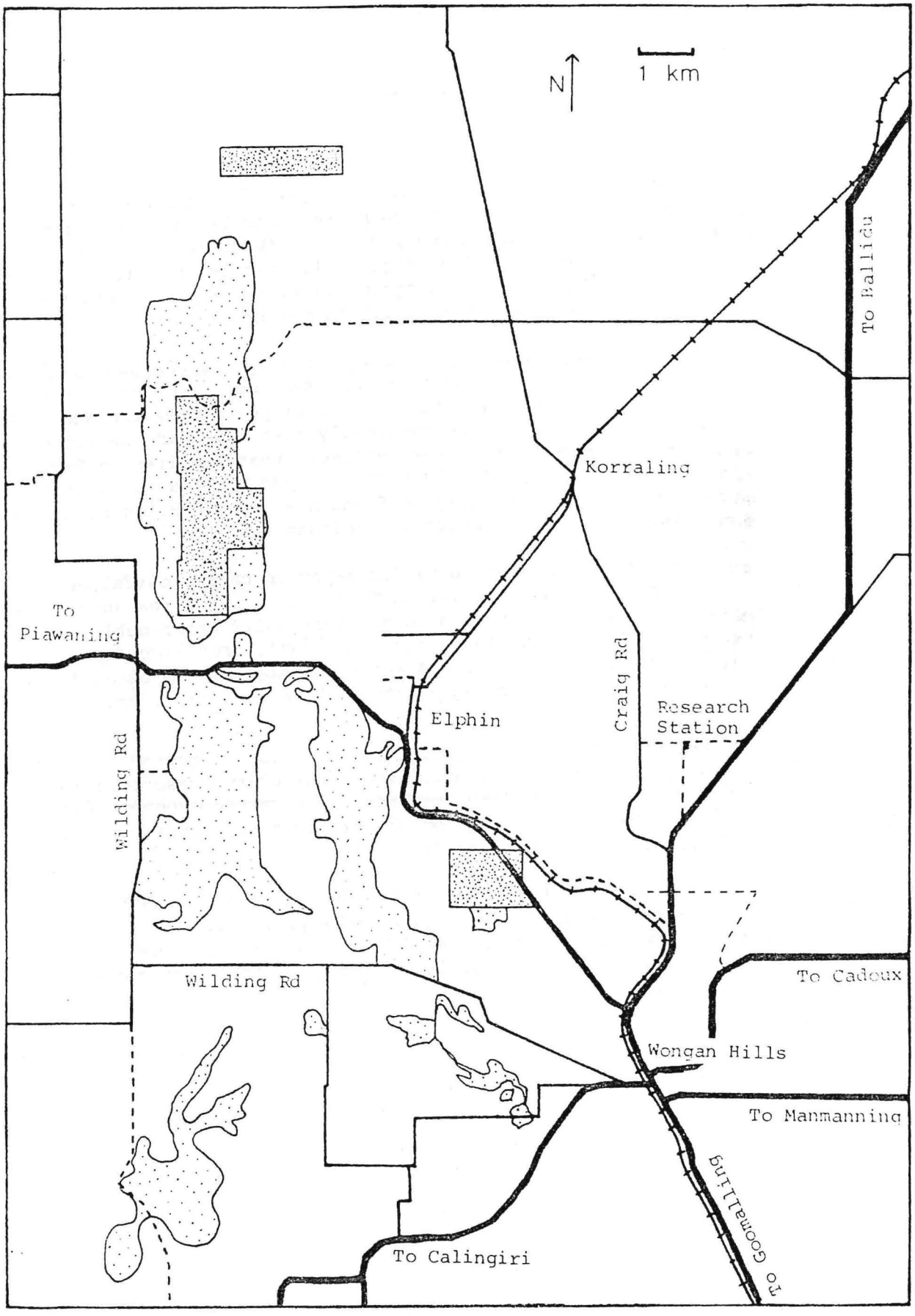
Marchant and Keighery (1979) and Kevin Kenneally (pers. comm.) were consulted to obtain a list of geographically restricted or rare plants occurring in the study area. The geographical range of each species was determined using the collection data for herbarium specimens housed in the Western Australian Herbarium (PERTH) combined with field observations made during this study.

Further information was sought only for species which appeared to be rare. However, several rare species (e.g. *Calytrix stowardii*) were not sought because too little was known about them at the time the study was conducted. *Eucalyptus eocarpa* was also excluded because it had already been examined in detail in another study (Hopper 1981). Although its closest known localities were near Ballidu, *Grevillea dryandroides* was included in this study because it inhabited yellow sandplain areas similar to those occurring close to Wongan Hills.

Four field excursions to Wongan Hills were undertaken during August-October 1980. Fig.1 shows the main study area and the portions searched. Fig. 2 shows the larger area surveyed for *Grevillea dryandroides* and for further populations of the other species. For each rare plant population located, the position, habitat, number of plant individuals and any other observations relevant to the species conservation status were recorded. However, the limited time available for field work meant that some parts of the Wongan Hills range were visited very briefly and some of their rare plant populations were incompletely recorded.

Figure 1. The Main Study Area at Wongan Hills.

The lightly stippled areas are the uncleared parts of the Wongan Hills range and the more heavily stippled areas are flora and fauna reserves.



RESULTS AND DISCUSSION

Table 1 lists 25 plant species occurring within a 20 kilometre radius of Wongan Hills which are believed to be rare or geographically restricted. The list includes 9 undescribed species, almost all endemic to the Wongan Hills range. If this is any guide, a high proportion of the rare and geographically restricted species of Western Australia must still await formal recognition.

Over 400 angiosperm species were recorded by Kenneally (1977) for the main study area and there are many more species in habitats not included in his publication. The proportion of the Wongan Hills flora listed as rare or geographically restricted is therefore well below 5%. However, it is very unlikely that the list in Table 1 is exhaustive. For example, *Rhizanthella gardneri* is one gazetted species which may eventually be found near Wongan Hills because the area appears to contain suitable habitats for it.

Vernacular names and a bibliography in chronological order are provided for the rare species in Table 2. Only a few species were sufficiently well known to have had vernacular names published. These were the poison plants (*Gastrolobium*), *Grevillea dryandroides* and *Verticordia staminosa*. A reference specimen is cited for each of the unpublished species to establish their identities.

Appendix 1 gives the collection details and reproductive stage of Western Australian herbarium specimens of the described species that were surveyed. Some specimens of *Daviesia euphorbioides* and *Grevillea dryandroides* were on loan in eastern Australia so could not be included in the appendix.

The exact locations and field observations recorded for each of the surveyed populations are given in Appendix 2. For a few of the better-known populations, some 'historical' details are also given. Photographs of the rare species and many of their habitats are provided in Appendix 3.

Table 1. Rare and Geographically Restricted Species of the Wongan Hills Area.

Key.
- * Species surveyed in this study
- # Species known only from two widely separated areas
- T Species known only from type locality (or a single locality)
- VR Very Rare - having less than a few hundred reproductively mature plants in natural populations
- R Rare - less than a few thousand reproductively mature plants in natural populations
- VGR Very Geographically Restricted - having a maximum geographical range of less than 50 km
- GR Geographically Restricted - maximum geographical range less than 160 km

Species	Approx. Range (km)	Gazetted Rare	Endemic to Wongan Hills Range	Classification			
				VR	R	VGR	GR
Occurring Within 20 km of Wongan Hills Town							
Acacia denticulosa F. Muell.	150	-	-	-	-	-	+
A. dura Benth.	30	-	-	-	-	+	-
A. semicircinalis Maiden & Blakely	9	-	+	-	+	+	-
* *A.* sp. aff. *obovata*	T	-	+	+	-	+	-
* *A.* sp. 2	T	-	+	+	-	+	-
A. sp. aff. *semicircinalis*	15	-	+	-	-	+	-
Boronia ericifolia Benth.	90	-	-	-	-	-	+
Calytrix stowardii S. Moore	T	-	?	+	-	+	-
Conostylis sp. aff. *teretiuscula*	40	-	-	-	+	+	-
Clematis sp.	9	-	+	-	-	+	-
* *Daviesia euphorbioides* Benth.	1	-	-	+	-	+	-
* *D.* sp.	5	-	+	-	?	+	-
* *Dryandra comosa* Meisn.	11	+	+	-	-	+	-
* *D. pulchella* Meisn.	8	+	+	-	-	+	-
Eremophila sargentii (S. Moore) J.W. Green	70	-	-	-	-	-	+
E. sp.	T	-	+	+	-	+	-

Table 1 (continued)

Species	Approx. Range (km)	Gazetted Rare	Endemic to Wongan Hills	Classification			
				VR	R	VGR	GR
Occurring Within 20 km of Wongan Hills Town (continued)							
* *Erioctemon* sp.	T	-	+	+	-	+	-
Eucalyptus caesia Benth.	300	+	-	-	+	-	-
* *Gastrolobium glaucum* C.A. Gardner	T	+	-	+	-	+	-
* *G. hamulosum* Meisn.	110	-	-	-	+	-	+
Melaleuca nebateri S. Moore	80	-	-	-	-	-	+
* *Microcorys* sp.	7	-	+	-	+	+	-
* *Rhagodia* sp.	T	-	+	-	+	+	-
* *Stylidium coronifome* R. Erickson & Willis	T	+	+	+	-	+	-
Tetratheca retrorsa J. Thompson	220	-	-	-	?	#	-
* *Verticordia staminosa* C.A. Gardner & George	300	+	-	+	-	#	-
Other Species Studied Nearby							
* *Grevillea thelemanniana* C.A. Gardner	60	+	-	-	+	-	+

Table 2. Vernacular Names, Bibliography and Reference Specimens for Rare Plants in the Wongan Hills Area.

Species	Vernacular Name	Bibliography or Reference Specimen
Acacia sp. aff. *obovata*.	Dwarf Rock Wattle	* K.F. Kenneally 7496
Acacia sp. 2	Wongan Gully Wattle	* B.R. Maslin 4205
Conostylis sp. aff. *teretiuscula*	-	S.D. Hopper 1108
Daviesia euphorbioides	Cactus Pea	Bentham 1864
Daviesia sp.	Wongan Bitter-pea	* K.F. Kenneally 2303
Dryandra comosa	Wongan Dryandra	Meisner 1856 Bentham 1870 Rye & Hopper 1981
Dryandra pulchella	Sprawling Dryandra	Meisner 1856 Bentham 1870 Kenneally 1977 (mislabelled *D. comosa*) Rye & Hopper 1981
Eremophila sp.	Wongan Eremophila	* K.F. Kenneally 7498
Eriostemon sp.	Wongan Eriostemon	* K.F. Kenneally 7466
Gastrolobium glaucum	Spike Poison; Wongan Poison.	Gardner 1942 Gardner & Bennetts 1956 Aplin 1973 Everist 1974 Rye & Hopper 1981
Gastrolobium hamulosum	Hook-leaf Poison	Meisner 1848 Bentham 1864 Gardner & Bennetts 1956 Aplin 1973 Everist 1974
Grevillea dryandroides	Phalanx Grevillea	Gardner 1933 Erickson *et al* 1979 Rye & Hopper 1981

* These species will be described in a combined publication by R.J. Chinnock (*Eremophila*), K.F. Kenneally (*Microcorys*), B.R. Maslin (*Acacia*) and P.G. Wilson (*Eriostemon, Rhagodia*) in *Nuytsia*, probably during 1981.

Table 2 (Continued)

Species	Vernacular Name	Bibliography or Reference Specimen
Microcorys sp.	-	* K.F. Kenneally 7497
Rhagodia sp.	Wongan Saltbush	* K.F. Kenneally 2384
Stylidium coroniforme	Wongan Triggerplant	Erickson & Willis 1966 Rye & Hopper 1981
Verticordia staminosa	Wongan Featherflower	Gardner & George 1963 Erickson *et al* 1979 Rye & Hopper 1981

Distribution and Habitat

The known distributions of rare species in the Wongan Hills area are shown in Fig. 3 and the localities for *Grevillea dryandroides* in Fig. 2. The most geographically restricted species are the seven that are known only from their 'type' localities (Table 1) and *Daviesia euphorbioides*, whose range is only ca 1.5 km. The three 'populations' of *D. euphorbioides* are so closely bunched (see Appendix 2) that they may all be remnants or offshoots of the type population.

At the other extreme, *Eucalyptus caesia* and *Verticordia staminosa* have wide ranges despite their rarity. Both occur in small populations on scattered granite outcrops. *V. staminosa* has only been recorded from two localities approximately 300 km apart, although many other granite rocks in the intervening region would appear to offer a suitable habitat for the species. *E. caesia* occurs on many rocks scattered over a similar distance. *Tetratheca retrorsa* also has quite a wide range (220 km) but is only known from two areas (Wongan Hills range and Tutanning) where there are lateritic breakaways (Thompson 1976).

The actual geographical range of extant populations of the plants may be quite different from the 'known' figures given in Table 1. Some populations represented by herbarium specimens may now be extinct while some extant populations have yet to be recorded. Most of the species known only from their 'type' localities are endemic to the Wongan Hills range and further populations would probably be located for some of them if the range were explored more fully.

Table 3 outlines the habitats occupied by each of the surveyed species. In Wongan Hills town, the mean annual rainfall is 390 mm, the mean minimum daily temperature 11.4°C and the mean maximum daily temperature 25.2°C (Bureau of Meteorology 1975).

Of the nine species endemic to the Wongan Hills range, four (*Acacia* sp. aff. *obovata*, *Acacia* sp. 2, *Eriostemon* sp. and *Rhagodia* sp.) are known from only one locality and have not been observed to grow with other rare species, although *Acacia* sp. 2 and *Eriostemon* sp. occur in close proximity and may overlap slightly. *Stylidium coroniforme* is also known from only one locality where it grows with *Dryandra comosa*. The remaining four species (*Daviesia* sp., *Dryandra comosa*, *Dryandra pulchella* and *Microcorys* sp.) have been observed in all possible pairwise combinations and are each known from many localities in the hills.

Acacia sp. 2, *Eriostemon* sp. and *Rhagodia* sp. are evidently restricted to gullies. *Rhagodia* sp. occurs in the only really deep creek gorge in the hills. *Acacia* sp. 2 and *Eriostemon* sp. grow in a soil with small rocks derived from greenstone; a soil which is not known from elsewhere in the hills (Kenneally pers. comm.). Each of these species may therefore occupy a habitat that is unique in the range. If so, these species have always been very rare and their solitary populations are probably almost as large now as they were prior to settlement in the Wongan Hills area.

Figure 2. Roads Surveyed in the Wongan Hills-Ballidu-Cadoux Area and the Location of *Grevillea drummondii* Populations.

● Sampled localities

○ Herbarium locality (not relocated)

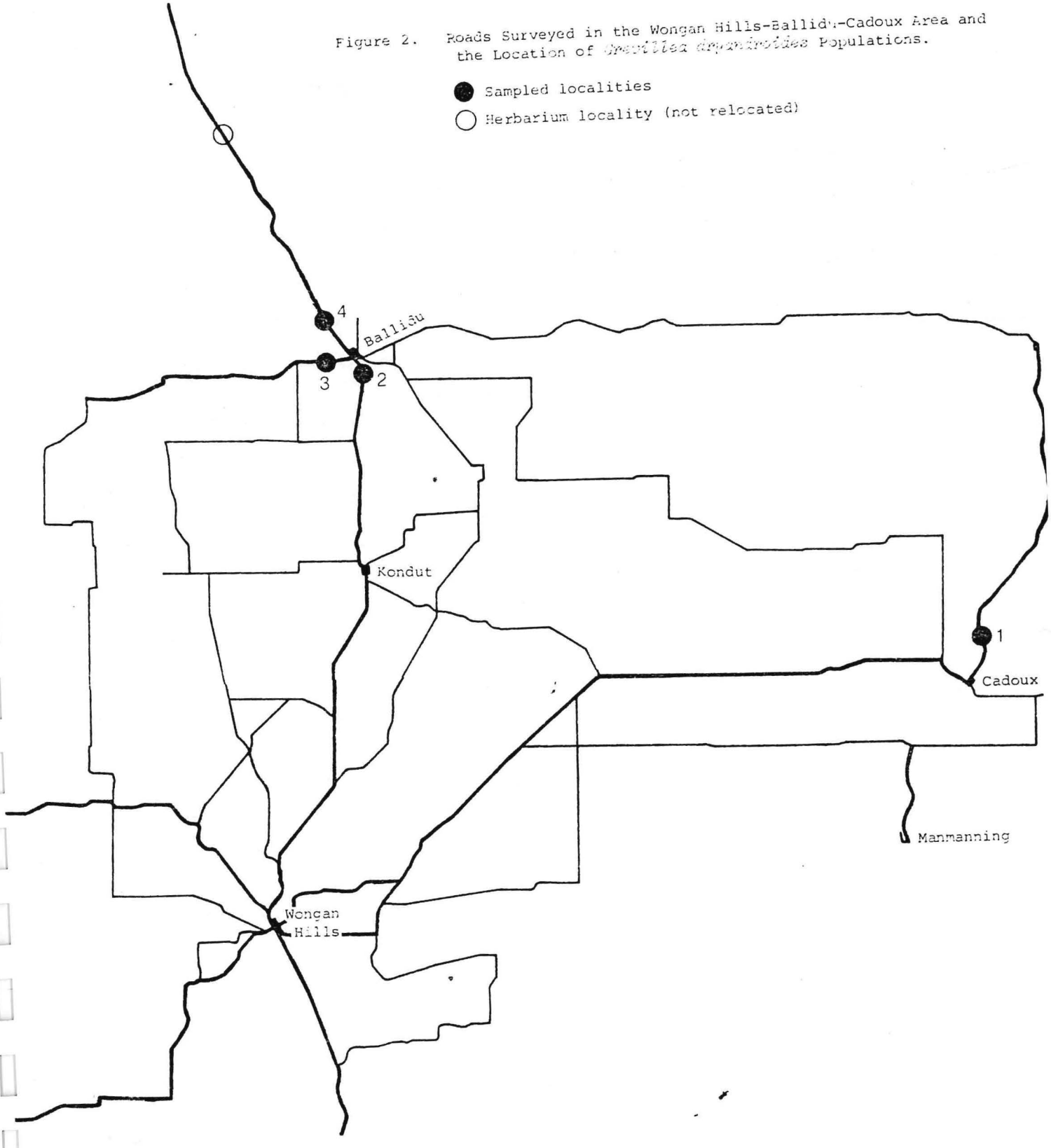


Figure 3. The Locations of Surveyed Populations of Rare Plants in the Main Wongan Hills Study Area.

The population numbers are the same as those given in Appendix 2.

a. *Daviesia* species.

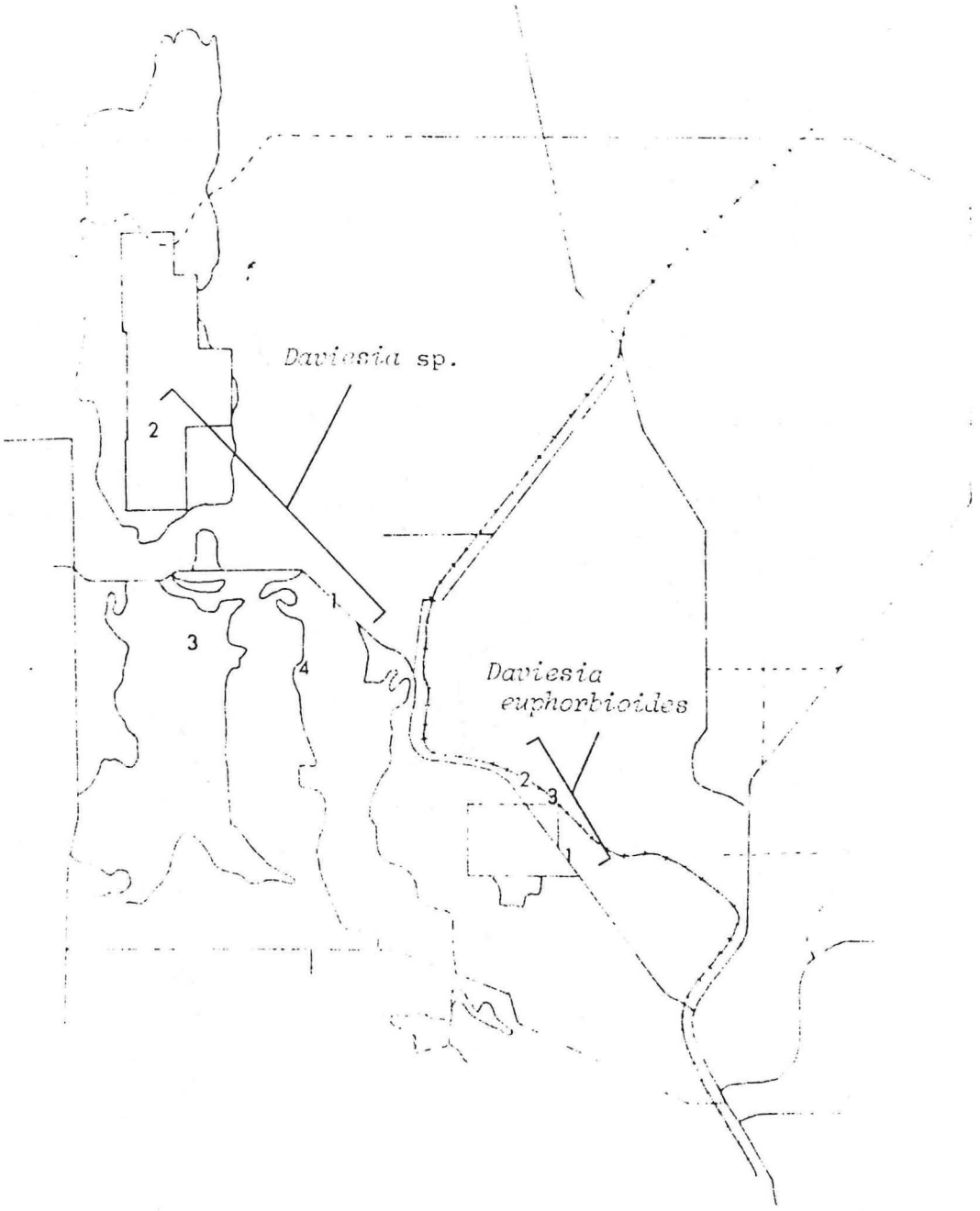


Figure 3 (continued).

b. *Dryandra comosa*.

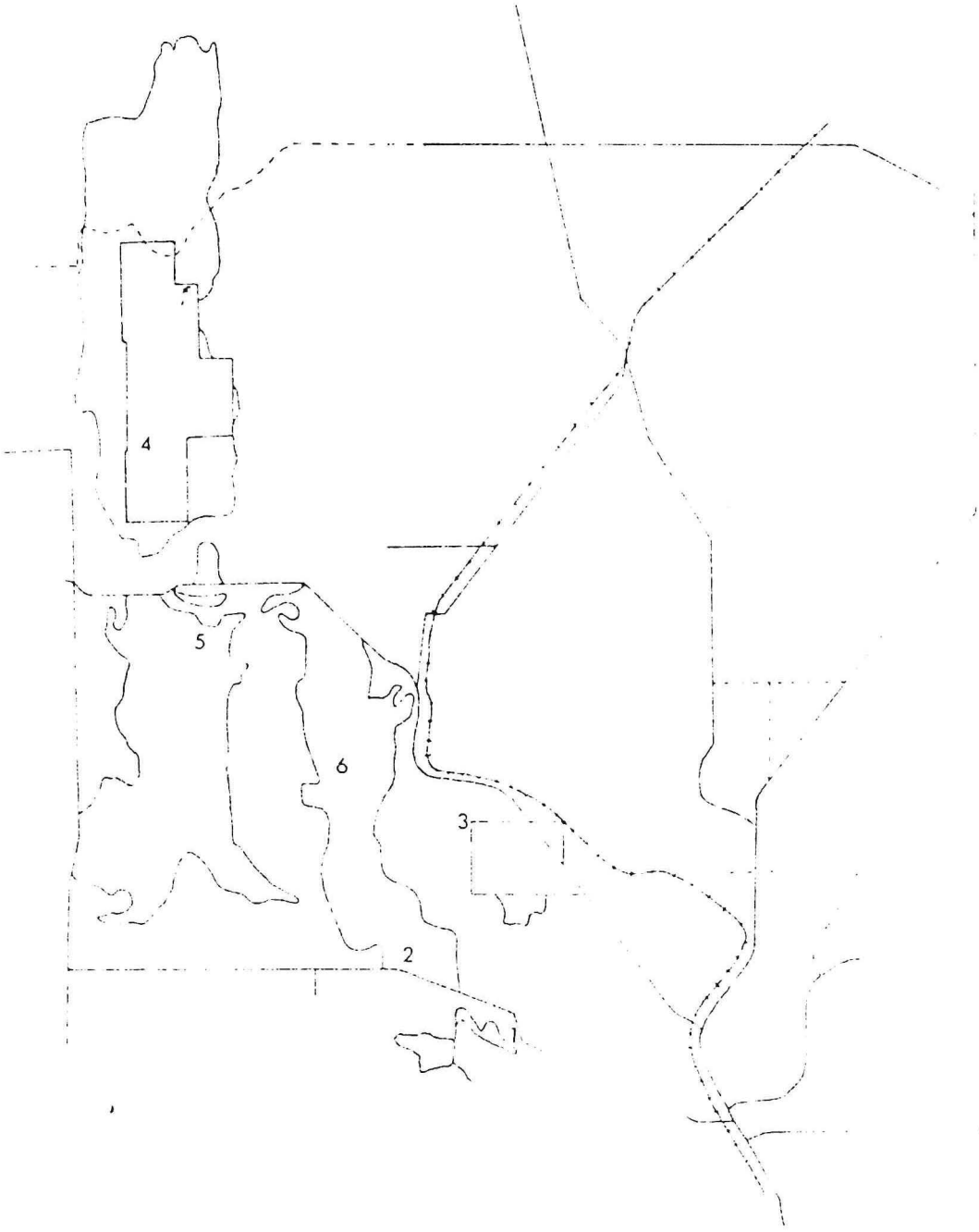


Figure 3 (continued)

c. *Dryandra pulchella*

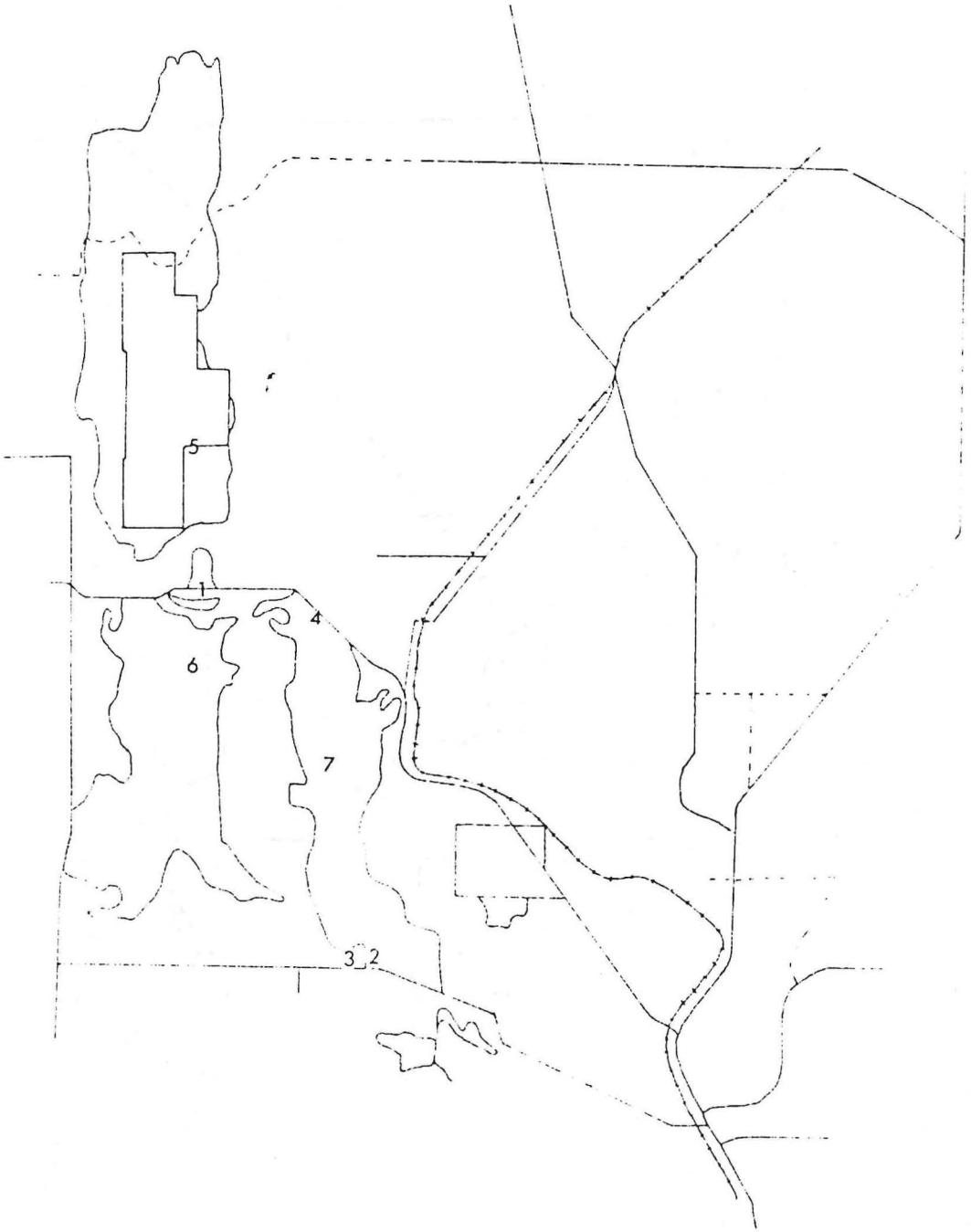


Figure 3 (continued)

d. *Microcorys* sp.

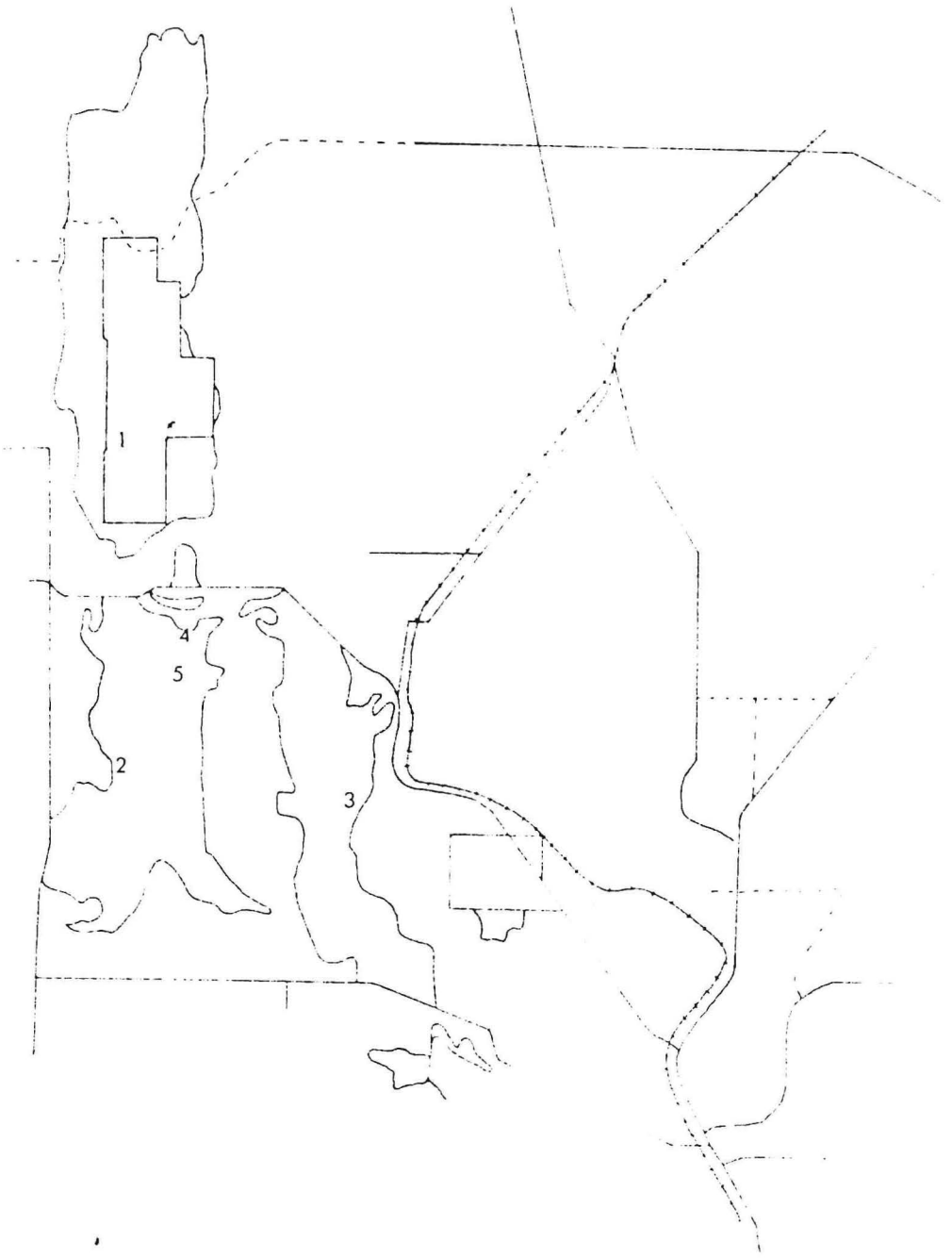


Figure 3 (continued)

e. Remaining species

O *Acacia* sp. aff. *obovata*
A *Acacia* sp. 2
C *Conostylis* sp.
E *Eriostemon* sp.
G *Gastrolobium glaucum*
H *Gastrolobium hamulosum*
R *Rhagodia* sp.
S *Stylidium coroniforme*

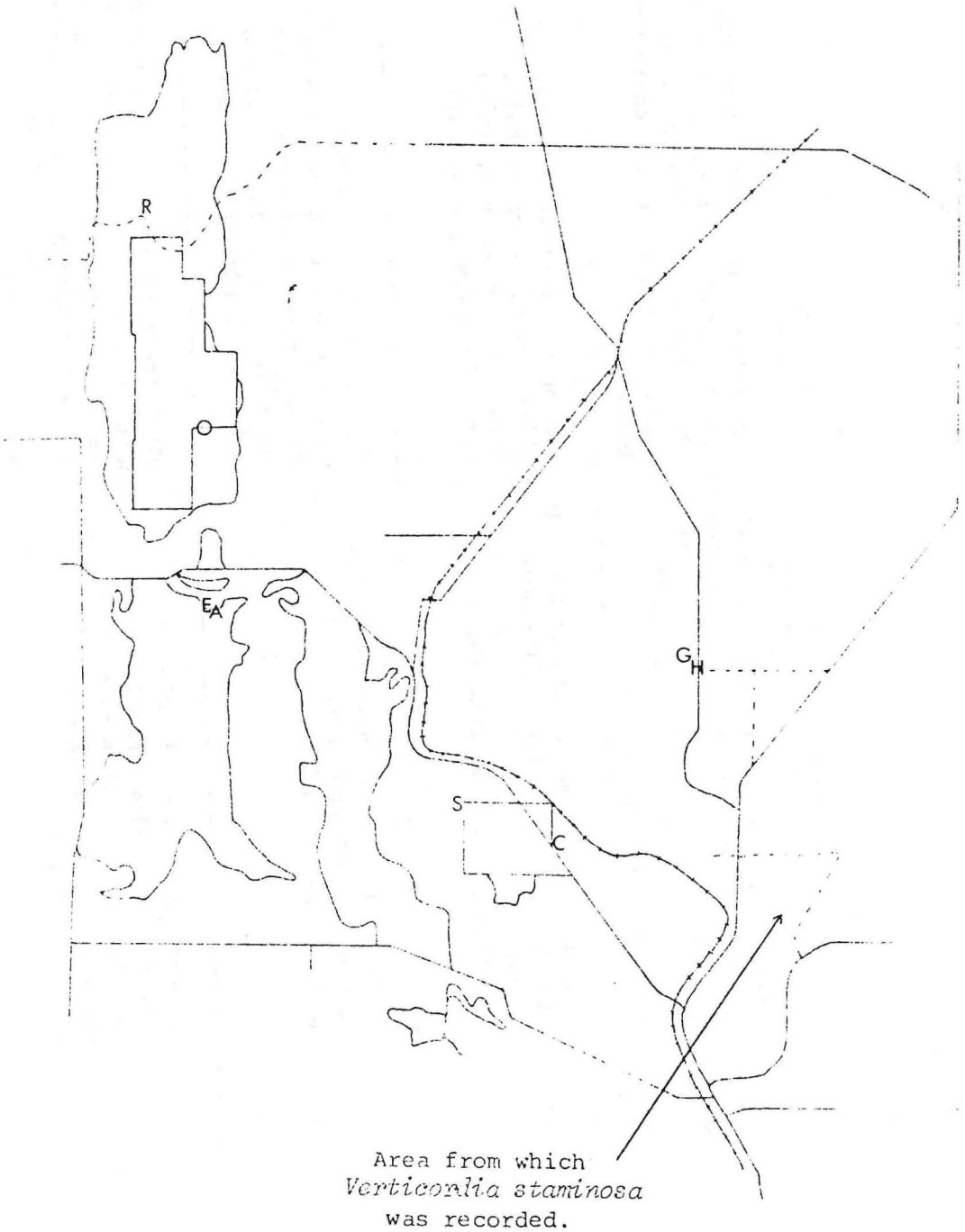


Table 3. Habitat Summary

Species	Soil and Landform	Vegetation
Acacia sp. 2	Red-brown clay with numerous small rocks (greenstone and laterite scree) *A. pharangites* occurred along creek gullies, being most common on the west-facing slopes.	Together with *Calothamnus asper*, *Casuarina acutivalvis* and *Melaleuca radula*, *Acacia* sp. 2 formed a dense shrub layer up to 5m tall, but mostly 3-4m. The lower shrubs were sparse and there was no evidence of disturbance.
Acacia sp. aff. *obovata*	Laterite conglomerate along the top of a breakaway. The plants were growing in rock crevices, their roots presumably reaching into the underlying clay.	An open undisturbed woodland of mallees (*Eucalyptus ebbanoensis*) to ca 6m tall. Other common species were *Casuarina campestris*, *Hakea scoparia* and *Dryandra* sp. aff. *hewardiana*, 2-3m tall.
Daviesia euphorbioides	Pale yellowish or white clay-loam with some sand and gravel, on the upper slopes of a hill.	*D. euphorbioides* occurred only as a colonizer on ground that had been cleared, growing with varied other species which thrive in disturbed areas, such as *Conospermum brownii*, *Glischrocaryon aureum*, *Verticordia chrysantha* and other *Verticordia* species.
Daviesia sp.	Orange-brown gravelly clay or relatively shallow gravelly soil over laterite conglomerate. On the lower or upper slopes of lateritic hills.	Most frequent where it had colonized ground that had been cleared. In undisturbed areas, scattered *Daviesia* plants grew in an open mallee woodland (e.g. of *Eucalyptus eudesmoides* or *E. ebbanoensis*), usually with *Casuarina campestris*, *Acacia* sp. aff. *semicircinalis* and various *Dryandra* species.

Table 3 (Continued)

Species	Soil and Landform	Vegetation
Dryandra comosa	Orange-brown gravelly clay or shallow gravelly soil over laterite conglomerate. On the summits of mesas, their upper slopes and sometimes their lower slopes.	Open woodlands of various mallee species, particularly *Eucalyptus ebbanoensis* and *E. drummondii*, to ca 7m tall. *Casuarina campestris* and *Hakea scoparia* (both ca 3m) were usually present and varied smaller shrubs.
Dryandra pulchella	Orange-brown gravelly clay, rarely shallow soil over laterite conglomerate. The lower to upper slopes of lateritic mesas.	Open woodlands of various mallee species, particularly *Eucalyptus ebbanoensis*, *E. eudesmoides* and *E. drummondii*, to 6 or 7m tall, with a lower storey (ca 3m) of *Casuarina campestris*. Varied smaller shrubs.
Eriostemon sp.	Reddish-brown clay with numerous small rocks (greenstone and laterite scree). The lower parts of a creek gully and adjacent hills and a flatter area at the base of the hills.	The steeper ground had an undisturbed dense shrubland to 5m of *Casuarina campestris* and *Calothamnus asper*. The lower area had a few scattered mallees (*Eucalyptus loxophleba* and *E. ebbanoensis*) and *Casuarina acutivalvis*. It had evidently been cleared and there was much bare ground. Both areas had *Baeckea crispiflora* and other small shrubs were common in the lower part.

Table 3 (Continued)

Species	Soil and Landform	Vegetation
Gastrolobium glaucum	Pale yellowish clay-loam with some sand and small pieces of gravel. Barely sloping lower part of a hill, which was capped with gravel.	The gastrolobiums were growing in a low shrubland on ground that had been disturbed and left to regenerate. Other shrubs present included *Hakea incrassata*, *Melaleuca* sp. and *Hakea scoparia*. The adjacent uncleared vegetation consisted of a thicket of *Casuarina campestris* up to 3.5 m tall.
Gastrolobium hamulosum	Pale yellowish clay-loam with some sand and gravel. Barely sloping lower part of a gravel-capped hill.	The gastrolobiums were growing on open, very disturbed ground with various small colonizer shrubs (including *Baeckea crispiflora*, *Gastrolobium calycinum* and *Mirbelia spinosa*) up to 1m tall, yellow everlastings (*Podolepis canescens*) and numerous herbaceous weeds. The adjacent uncleared vegetation consisted of a thicket of *Casuarina campestris* up to 3.5 m tall.
Grevillea dryandroides	Pale or bright yellow sand-loam. Very gentle slopes near the bases of hills.	The species was most frequent as a colonizer of cleared ground, growing with a variety of other small colonizing shrubs and herbs and often herbaceous weeds. The dominant species, *Grevillea armigera*, was up to ca 3m tall and generally infrequent.

Table 3 (Continued)

Species	Soil and Landform	Vegetation
Microcorys sp.	Some plants grow in the rock crevices of laterite conglomerate along the top edge of breakaways, presumably with their roots reaching into the underlying clay. Others grow in gravelly soil on top of mesas or on their upper slopes.	Most frequent where it had colonized cleared ground on firebreaks or tracks, growing with great variety of other shrub species. On the undisturbed breakaways, it grew with *Acacia* sp. aff. *semicircinalis*, sometimes with *Hakea scoparia* and *Petrophile shuttleworthiana*.
Rhagodia sp.	Rich brown clay and small rocks (lateritic scree). The base of a creek gully and the steep slopes of the breakaways on either side.	An open woodland of *Eucalyptus loxophleba* to ca 10m, with *Acacia acuminata* (to ca 6.5 m), *Anthocercis genistoides*, *Scaevola spinescens*, *Dodonaea lanraeoides*, *Melaleuca undulata*, *Clematis* sp. and other species. There was much bare ground. It was probably subjected to minor, but frequent, distrurbance.
Stylidium coroniforme	Orange-brown laterite conglomerate. This was originally covered by a shallow layer of yellowish sandy soil. Gentle northern slope of a hill.	The stylidium was growing in a very open area with numerous *Dampiera eriocephala* plants, a few small shrubs of *Baeckea crispiflora*, *Gastrolobium spinosum* and *Melaleuca pungens*. These were encircled by *Dryandra comosa* shrubs to 3.5 m tall; mallees (*Eucalyptus redunca* and *E. pyriformis*) to ca 8m; *Casuarina acutivalvis* to ca 6m; *Melaleuca uncinata* and *Acacia nigripilosa*.

Table 3 (Continued)

Species	Soil and Landform	Vegetation
Verticordia staminosa	Granite outcrops or sheets on a hillside.	All of the granite rocks were skirted by numerous small shrubs (less than 0.5 m) of *Verticordia chrysantha* and *Calytrix* sp., sometimes with a few taller *Melaleuca fulgens* shrubs.

In mature undisturbed vegetation, *Microcorys* sp. is apparently restricted to the tops of breakaways, growing in cracks in lateritic conglomerate. *Acacia* sp. aff. *obovata* occurs on an identical habitat. Since lateritic breakaways are scattered through most of the Wongan Hills range, more natural populations of both species would probably be found if the breakaways were systematically searched. However, larger populations of *Microcorys* sp. may be found in disturbed areas in the upper parts of the range. The largest known population (population 1) occurs along a wide track that had been cut across the top of a mesa, but no *Microcorys* sp. plants were observed in the undisturbed vegetation on either side of the track.

Daviesia sp. and the two *Dryandra* species also appear to be successful colonizers in certain situations, but each occupies a greater range of undisturbed habitats than *Microcorys* sp. The largest population of *Daviesia* sp. occurred low in the range where it had colonized a road verge (population 1). In undisturbed vegetation the species was relatively uncommon but occupied the top of at least one mesa as well as occurring on the lower slopes of the hills.

The two dryandras rarely grew together, although they sometimes occurred intermixed with the other shrub dryandra species of the range, *D.* sp. aff. *hewardiana* and *D.* sp. aff. *cirsioides*. At one locality all four dryandras were observed in fairly close proximity, where they had apparently all colonized a disturbed patch of ground bordering farmland. In undisturbed areas, *D. pulchella* and *D. comosa* often occurred in wide belts, and only came in contact with one another at the extreme borders of their respective populations.

Dryandra comosa tended to occupy higher parts of the mesas than *D. pulchella* and only *D. comosa* was observed in areas where there was laterite conglomerate at ground level or just below. Both species occurred in the deeper gravelly soils of the lower slopes. However, *D. pulchella* formed much larger populations in these areas than *D. comosa*, whose largest populations were on the upper parts of the range. *Dryandra* sp. aff. *cirsioides* was apparently restricted to the lowest parts of the range. *Dryandra* sp. aff. *hewardiana* was widespread and probably the most common species in the range. It would be interesting to investigate the distribution patterns of the four dryandra species more fully because sites which appeared in this quick survey to offer very similar habitats often carried different dryandras or combinations of them.

Stylidium coroniforme occurs at the edge of the Wongan Hills range where the yellowish, somewhat sandy soil common on the plains overlies the laterite conglomerate common in the hills. One of the Wongan Hills endemics (*Dryandra comosa*) occurs at the site together with three species (*Eucalyptus pyriformis*, *Dampiera eriocephala* and *Acacia nigripilosa*) which normally occur on sandplain and are not known from anywhere else in the range. There does not appear to be any other 'natural' area in the range with a suitable soil type to support all these species, although similar habitats may once have existed in low parts of the range that are now being farmed. If *Stylidium coroniforme* is quite specific in its habitat, it is very unlikely to have other populations in the Wongan Hills area. In the present survey, more time was spent searching for further populations

of this species than for other rare plants. Various habitats skirting and on the edges of the range were examined unsuccessfully.

East of Wongan Hills range and north of the town is an area of small hills with very mixed soils. *Daviesia euphorbioides* and *Gastrolobium glaucum* are endemic to this area and two other rare species, *Conostylis* sp. aff. *teretiuscula* and *Gastrolobium* sp. nov., also occur there. *Daviesia euphorbioides* and *Conostylis* sp. aff. *teretiuscula* occur together on a hill bordering the Wongan Hills range. The soil contains sand, gravel, loam and clay, presumably a mixture of the range's soils with 'sandplain' soils. *Daviesia euphorbioides* is a colonizer, occurring on the road and railway verges and on disused tracks. No plants were seen in the undisturbed vegetation.

The gastrolobiums occur at a site further east on similar mixed soil. Both species are poison plants and require some clay in the soil in order to produce their toxin, monofluoroacetic acid (T.E.H. Aplin pers. comm.). However, the ground also contains sand, gravel and loam. Both species are colonizers and they grew together on the road verges when the site was visited about 10 years ago by T.E.H. Aplin. The verges have now become very weedy and *Gastrolobium glaucum* no longer occurs on them although it is quite common in low shrubland about 0.1 km from the road. Neither species occurs in the undisturbed climax vegetation of the site - a *Casuarina campestris* thicket.

The unusual mixed soils occupied by *Daviesia euphorbioides* and *Gastrolobium glaucum* might explain the extremely restricted range of each species. However, the species do not occur on a number of similar soils that were examined in the same general area.

The only known locality for *Verticordia staminosa* in the Wongan Hills region is a little further west in an area of numerous granite sheets and at least two granite outcrops. A search for the species in this area and many other granite rocks around Wongan Hills was unsuccessful.

Grevillea dryandroides was found at four localities (Fig. 2) outside the main study area, growing on yellow sandy soil dominated by *Grevillea armigera*. It was not found at numerous other yellow sand patches surveyed, including many within the main study area. It is another colonizer, with almost all the plants occurring on ground that had been cleared.

Reproductive Biology

The known flowering times and other aspects of the plants' reproductive biology are summarized in Table 4. Apart from the winter-flowering *Verticordia staminosa*, all the species flower during spring. Some begin flowering in winter, some are restricted to spring and others continue flowering into summer.

Comparisons of flowering times are most interesting between related species which occupy similar niches because a flowering time difference provides a premating barrier to hybridization. *Gastrolobium glaucum* and *G. hamulosum* apparently flower simultaneously. *Dryandra comosa* tends to flower earlier than *D. pulchella* although there is considerable overlap. Both of these species pairs also overlap in flowering time with at least one other sympatric member of their respective genera. However, the fairly large morphological differences between the species within each genus suggests that they are not particularly closely related. No hybrids were observed involving any of the rare species studied.

The flowering periods in 1980 were similar to those in previous years as far as can be determined from the herbarium record (Appendix 1). Variation in flowering time was noted between populations of the same species and between individuals of the same population. For example, one individual of *Dryandra pulchella* (population 3) had started to flower on the 22 August, whereas most plants did not start to flower until late September, October or even November in the latest populations.

Four species (*D. comosa, D. pulchella, Grevillea dryandroides* and *Microcorys* sp.) are apparently adapted for bird pollination. Their flowers are large and solitary (*Microcorys*) or massed in large heads, red or yellow, elongated, and produce copious nectar. Early one morning two species of birds were observed feeding from the flowers of *Dryandra comosa* (Table 5). No further observations were made of animals of any kind visiting the flowers of the 'bird' species. However, the populations were generally not visited at the time of day when honeyeaters are most active.

The remaining ten species had smaller flowers and appeared to be exclusively insect-pollinated, although observations of insects visiting the flowers were scanty (Table 5).

The fruiting periods of the rare species are generally poorly known. In *Eriostemon* sp., the gastrolobiums and *Grevillea dryandroides*, the fruits apparently mature and dehisce or are released from the plant within a month or two of flowering. *Daviesia euphorbioides* (and presumably *Daviesia* sp.) takes much longer for its seeds to mature although the fruits apparently reach full size within a month. The pods observed between late September and late November were still green and fleshy in contrast to the dry blackened dehisced pods of the previous year, a few of which were still attached to the plants.

The dryandra species bore numerous woody follicles from the previous year(s) which appeared mature but had not dehisced. These

Table 4. Reproductive Biology.

Species	Flowering Period	Presumed Pollination Type	Fruit and Seed Set	Vegetative Reproduction and Fire Tolerance
Acacia sp. aff. *obovata*	Oct-Nov	Insect	Few fruits per plant. 2-3 seeds per fruit.	Single-stemmed, but would tend to be protected from fires by their rocky habitat (see Table 3).
Acacia sp. 2	Aug-Sep	Insect	Abundant fruits per plant and ca 6 seeds per pod usually. (B.R. Maslin pers. comm.)	Plants are single-stemmed and therefore presumably killed by fires.
Conostylis sp. aff. *teretiuscula*	Aug-Sep	Insect	Probably low (S. Hopper pers. comm.)	Probably killed by fires. (S. Hopper pers. comm.)
Daviesia euphorbioides	Aug-Sep	Insect	Few to ca 50 fruits set per plant. Seed set averaged 0.7 per pod in a sample of 20 pods.	The species is killed by fire, although its fleshy stems and its tendency to occupy open ground may partially protect it.
Daviesia sp.	Sep-Nov	Insect	Few fruits set per plant apparently. In a sample of 26 pods, each had a single seed.	Single-stemmed small bushy plants which should be readily killed by fires.

Table 4 (Continued)

Species	Flowering Period	Presumed Pollination Type	Fruit and Seed Set	Vegetative Reproduction and Fire Tolerance
Dryandra comosa	Aug-Oct	Bird	Abundant fruiting heads per plant. In a sample of 46 fruiting heads there was an average of 2.65 follicles per head. Each follicle examined contained one seed.	Single-stemmed and often retaining thick mats of dead leaves. Should be readily killed by fires.
Dryandra pulchella	Sep-Dec	Bird	Numerous flower heads per plant but most had set no fruits, a few had 1 fruit (single-seeded) and very few had 2 fruits.	As for *D. comosa*, but probably more susceptible to fires because of its sprawling habit.
Eriostemon sp.	Aug-Sep	Insect	Appeared to set few fruits (and seeds) per plant.	Single-stemmed small plants which should be readily killed by fire.
Gastrolobium glaucum	Aug-Sep	Insect	Appeared to set few fruits per plant. Maximum of 2 seeds/fruit possible.	As above

Table 4 (Continued)

Species	Flowering Period	Presumed Pollination Type	Fruit and Seed Set	Vegetative Reproduction and Fire Tolerance
Gastrolobium hamulosum	Aug-Oct	Insect	Appeared to set few fruits (and seeds) per plant. Maximum of 2 seeds/fruit possible.	Single-stemmed small plants which should be readily killed by fire.
Grevillea dryandroides	Aug-Oct	Bird	Few to ca 40 fruits per plant In a sample of 10 fruits the average seed set/fruit was 1.8	Capable of extensive vegetative reproduction by rhizomes. Presumably able to resprout after fires.
Microcorys sp.	Sep-Nov	Bird	Few fruits per plant	Single-stemmed shrubs, but would tend to be partly protected from fires by their rocky or open habitats.
Rhagodia sp.	Oct-Nov	Insect		Small compact shrubs which would be partially protected from fire by their rocky or open habitats.
Stylidium coronifome	Sep-Oct	Insect	No fruits set on the solitary plant following enforced inbreeding.	Should be protected from fire by its open rocky habitat.

Table 4 (Continued)

Species	Flowering Period	Presumed Pollination Type	Fruit and Seed Set	Vegetative Reproduction and Fire Tolerance
Verticordia staminosa	Jun-Aug	Insect	Maximum of 1 or 2 seeds per fruit.	Small Single-stemmed shrubs which should be readily killed by fire.

Table 5. Observations of Faunal Activity.

Species	Pollen and Nectar Feeders	Other Animals
Acacia sp. 2		Many of the leaves had been grazed, especially at the tips, and white silky nests were observed near the ends of some branches. Three small insects collected from the plants were a bug (family Pyrrhocoridae ?), a beetle (family Chrysomelidae) and an unidentified moth larva.
Daviesia euphorbioides		There was no evidence of insect attack and the spines on its stems would protect the species from grazing by larger animals.
Daviesia sp.	Hover flies (family Syrphidae) visited the flowers, apparently feeding on nectar rather than pollen. Small blue butterflies (family Lycaenidae) were observed feeding on nectar.	
Dryandra comosa	One honeyeater (probably *Lichenostomus virescens*) was observed feeding from the flowers and numerous smaller birds of a different species also appeared to be feeding from the flowers, which had copious nectar.	Mealy bugs (family Coccidae or Pseudococcidae) were common on the leaves. The centres of some flower heads had been destroyed by insect larvae (probably a moth or weevil). These heads had failed to set seed.

Table 5 (Continued)

Species	Pollen and Nectar Feeders	Other Animals
Dryandra pulchella	None observed, but the flowers had copious nectar.	Mealy bugs (family Coccidae or Pseudococcidae) were common on the leaves.
Gastrolobium hamulosum	One honey bee (*Apis mellifera*) was observed on the flowers apparently feeding on nectar.	A bug (family Miridae) was collected from the flowers.
Grevillea dryandroides	None observed, but the flowers had copious nectar.	
Stylidium coroniforme	None observed, but a few flowers had been triggered.	

species would probably respond to fires by a massed release of their seeds. In the absence of special stimuli the seeds probably take years to be released.

Like most acacias, *Acacia* sp. 2 sheds its seeds and fruits seasonally a short interval after flowering. *Acacia* sp. aff. *obovata* is interesting because the plants bore flower buds and large, but unopened, fruits simultaneously in October 1980. This indicated either that the species had flowered earlier in the same year or that the fruits had taken more than a year to mature. The species probably flowers twice a year in autumn and spring.

The remaining species listed in Table 3 (*Conostylis* sp., *Rhagodia* sp., *Stylidium coroniforme* and *Verticordia staminosa*) would probably all release their seeds or fruits within a few months of flowering.

The solitary plant of *Stylidium coroniforme* failed to set seed from selfing, although there was a little evidence to suggest that the flowers were pollinated (Table 5). This failure was to be expected because most stylidiums are highly outbreeding (S.H. James 1979).

For the other species it was not possible to determine whether they were inbreeding or outbreeding. All that were examined set seed in varying quantities (Table 4) but the level of seed set was not correlated with the frequency of observed seedlings (see Table 6). *Dryandra comosa* had a much higher seed set than *D. pulchella* and would therefore have been expected to produce more seedlings. However, no seedlings of *D. comosa* were observed whereas seedlings of *D. pulchella* were common. The observed occurrence of dense clumps of *D. comosa* in areas which had been disturbed then allowed to regenerate suggested that the species is capable of producing numerous seedlings when conditions are favourable.

For most species, the present frequency of seedlings may be significantly lower than normal as a result of the drought over the last 5 years. The drought should certainly have increased the mortality of seedlings during their first summer(s) and may also have lowered the germination rate. However, a few drought-resistant species might have benefited by the decreased competition and actually increased their recruitment.

Some species or populations contained numerous dead or dying mature plants. The most likely cause appeared to be the drought but other possibilities cannot be ruled out. The species suffering the greatest losses were *Dryandra pulchella*, *Grevillea dryandroides* and, to a lesser extent, the two daviesias. Plants growing on the choicest sites where water appeared the least limiting were much healthier and tended to flower much earlier than plants on more drought-susceptible sites. The species which appeared to be surviving the drought most successfully were the acacias, *Eriostemon* sp., *Microcorys* sp. and *Rhagodia* sp.

Grevillea dryandroides was the only species which had an obvious means of vegetative reproduction and regeneration after fires (Table 4). This species has undergone prolific vegetative reproduction by

means of rhizomes at its Cadoux population but, surprisingly, did not appear to have reproduced except by seed at its other three populations near Ballidu. There seems no explanation for this except for the possibility that the plants of the two areas have a marked genetically-determined difference in their ability to spread by rhizomes.

There have been no fires through most of the Wongan Hills range and nearby areas for a very long time and consequently there are some remarkably mature stands of plants. This might also explain the lack of seedlings of a few species, particularly *Dryandra comosa*. In the absence of fires it is impossible to tell exactly how fire-susceptible each species is.

Conservation Status in the Wild

Most of the named species surveyed in this study were included in the lists of rare, geographically restricted or poorly collected species published by Hartley & Leigh 1979 and by Marchant & Keighery 1979. Appendix 4 lists these species and compares the published assessments of their conservation status with assessments made using the same categories and based on the data now available. The only case of complete agreement was for the Hartley & Leigh classification of *Verticordia staminosa*. The magnitude of the discrepancies between the 1979 and present assessments of conservation status is a disturbing indication of the great inadequacy of our knowledge of the rare Western Australian plants.

For *Grevillea dryandroides*, the present assessment may be inaccurate because some Western Australian herbarium specimens are on loan. A distribution map produced for the species by Mr D. McGillivray in Rye *et al* (1980) suggests that the species has an extant geographical range much greater than 100 km (i.e. category 3 rather than 2).

Table 1 shows the categories into which the Wongan Hills species fell based on the known number of reproductively mature individuals in their wild populations and on their geographical ranges. The categories based on geographical range are precisely defined and therefore completely objective. However, the 'rare' and 'very rare' categories are somewhat subjective because the number of plant individuals is not precisely defined. *Acacia* sp. 2, with an estimated 375-400 individuals (Table 6), was the only species close to the borderline of these two categories. It was classified as 'very rare' rather than 'rare' because it had only one known population.

Table 6 shows the estimated number of plants at the surveyed localities as well as the actual number counted. There was frequently insufficient time even to attempt to count plants over a whole locality. At least three of the species listed (*Conostylis* sp. aff. *teretiuscula*, *Gastrolobium hamulosum*, *Verticordia staminosa* and probably *Grevillea dryandroides*) also occur outside the study area, but only *G. hamulosum* is well represented by its populations in other areas.

Some of the 'populations' surveyed in this study were probably fragments of larger populations that had been divided when the intervening land was cleared. For example, populations 2 and 3 of *Grevillea dryandroides* are on the same hillside but are on different road verges separated by farmland. Some of the outlying populations of *Dryandra comosa* and *D. pulchella* may also be remnants of larger populations like those occurring in the more central parts of the Wongan Hills range.

The Wongan Hills species examined in this study range from one species (*Stylidium coroniforme*) which appeared to be on the verge of

Table 6. Conservation Status in the Study Area

The total numbers of plants given are for all populations and include seedlings.

Species	No. of Populations	Total No. of Plants		No. of Seedlings	Land Status
		Actually Counted	Estimated Present		
Acacia sp. aff. *obovata*	1	25	50-100	5	Private
Acacia sp. 2	1	329	375-400	None observed	Private
Conostylis sp. aff. *teretiuscula*	1	n.a.	n.a.	n.a.	A water catchment reserve and possibly also on a road verge and an A class flora and fauna reserve.
Daviesia euphorbioides	3	87	90-100	14+	Road and railway reserves with a few plants on a water catchment reserve. It was possibly also on the Department of Agriculture Experimental Farm.
Daviesia sp.	4+	123	At least 500	Few noticed	Road reserve, private land and an A class flora and fauna reserve.

Table 6 (Continued)

Species	No. of Populations	Total No. of Plants		No. of Seedlings	Land Status
		Actually Counted	Estimated Present		
Dryandra comosa	6+	ca 370	At least 3,000	None observed	Private land, an A class flora and fauna reserve and road reserves.
Dryandra pulchella	7+	ca 270	At least 3,000	Common in the larger populations	Private land, an A class flora and fauna reserve and road reserves.
Eriostemon sp.	1	173	200-250	10 or more	Private
Gastrolobium glaucum	1	206	250	ca 20	Department of Agriculture Experimental Farm
Gastrolobium hamulosum	1	4		0	Road reserve
Grevillea dryandroides	4	253*	Over 1,000*	None observed*	Road and railway reserves

* Populations 2-4 contained 67 counted plants. Population 1 contained very numerous plants derived mainly by vegetative reproduction and impossible to count. No young seedlings observed, but older seedlings would have been indistinguishable from suckers.

Table 6 (Continued)

Species	No. of Populations	Total No. of Plants		No. of Seedlings	Land Status
		Actually Counted	Estimated Present		
Microcorys sp.	5	165	200	50 or more	About half on private land and half on an A class flora and fauna reserve.
Rhagodia sp.	1	53	150-200	Several	Private
Stylidium coroniforme	1	1	1	0	Private
Verticordia staminosa	1	0	May be extinct	0	Water catchment reserve

extinction through to several species which appeared to be too common to warrant being gazetted as rare flora. The determination of each species' overall conservation status in the wild was based on a consideration of all the following factors:

1. Geographical range (Table 1)
2. Number of populations
3. Number of plant individuals (Table 6)
4. Land status
5. Fire tolerance, reproductive capacity and other biological characteristics (Table 4)
6. Evidence for a decline (or increase) in the number of plant individuals since European settlement began
7. Commercial exploitation

The surveyed species are listed below, approximately in order of decreasing vulnerability to extinction, with a brief outline of their individual circumstances. Several other species which appeared from a cursory examination to be fairly rare and in need of further study to determine whether they warrant gazettal were *Acacia semicircinalis*, *Clematis* sp., *Eremophila* sp. and *Tetratheca retrorsa*.

Stylidium coroniforme

S. coroniforme is in urgent need of protection and it may already be too late to save the species from extinction. The triggerplant is only known from its type locality, a small patch of bush on the boundary between two paddocks. It was discovered in 1963 when this site was visited by one of the landowners, Mrs Molly Rogers, and the species' describers, Rica Erickson and J.H. Willis. At that time *S. coroniforme* was abundant there, but the population is now reduced to a single individual.

Mrs Rogers (pers. comm.) believes she may have seen a second population of the species on the east side of the Wongan Hills - Elphin road, probably not far from the entrance to the Rifle Club. However, she did not examine the plants closely nor collect a specimen No plants of the species were found there, or at any new localities, during the present study. The type locality appears to have a unique habitat (see p. 22) to which the species may always have been endemic. This could explain the failure to locate further populations.

The solitary plant at the type locality produced numerous flowers during spring 1980 but failed to set seed. It was considerably smaller than the plants observed in 1963 (Erickson & Willis 1966; M. Rogers pers. comm.). The decrease in stature probably resulted from the recent spell of drought although inbreeding depression is another possibility. The plant had numerous rosettes and appeared quite mature so that it could possibly be a survivor from the population existing in the 1960's rather than a subsequent generation.

The site has been disturbed by stock grazing and the sandy top-soil has apparently eroded away. The drought may also have

contributed to the species' decline. No seeds were produced this year but there may be residual seeds from previous years which might be able to germinate and survive if the area were fenced off to exclude stock. It might be possible to propagate the species vegetatively or by tissue culture. However, the resulting plants, all having the genetic make-up of the parent plant, would be unable to undergo crosspollination and therefore be unlikely to produce seeds.

Gastrolobium glaucum

This species is also known only from its type locality. It occurs on an uncleared section of the Wongan Hills Experimental Farm and would become extinct if this part of the farm were developed into a new field. Like other gazetted species, *G. glaucum* is legally protected but will not receive any protection in practice until the owners of the land it occupies are informed of its presence there.

About 10 years ago, T.E.H. Aplin (pers. comm.) visited the site and saw numerous plants on both road reserves as well as on the adjacent experimental farm. The species has evidently declined since then because there are no longer any plants on the road verges. However, the species is evidently a colonizer and has probably always been very rare. It is not certain whether it was more or less abundant before it colonized the apparently disturbed ground on which it presently occurs (see p. 23).

Verticordia staminosa

The type specimen of this species was collected by Harry Butler north-east of Wongan Hills on a granite outcrop in the town's main water catchment reserve (No. 16418) during 1961 (Appendix 1, W.H. Butler pers. comm.). The species had been collected twice previously in the area, probably from the same population, but not since. Although many granite outcrops or sheets in the reserve and other areas around Wongan Hills were searched in this study (see Fig. 2), the species was not relocated. It is undoubtedly very rare, and possibly extinct, in the study area.

Fairly recently the species was discovered at a second locality on a granite outcrop east of Hyden. A photograph taken at this population was published in Erickson *et al* (1979).

Daviesia euphorbioides

All collections of this species have apparently been made between Wongan Hills and Elphin, in the area where the three known surviving 'populations' occur. These populations are very small and restricted to the open disturbed verges of the roads or tracks and the railway line. Being a colonizer with a very restricted range, the species probably has always been a very rare plant and might be more common now than it was when Western Australia was first settled.

Provided the present land use is not altered, the species does not appear to be endangered. The greatest threat to its survival would probably be competition from weed species if these proliferate. One population extends into a water catchment reserve and possibly onto an A class flora and fauna reserve. Extension of the latter to include a small portion of the former and also some land from the Experimental Farm would improve the species' prospects.

Acacia sp. aff. *obovata*

In terms of its known population and plant numbers this species would have to be considered vulnerable and extremely rare. However, it occurs on a habitat which is fairly common in the Wongan Hills range and further populations will probably be found. A single small plant of the species may have been sighted by the author on the laterite breakaway near the television translator tower on 20 November. The site needs to be revisited and thoroughly surveyed.

The only verified population occurs at the boundary of an A class flora and fauna reserve (No. 33530) but no plants were sighted within the reserve. If the reserve does not prove to contain significant populations of *Acacia* sp. aff. *obovata*, the small area this population occupies could perhaps be added to the reserve. Despite the drought, the species is apparently very healthy and producing adequate seedlings to maintain the population.

Acacia sp. 2, *Eriostemon* sp. and *Rhagodia* sp.

Each of these is known from only one population in the Wongan Hills range, probably comprising several hundred plants. Unlike *Acacia* sp. aff. *obovata*, they occupy habitats which are unusual, and possibly unique in the range. Despite their larger number of individuals, they may therefore be more threatened than *Acacia* sp. aff. *obovata*. All occur on private land and need to be gazetted to ensure that they are not disturbed by a change in land use. Each population appears to be thriving despite the drought, although no seedlings were sighted for *Acacia* sp. 2.

Conostylis sp. aff. *teretiuscula*, *Grevillea dryandroides* and *Gastrolobium hamulosum*

These species all have ranges greater than the main Wongan Hills study area. The four known populations of *Grevillea dryandroides* occur on road or railway reserves where they could eventually be swamped by weeds. Three of them, occurring near Ballidu, are very small and appear to be declining, perhaps because of the drought. The species is very attractive and is commercially exploited in the seed trade. Seed collectors could feasibly eliminate recruitment by seed at the small populations. Although the species has undergone extensive vegetative reproduction at the large Cadoux population, there was no evidence of vegetative reproduction at the Ballidu populations.

Less is known about *Conostylis* sp. aff. *teretiuscula* because it was not surveyed in this study. A very small population occurs near Manmanning (A.S. George pers. comm.) and it is otherwise known only on the Wongan Hills - Piawaning road. It has been collected ca 3, 3.6, 4.2 and 4.4 km north-west of Wongan Hills, but is rather sparse (S.D. Hopper pers. comm.). Two of these localities are on a water catchment reserve (No. 16418) and two on an A class flora and fauna reserve (No. 25808).

Gastrolobium hamulosum is probably very rare in the Wongan Hills area but has many populations further afield. There are no data of plant numbers at these populations but T.E.H. Aplin (pers. comm.) believes that the species is now quite rare.

Microcorys sp.

This species is known from five localities and its largest population occurs on an A class flora and fauna reserve (No. 33530). Another very small population occurs on private land which will probably soon become an A class flora and fauna reserve. In undisturbed vegetation the species is, and presumably always has been, extremely rare. However, it is a successful colonizer of cleared ground on the upper part of the Wongan Hills range and is probably much more common now than it was before the Wongan Hills area was settled. From the known figures (Table 6) the species is 'very rare' but if the whole range had been surveyed, the *Microcorys* species would probably have been classed as 'rare'. Before this study, the species was only known from two localities (K. Kenneally pers. comm.). It is now known from five and there is little doubt that further populations will be found.

Daviesia sp.

This species was only briefly surveyed in this study. Previously known only from one or two localities, it was found to be quite widespread in the range. However, it was usually quite infrequent in undisturbed vegetation and a large proportion of the plants were dead, presumably as a result of the drought. The greatest concentration of and healthiest plants were growing as colonizers on the verges of a road (population 1). Hence this species, too, may have actually increased in numbers since the Wongan Hills area was settled. More information is needed to determine whether the species is sufficiently rare to warrant gazettal.

Dryandra comosa and *D. pulchella*

Although these species have been gazetted as rare flora, they appeared to be the most abundant of all the species surveyed. Both had numerous populations in the Wongan Hills range and several populations of each were too large for it to have been practicable to count individual plants. Neither species should have been gazetted as rare because the estimated numbers of plants in the surveyed populations exceeded 3,000 (Table 6) and they would undoubtedly have had further populations in parts of the Wongan Hills range that were not examined in this study.

Most populations of *D. comosa* appeared very healthy but most *D. pulchella* populations appeared to be declining in numbers because they contained numerous dead plants. However, this is probably only a temporary decline, presumably caused by the drought.

Cultivation

At least one person, a farmer in the Wongan Hills area, has grown *Daviesia euphorbioides* in cultivation (S.D. Hopper pers. comm.). *Grevillea dryandroides* is apparently established in cultivation because it was commercially exploited by a seed dealer during 1977-79 (Rye *et al* 1980). Marchant & Keighery (1979) listed *Dryandra pulchella* as being subject to heavy commercial exploitation, presumably in the cut flower trade. However, the species was not advertized for sale by any of the wildflower dealers surveyed during 1977-79 by Rye *et al* (1980). None of the other species surveyed in the present study is known to have been cultivated or commercially exploited.

With the possible exception of *Grevillea dryandroides*, none of the species is sufficiently well established in cultivation to be considered safe from total extinction should its wild populations be destroyed. Most are sufficiently attractive (see Appendix 3) to make good garden subjects, but are too poorly known to be grown. *Daviesia euphorbioides* is of particular interest for cultivation because of its bizarre cactus-like appearance. Its stems are very thick, fleshy, spiny, leafless and often tinged with red. The large red flowers of *Microcorys* sp. are the most spectacular in the genus. *Verticordia staminosa* is also particularly striking because of the combination of red and yellow colours in its flowers (see Erickson *et al* 1979).

RECOMMENDATIONS

The following amendments should be made to the gazetted rare flora:

(a) Addition of *Acacia* sp. aff. *obovata*, *Acacia* sp. 2, *Daviesia euphorbioides*, *Eriostemon* sp. , *Microcorys* sp. and *Rhagodia* sp. as soon as possible.

(b) Deletion of *Dryandra comosa* and *D. pulchella*.

Acacia semicircinalis, *Calytrix stowardii*, *Conostylis* sp. aff. *teretiuscula*, *Daviesia* sp., *Gastrolobium hamulosum* and *Tetratheca retrorsa* should be considered for gazettal. On present indications they are sufficiently rare to be gazetted but their conservation statuses need to be further assessed. Further information is required for all the rare species in the Wongan Hills area, but priority should probably be given to further searches for populations of *Stylidium coroniforme* and *Verticordia staminosa*.

In terms of protecting rare species, the most desirable areas for the creation of new nature reserves or annexation to existing nature reserves are shown in Fig. 4. They are:

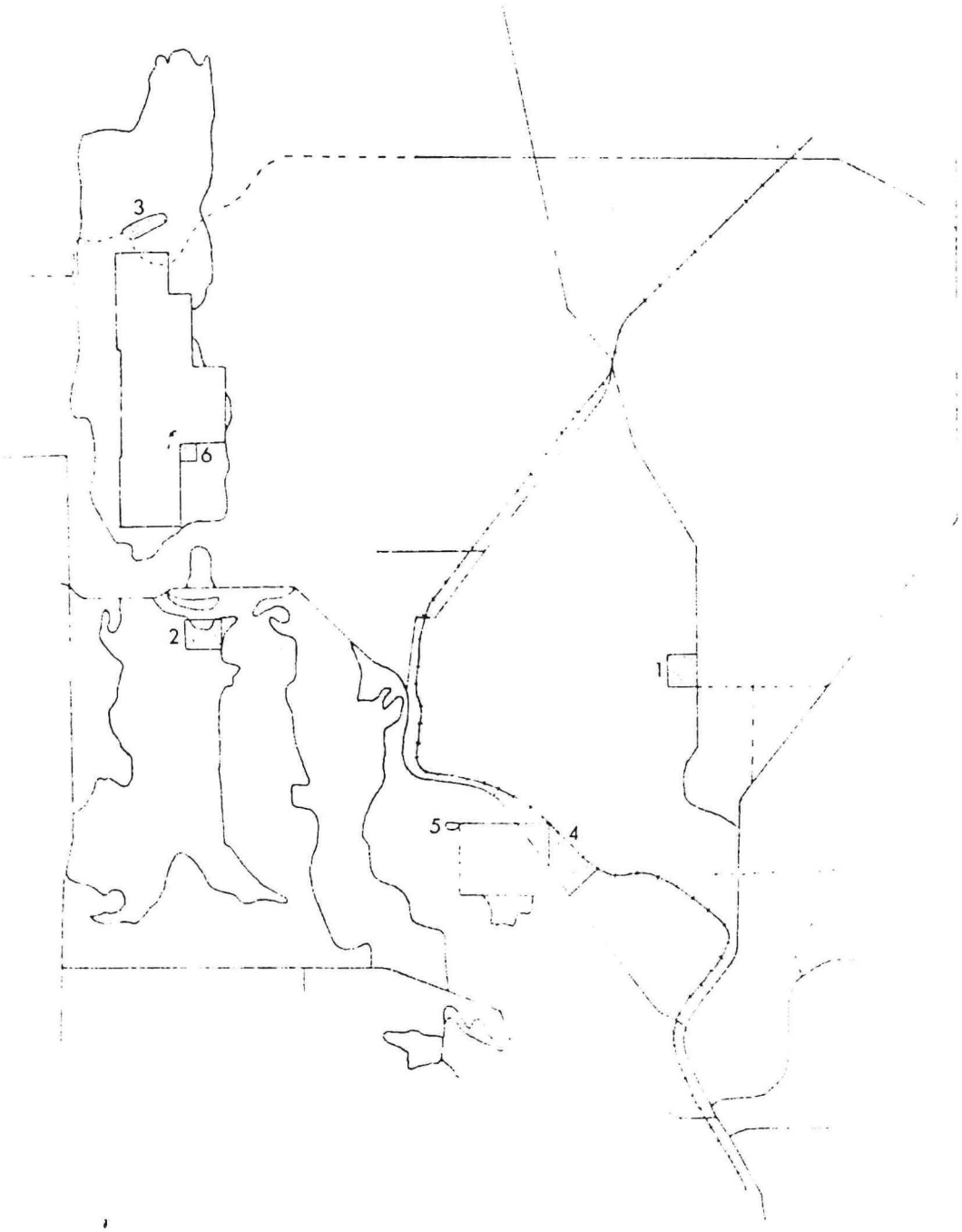
1. The portion of the Experimental Farm including the *Gastrolobium glaucum* population.
2. The land on O'Brien's property including the hill where the television translator tower stands (*Acacia* sp. 2, *Eriostemon* sp. and other rare species).
3. Monks Well Gully (*Rhagodia* sp.)
4. The land located between the railway line and the Wongan Hills - Elphin road, adjacent to Reserve 25808 (*Daviesia euphorbioides* and *Conostylis* sp. aff. *teretiuscula*).

Other important areas shown in Fig. 4 are:

5. The patch of bushland on the Rogers' property where *Stylidium coroniforme* was found. This should be fenced off as soon as possible to exclude stock. If the population proves to be viable, this land could be added to Reserve 25808.
6. The area on P. Conway's land including *Acacia* sp. aff. *obovata*. This should be considered for incorporation into Reserve 33530, especially if no further populations of the species can be found.

Cultivated stocks need to be established and maintained for all the rare species, with priority given to *Stylidium coroniforme* and the eight other species classified as 'very rare'. Since *S. coroniforme* has failed to set seed, an attempt should be made to grow it by tissue culture.

Figure 4. Inadequately Protected Areas that contain Populations of Very Rare Plants.



ACKNOWLEDGEMENTS

This study was funded by the Department of Fisheries and Wildlife. I would like to thank Mr K.F. Kenneally for showing me the locations of many populations of rare plants in the Wongan Hills, for allowing me to use some of his photographs in this report and for much general information. I am grateful to several other botanists, Mr T.E.H. Aplin, Dr S.D. Hopper, Mr B.R. Maslin and Mr P.W. Wilson and also to several residents at Wongan Hills, Mr D. Bell, Mr P. Roberts and Mrs M. Rogers, for information on particular species.

REFERENCES

Aplin, T.E.H. (1973). Poison plants of Western Australia. The toxic species of the genera *Gastrolobium* and *Oxylobium*. *West. Aust. Dept. Agric. Bull. No. 3772*

Bentham, G. (1864). "Flora Australiensis" Vol. 2 Lovell Reeve & Co. : London.

Bentham, G. (1870). "Flora Australiensis" Vol. 5 Lovell Reeve & Co. : London.

Bureau of Meteorology (1975). "Climatic Averages Australia." Aust. Govt. Pub. Service : Canberra.

Erickson, R., George, A.S., Marchant, N.G. & Morcombe, M.K. (1979). "Flowers and Plants of Western Australia." A.H. & A.W. Reed Pty. Ltd. : Sydney.

Erickson, R. & Willis, J.H. (1966). Some additions to Australian Stylidiaceae. *Victorian Nat.* 83 : 107-112.

Everist, S.L. (1974). "Poisonous Plants of Australia." Angus & Robertson : Sydney.

Gardner, C.A. (1933). Contributiones florae Australiae Occidentalis. 2. *J. Roy. Soc. West. Aust.* 19 : 79-93.

Gardner, C.A. (1942). Contributiones florae Australiae Occidentalis. 11. *J. Roy. Soc. West. Aust.* 27 : 165-210.

Gardner, C.A. & Bennetts, H.W. (1956). "The Toxic Plants of Western Australia." West. Aust. Newspapers Ltd. : Perth.

Gardner, C.A. & George, A.S. (1963). Eight new plants from Western Australia. *J. Roy. Soc. West. Aust.* 46 : 129-138.

Hartley, W. & Leigh, J. (1979). Plants at risk in Australia. *Aust. Nat. Parks and Wildlife Service Occasional Paper No. 3*

Hopper, S.D. (1981). Conservation status of *Eucalyptus caesia*. *Dept. Fish. Wildl. Rept.* (in preparation).

James, S.H. (1979). Chromosome numbers and genetic systems in the trigger plants of Western Australia (*Stylidium*, Stylidiaceae). *Aust. J. Bot.* 27 : 17-25.

Kenneally, K.F. (1977). (Ed.). "The Natural History of the Wongan Hills." West. Aust. Naturalists' Club : Perth.

Marchant, N.G. & Keighery, G.J. (1979). Poorly Collected and Presumably Rare Vascular Plants of Western Australia. *Kings Park Research Notes No. 5.*

Meisner, C.F. (1848). Proteaceae. *In* Lehmann, J.G.C. (Ed.). "Plantae Preissianae." Vol. 1, pp. 491-601. Meissneri : Hamburg.

Meisner, C.F. (1856). Proteaceae. *DC. Prodr.* 14 : 211-482.

Rye, B.L. & Hopper, S.D. (1981). A guide to the gazetted rare flora of Western Australia. *Dept. Fish. Wildl. West. Aust. Rept. No. 42.* (in preparation).

Rye, B.L., Hopper, S.D. & Watson, L.E. (1980). Commercially exploited vascular plants native in Western Australia : census, atlas and preliminary assessment of conservation status. *Dept. Fish. Wildl. West. Aust. Rept. No. 40.*

Thompson, J. (1976). A revision of the genus *Tetratheca* (Tremandraceae). *Telopea* 1 : 139-215.

Appendix 1: Details of the PERTH Herbarium Specimens for the Rare Plants Studied, excluding the Undescribed Species.

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Daviesia euphorbioides			
	J. Drummond 76	-	ISOTYPE. Western Australia
5 September 1924	C.A. Gardner 845 1st collection	Flowering	Wongan Hills, sand plains Flowers yellow with red keel
September 1924	Carne and Gardner	Flowering	Wongan Hills
Dryandra comosa			
September 1842	J. Drummond IV 313	-	ISOTYPE
11 September 1961	R.D. Royce 6638	Flowering	Wongan Hills, west of Elphin, on ironstone hill Shrub 3 ft tall
3 October 1962	F. Lullfitz 1652	Flowering	2 miles west of Wongan Hills on the Piawaning road, gravel crest Erect shrub 6 ft tall (2 m). Leaves toothed, 14 inches, close matted. Flowers cream. Bracts brown, to full length of flowers.

Appendix 1 (Continued)

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Dryandra comosa (Continued)			
23 August 1963	C.A. Gardner 14325	Flowering	Wongan Hills (in hills) in thickets in gravel Dense erect shrub up to 2.2 m tall. Perianth pale yellow and style yellow. Involucre brown.
23 August 1965	K. Newbey 1997	Flowering	Wongan Hills, in gravel 5 ft high
Dryandra pulchella			
September 1842	J. Drummond IV 312	-	ISOTYPE
16 June 1962	A.S. George 3703	Vegetative	Wongan Hills, near south end of hills Dense shrub ca 1 m tall
27 August 1963	C.A. Gardner 14311	Vegetative	Wongan Hills, in thickets in gravel Decumbent shrub, 60 cm tall, up to 2.7 m across
3 October 1963	C.A. Gardner s.n.	Flowering and in bud	Wongan Hills, in dense thickets in gravel Loose shrub with dense branchlets and glaucous leaves. Perianth greenish-yellow. 30-40 cm tall, 2-3 m diameter
8 November 1964	G.L. s.n.	Flowering, some buds	Wongan Hills

Appendix 1 (Continued)

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Dryandra pulchella (Continued)			
2 September 1965	K. Newbey 2310	-	2 miles west of Elphin in gravel-loam To 6 ft high
26 January 1979	B. Barnsley 935	Old dead flowers	28 km from Piawaning on road to Wongan Hills town ($30^{\circ}50'S$, $116^{\circ}29'E$). Ca 300 m altitude, gentle lower N-facing slope of hills in gravelly lateritic clay. Mallee shrubland with *Eucalyptus drummondii* and *Casuarina campestris*. Common. Spreading but with ascending branches to 1.5 m high.
Gastrolobium glaucum			
September 1924	C.A. Gardner s.n.	Flowering, with buds	HOLOTYPE. Ca 3 miles due north of Wongan Hills, in gravelly soil on sand heath. Bushy shrub, 10-18 inches tall. Flowers orange-red.
8 September 1959	C.A. Gardner 12120	Flowering, with buds	Near Wongan Hills in gravel. Dense shrub, 30 cm tall. Corolla orange-yellow.
23 August 1963	C.A. Gardner 14327	Flowering, with buds	Near Wongan Hills in gravel. Dense shrub, up to 60 cm tall. Petals orange-yellow, tinged with purple.

Appendix 1 (Continued)

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Gastrolobium hamulosum			
September 1923	H.K. Wade s.n.	Flowers and buds	Calingiri
5 October 1926	T.P. Duggan s.n.	Flowers and buds	Near Calingiri
13 September 1932	W.E. Blackall 2550	Flowers and buds	Between Moora and Watheroo Loose erect shrub 1-1½ ft. Standard and wings orange-yellow, wings dark red.
17 October 1934	C.A. Gardner s.n.	Flowers, immature fruits few buds.	Clay flats, Calingiri Diffuse or erect, 12-18 inches. Flowers deep yellow with purple keel.
21 September 1955	R.D. Royce 5147	Flowers, buds.	Wongan Hills Research Station. Sandy soil. Low shrub.
22 September 1955	R.D. Royce 5150	Flowers, buds	10 miles east of New Norcia. Low spreading shrub.
22 October 1959	R.J. Doyle	Flowers, buds	-
11 September 1964	T.E.H. Aplin 2784	Flowers, buds	148-149 mile pegs on Geraldton Hwy on stony quartzite ridge. Mallee-scrub association.
16 September 1964	T.E.H. Aplin 5802	Flowers, buds	5 miles east of Carani. Gravelly loam-quartzite ridge Wandoo association.

Appendix 1 (Continued)

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Grevillea dryandroides			
22 September 1931	C.A. Gardner 2711	Flowering, with buds	HOLOTYPE. Near Ballidu on low heath, usually under taller shrubs. In yellow sandy loam with *Synaphaea polymorphus* and *Eedeiocolea monostachya*.
26 September 1931	W.E. Blackall B 791	Flowering, with buds and fruits	Between Pithara and Wongan Hills Leaves pinnate. Diffuse. Flowers red. Panicles prostrate.
13 September 1968	E.M. Canning s.n.	Flowering	27 miles from Wubin towards Wongan Hills. 6 inches high, flowers red.
17 June 1976	D.J. McGillivray 3421 and A.S. George	Not flowering	Ca 2 km north of Cadoux Post Office, pale yellowish sand. Abundant, forming dense patches through development of rhizomes.
Stylidium coroniforme			
17 September 1963	R. Erickson s.n.	Flowering, with buds	ISOTYPE. Wongan Hills, ca 4 miles north-west of Wongan Hills township, growing with *Dryandra comosa* on shallow sandy soil over ironstone rock.
1964	M. Rogers s.n.	Flowering	Wongan Hills

Appendix 1 (Continued)

Collection Date	Collector & Number	Reproductive Stage	Location, Habitat and Other Details
Verticordia staminosa			
August 1955	S. Elliot 4	Flowering, few buds	Wongan Hills
August 1957	W.H. Butler s.n.	Flowering	Wongan Hills Catchment Reserve
12 June 1961	W.H. Butler s.n.	Flowering with buds	HOLOTYPE. Wongan Hills.

Appendix 2

Details and Maps of the Individual Populations Surveyed.

Taxon: *Acacia* sp. aff. *obovata*

Population No: 1

Principal Survey Date: 27 October 1980

LOCALITY (Map 5)

Description: The top of a breakaway 0.45 km due west of the end of a track on P. Conway's property which leads back past the farmhouse to Conway Rd. The distance from the end of this track to the intersection of Conway Rd with the Elphin-Korraling road is 4.7 km.

Air Distance and Direction from Wongan Hills: 11.8 km, 320°

Latitude and Longitude: 30°49'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: On the border of A Class Flora and Fauna Reserve No 33530 and private property owned by P. Conway. Mostly on private land.

HABITAT

Soil: The *Acacia* plants were growing in the rock crevices of almost solid laterite.

Landform: Summit of a lateritic breakaway.

Vegetation: Mallees (*Eucalyptus ebbanoensis*) to ca 6 m tall were dominant. Other common species were *Casuarina campestris* (to 3m), *Hakea scoparia* (to 2.5m) and *Dryandra* sp. aff. *hewardiana*. The area appeared completely undisturbed.

POPULATION DATA

Area Occupied: A thin strip along the edge of the breakaway ca 1 m wide and 30 m long.

Number of Plants: 20 reproductively mature plants. 5 seedlings, each with 2 divided leaves. The population may extend further along the breakaway than was investigated.

Age Structure: 5 cm - 0.5 m

Condition: Healthy

Reproductive Stage: Flower buds common and a few flowers open on a couple of plants. The plants also had immature fruits which appeared to be full-sized but had not yet dried.

Seed Set: 2 or 3 seeds per fruit but, owing to the plants' small stature, each plant bore few fruits.

Taxon: *Acacia* sp. 2

Population No: 1

Principal Survey Date: 19 August 1980

LOCALITY (Map 7)

Description: Ca 0.7 km south-east of the Wongan Hills - Piawaning road, just north of the television translator tower. A track leading towards the site starts 12.3 km north-west of Wongan Hills town centre and 1.3 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 10.0 km, 310°

Latitude and Longitude: 30°50'S, 116°38'W

Shire Name: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

Soil: Red-brown clay with numerous small rocks (greenstone and laterite scree).

Landform: Creek gullies at the northern end of a belt of lateritic hills. *Acacia* sp. 2 occurs in the creek beds and the slopes about the creeks, but being most common on the west-facing slopes.

Vegetation: The dominant plants were *Casuarina acutivalvis*, *Calothamnus asper* and *Melaleuca radula*. Together with *Acacia* sp. 2, they formed a dense shrub layer up to 5m tall, but mostly only 3-4m tall. The lower shrubs were sparse and there was little vegetation at ground level.

The area appeared to have been little disturbed.

POPULATION DATA

Area Occupied: The east-west extent was ca 0.1 km and the distance up the gullies ca 0.07 km.

Number of Plants: 329, all reproductively mature, were counted but probably more present.

Age Structure: Ca 2-5m tall

Condition: Healthy

Reproductive Stage: Flowers and buds.

Faunal Activity: Many of the leaves had been grazed, especially at the tips, and white silky nests were observed near the ends of some branches. Three small insects collected from the plants were a beetle (family Chrysomelidae), a bug (family Pyrrhocoridae ?) and an unidentified moth larva.

Taxon: *Daviesia euphorbioides*

Population No: 1

Principal Survey Date: 30 September 1980

LOCALITY (Map 11)

Description: On the north-east side of the Wongan Hills - Piawaning road, 4.1 - 4.3 km from Wongan Hills town centre, 0.3 - 0.5 km south-east of the entry to the Pistol Club and 3.6 - 3.8 km south-east of the turnoff to Elphin siding.

Air Distance and Direction from Wongan Hills: 4.4 km, 325°

Latitude and Longitude: 30°52'S, 116°41'W

Shire Name: Wongan-Ballidu

Land Status: Road reserve, with a few plants on the adjoining water catchment reserve (No 16418).

HABITAT

Soil: Pale yellowish clay-loam with some sand and gravel.

Topography: On the upper south-western slope of a hill.

Vegetation: Varied herbs and shrubs mostly less than 0.5 m tall, rarely up to 1 m, including *Conospermum brownii*, *Boronia coerulescens*, *Glischrocaryon aureum*, *Lysinema ciliatum* and *Calytrix* sp. There was much bare ground. The adjacent uncleared vegetation was a thick shrubland dominated by *Casuarina campestris* (up to 3 m, rarely 4 m) and *Hakea scoparia* (to 1.5 m).

The ground along the side of the road was cleared some years ago when a telephone cable was laid. The regrowth of colonizing species examined in 1980 was quite different from the climax community of the uncleared bushland, in which no *Daviesia euphorbioides* plants were seen.

POPULATION DATA

Area Occupied: 0.2 km along the road verge

Number of Plants: 36, including at least 4 seedlings

Age Structure: 20-70 cm tall
Up to 120 cm across

Condition: Most appeared to be very healthy, but 6 dead plants were noted.

Reproductive Stage: 30 September 1980 - immature fruits, mostly full-sized but still green.

28 October 1980 - green full-sized fruits. None had split.

20 November 1980 - fruits still immature.

Seed Set: There are only 2 ovules per flower so that the maximum seed set possible is 2 seeds/pod. In a sample of 20 immature pods from 4 or 5 plants, the average seed set was 0.7 seeds/pod. Two of the pods were 2-seeded.

Taxon: *Daviesia euphorbioides*

Population No: 2

Principal Survey Date: 1 October 1980

LOCALITY (Map 11)

Description: On both sides of the railway line, 0.15 - 0.3 km south-east of a railway crossing, which is just east of the Wongan Hills - Piawaning road, 5.5 km north-east of Wongan Hills town centre and 2.8 km south-east of the turnoff to Elphin siding.

Air Distance and Direction from Wongan Hills: 5.1 km, 325°

Latitude and Longitude: 30°52'S, 116°41'W

Land Status: Railway reserve, possibly just extending into the adjoining uncleared land on the Department of Agriculture Experimental Farm (Reserve No 18672).

HABITAT

Soil: Pale yellow-grey clay-loam with some sand and gravel.

Topography: On the north-western slope of a hill.

Vegetation: Varied scattered shrubs up to 1 m tall, including *Conospermum brownii*, *Gastrolobium calycinum*, *Daviesia juncea* and *Verticordia chrysantha*, with numerous yellow everlastings (*Waitzia* or *Podolepis*) and much bare ground. The adjacent uncleared bushland was a thicket of *Casuarina campestris*, up to 2m or more tall.

D. euphorbioides grew on the ground that had been cleared along the boundaries of the railway line and a track running parallel to the line, but not in the uncleared bushland. The charred remains of some daviesia plants and also some casuarinas indicated that a fire had been through, probably last summer or the previous summer.

POPULATION DATA

Area Occupied: 0.15 km along the railway line (on both sides) and along a nearby parallel track.

Number of Plants: 12 reproductively mature
7 seedlings, in two clumps immediately surrounding old dead plants.

Age Structure: 4-70 cm tall
Up to 80 cm across

Condition: More than 19 dead plants were noted and some of the surviving plants were in a poor condition.

Reproductive Stage: 1 October 1980 - immature fruits, full-sized but still green.
28 October 1980 - fruits still not opened.

Taxon: *Daviesia euphorbioides*

Population No: 3

Principal Survey Date: 28 October 1980

LOCALITY (Map 11)

Description: On both sides of the railway line, 0.6 - 0.75 km south-east of a railway crossing, which is just east of the Wongan Hills - Piawaning road, 5.5 km north-west of Wongan Hills town centre and 2.8 km south-east of the turnoff to Elphin siding.

Air Distance and Direction from Wongan Hills: 4.4 km, 330°

Latitude and Longitude: 30°52' S, 116°41W

Land Status: Railway reserve, possibly just extending into the adjoining uncleared land on the Department of Agriculture Experimental Farm (Reserve No 18672).

HABITAT

Soil: White loam with sand and some gravel.

Topography: The top and upper north-western slope of a hill.

Vegetation: *D. euphorbioides* was growing on very open ground which had been cleared and left to regenerate. Many shrub and herb species, all less than 0.5 m tall, had also colonized the area, including *Verticordia brownii*, *V. picta*, *V. chrysantha*, *Glischrocaryon aureum*, *Dampiera* sp. and *Baeckea* sp.

The adjacent uncleared vegetation was dominated by *Grevillea armigera* (to 2m tall) but contained no casuarinas. Common shrubs were *Eremaea pauciflora*, *Calothamnus sanguineus* and *Leptospermum* sp.

POPULATION DATA

Area Occupied: 0.15 km along both sides of the railway line, with one plant on the verge of the parallel track.

Number of Plants: 29 reproductively mature
3 seedlings in a group

Age Structure: 7-100 cm tall

Condition: Some plants were dead but for a few shoots, while others appeared very healthy.

Reproductive Stage: Immature fruits, full-sized but still green.

Taxon: *Daviesia* sp.

Population No: 1

Principal Survey Date: 29 September 1980

LOCALITY (Map 10)

Description: On the Wongan Hills - Piawaning road, 9.0 - 9.7 km north-west of Wongan Hills town centre, 1.2 - 2.0 km north-west of the turnoff to Elphin and 3.8 - 4.5 km east of Wilding Rd

Air Distance and Direction from Wongan Hills: 8.8 km, 320°

Latitude and Longitude: 30°50'S, 116°39'W

Shire: Wongan-Ballidu

Land Status: Road reserve, extending back into private land owned by E.C.M. Rogers

HABITAT

Soil: Orange-brown clay and gravel

Topography: North-eastern slope of a lateritic hill

Vegetation: The dominant mallee species, *Eucalyptus eudesmoides*, was up to ca 6m tall and very scattered. *Casuarina campestris* (to ca 3m) was common and the smaller shrubs included *Daviesia juncea*, *Dryandra pulchella*, *Acacia pulchella* var. *glaberrima* and *Grevillea paniculata*. There were also yellow everlastings (*Waitzia acuminata*).

The road verge was cut into the hill on the south-western side when the road was made and has been thickly regenerated with daviesias, some *Dryandra pulchella* plants and other species.

POPULATION DATA

Area Occupied: 0.65 km along the road on both verges and extending back into the bush on the south-western side

Number of Plants: 93 plants along both verges

Age Structure: 0.2 - 1.2 m high
up to 2.5 m across

Condition: Most plants along the verge were very healthy but 12 dead plants were counted. Back from the verge there were fewer plants, mostly dead or in very poor condition.

Reproductive Stage: 29 September 1980 - flowers and buds, few flowers finished

27 October 1980 - buds, flowers and immature fruits

Seed Set: Since there are 2 ovules per flower, a maximum of 2 seeds are set per fruit. In a sample of 26 young fruits from 4 plants, each fruit had set a single seed.

Faunal Activity: 2 October 1980 - Hover flies (family Syrphidae) were feeding from the flowers and appeared to be taking nectar rather than pollen.

27 October 1980 - Small blue butterflies (family Lycaenidae) were feeding from the flowers. Hover flies were hovering near the flowers but not observed feeding.

Taxon: *Daviesia* sp.

Population No: 2

Principal Survey Date: 27 October 1980

LOCALITY (Map 5)

Description: 0.9 - 1.3 km due west of the end of a track on P. Conway's property which leads back past the farm-house to Conway Rd. The distance from the end of this track to the intersection of Conway Rd with the Elphin-Korraling road is 4.7 km.

Air Distance and Direction from Wongan Hills: 12.3 km, 320°

Latitude and Longitude: 30°49'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: A Class Flora and Fauna Reserve No. 33530

HABITAT

Soil: Gravelly soil apparently forming a shallow layer over laterite conglomerate

Landform: Summit of a lateritic mesa with an east-facing slope

Vegetation: Scattered mallees (*Eucalyptus ebbanoensis*) and numerous *Casuarina campestris* plants were dominant. *Daviesia* sp. occurred both in the areas occupied by *Dryandra comosa* (see population 4's description) and *Dryandra pulchella* (see population 5). However, all the live daviesias seen occurred as colonizers on a wide access path.

POPULATION DATA

Area Occupied: Apparently restricted to the path over a distance of ca 0.4 km

Number of Plants: 7, all reproductively mature

Age Structure: 0.2 - 0.5 m

Condition: The plants on the path were healthy but one dead plant was observed away from the path.

Reproductive Stage: Buds, flowers and fruits

Taxon:- *Daviesia* sp.

Population No: 3

Principal Survey Date: 20 November 1980

LOCALITY (Map 7)

Description: Along the PMG access road to the television translator tower, ca 0.4-1.0 km from the tower and 1.4-2.0 km south of the PMG gate on the Wongan Hills - Piawaning road. The PMG gate is 11.4 km north-west of Wongan Hills and 2.2 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 9.3 km, 310°

Latitude and Longitude: 30°51'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

The plants were on the slopes of a high lateritic hill in thick shrubland dominated by an open mallee woodland.

POPULATION DATA

Area Occupied: 0.6 km or more along the road, probably extending much further on either side of the road.

Number of Plants: Only 5 plants were counted (in passing) although there must have been many more present.

Taxon: *Daviesia* sp.

Population No: 4 onwards

Principal Survey Date: 20 November 1980

LOCALITY (Map 10)

Description: On the west side of bushland on the Rogers' property ca 0.8-1.4 km south-west of the Wongan Hills - Piawaning road. A track leading to the site (via a cutting through the hills) starts 9 km north-west of Wongan Hills town centre.

Air Distance and Direction from Wongan Hills: 6.2 km, 315°

Latitude and Longitude: 30°51'S, 116°39'W

Shire: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers and proposed to become an A Class Flora and Fauna Reserve.

HABITAT

Soil: Orange-brown clay and gravel

Landform: Gentle western slope of a hill

Vegetation: Open undisturbed mallee woodland (mostly of *Eucalyptus eudesmoides* and *E. drummondii*) up to 7m tall. Other species noted: *Acacia* sp. aff. *semicircinalis*, *Casuarina campestris* and *Dryandra* sp. aff. *hewardiana*.

POPULATION DATA

Area Occupied: The population extended for at least 0.6 km.

Number of Plants: 14 counted at three points along the fence but undoubtedly more plants present.

Condition: Some healthy, a few dead or almost dead.

Reproductive Stage: Not flowering. No fruits noticed.

Taxon: *Dryandra comosa*

Population No: 1

Principal Survey Date: 21 August 1980

LOCALITY (Map 12)

Description: On the south-west side of Wilding Rd, at a bend, 2.7 km west of the Wongan Hills - Calingiri road, 3.5 km west of Wongan Hills town centre and 6.7 km east of Bailey Rd.

Air Distance and Direction from Wongan Hills: 3.2 km, 285°

Latitude and Longitude: 30°53'S, 116°41'W

Shire: Wongan-Ballidu

Land Status: Road reserve, with two plants in the adjoining private farmland

HABITAT

Soil: Orange-brown clay and gravel

Landform: Middle northern slope of a lateritic hill

Vegetation: The dominant plants were mallees (*Eucalyptus ebbanoensis*) up to ca 7m tall and *Casuarina campestris* shrubs were common. Other species present were *Melaleuca uncinata*, *Grevillea petrophiloides*, *G. paniculata*, *Acacia acuminata*, *A. lasiocalyx*, *Hakea scoparia*, *Micromyrtus racemosa*, *Cryptandra leucophracta*, *Gastrolobium spinosum* and others. *Dryandra* sp. aff. *hewardiana* occurred nearby.

The road verge was thickly vegetated and appeared to have been little disturbed. However, the adjoining paddock's vegetation had been cleared but for a few large shrubs and trees and was subjected to stock grazing.

POPULATION DATA

Area Occupied: 0.05 km along the road

Number of Plants: 36, all reproductively mature

Age Structure: 1 - 3.5 m tall
Up to 4 m across

Condition: Healthy, except for 8 small dead plants which were among thick clumps and had apparently been smothered by their neighbours

Reproductive Stage: Flowers and buds

Seed Set: In a sample of 46 fruiting heads all from one plant, there was a range of 0 - 14 follicles set per head and an average of 2.65 follicles per head. Each follicle contained 1 seed.

Faunal Activity: No animals observed visiting the plants but the flowers had copious nectar. Mealy bugs (family Coccidae or Pseudococcidae) were common on the leaves. An empty cocoon of an insect's pupal stage was found in one of the fruiting heads which had not set seed. This insect probably prevents the flower heads it attacks from producing seeds.

Taxon: *Dryandra comosa*

Population No: 2

Principal Survey Date: 21 August 1980.

LOCALITY (Map 12)

Description: At least 0.1 km north of Wilding Rd, ca 4.5 km west of the Wongan Hills - Calingiri road and 5 km east of Bailey Rd.

Air Distance and Direction from Wongan Hills: 4.6 km, 295°

Latitude and Longitude: 30°52'S, 116°40'W.

Shire: Wongan-Ballidu

Land Status: Private land owned by A.J.M. Staples.

HABITAT

Soil: Orange-brown clay and gravel.

Topography: Lower southern slope of a lateritic hill.

Vegetation: Scattered mallees (*Eucalyptus ebbanoensis*) up to 7 m tall were dominant and a tall shrub layer included *Casuarina campestris* (to 3 m), *Hakea scoparia* (to 3 m) and *Dryandra* sp. aff. *cirsioides*. Smaller shrubs, including *Micromyrtus racemosa* and *Cryptandra leucophracta*, were very sparse and there was much bare ground.

The area was fenced off from farm paddocks but appeared, from the sparsity of the understorey, to have been disturbed - perhaps by fires and stock grazing.

POPULATION DATA

Area Occupied: At least 0.1 km long.

Number of Plants: 4, all reproductively mature.

Age Structure: All ca 3 m tall.

Condition: One plant was healthy but the others were barely alive.

Reproductive Stage: The healthiest plant had flowers and buds.

Taxon: *Dryandra comosa*

Population No: 3

Principal Survey Date: 30 September 1980

LOCALITY (Map 11)

Description: Along a fence bordering the hot-rod racing track, 0.5 km south of the Wongan Hills - Piawaning road. The entrance to the racing track is 6 km north-east of Wongan Hills town centre and 2 km south of the turnoff to Elphin siding.

Air Distance and Direction from Wongan Hills: 5.2 km, 315°

Latitude and Longitude: 30°52'S, 116°41'W

Shire: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers

HABITAT

Soil: Yellow-grey somewhat sandy soil over orange-brown clay-loam with much laterite

Topography: Gentle north-facing slope of a hill

Vegetation: The dominant plants were mallees, *Eucalyptus redunca* and *E. pyriformis*, (to ca 8m tall) and *Casuarina acutivalvis* (to ca 6m). Other species present were *Meleleuca uncinata*, *Acacia nigripilosa*, *Melaleuca pungens*, *Gastrolobium spinosum*, *Baeckea crispiflora*, *Dampiera eriocephala* and *Stylidium coroniforme*. There was much bare ground and few weeds.

History: The site is on the boundary of a paddock and has been grazed by sheep. It also appeared to have suffered erosion, with much of the sandy topsoil (noted by Erickson and Willis 1966) having been lost.

Mrs Molly Rogers (pers. comm.) observed that the ground had a denser cover of small plants when she visited the site in 1963 and 1964. She suggested that the drought over the last few years and the stock grazing had led to the present bareness at the site.

POPULATION DATA

Area Occupied: The area was less than 80m wide and of a similar depth

Number of Plants: 59, all reproductively mature

Age Structure: 1.5 - 3.5 m

Condition: Healthy. Although 5 dead plants were observed, these were located in very dense clumps and had apparently succumbed to the intense competition.

Reproductive Stage: 30 September 1980 - numerous flowers, buds and finished flowers

27 October 1980 - immature fruits

Faunal Activity: 30 September 1980 - Mealy bugs (family Coccidae or Pseudococcidae) were first observed on a very small proportion of the leaves.

2 October 1980 - At 8 a.m. one honeyeater (probably *Lichenostomus virescens*) was observed probing the flowers hidden deep in the foliage and numerous smaller birds of a different species were shuffling through the foliage, also apparently feeding at the flowers. The latter species was also catching insects near the ground. No insects were observed near the flowers, which had little nectar, suggesting that the birds had probed the flowers mainly for nectar rather than insects.

27 October 1980 - Although flowering had ceased, numerous insects were observed flying among or near the foliage at about 12.30 p.m.

Taxon: *Dryandra comosa*

Population No: 4

Principal Survey Date: 27 October 1980

LOCALITY (Map 4)

Description: 1.0 - 1.5 km due west of the end of a track on P.Conway's property which leads back past the farm-house to Conway Rd. The distance from the end of this track to the intersection of Conway Rd with the Elphin - Korraling road is 4.7 km

Air Distance and Direction from Wongan Hills: 12.3 km, 320°

Latitude and Longitude: 30°49'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: A Class Flora and Fauna Reserve No. 33530

HABITAT

Soil: Gravelly soil, apparently forming a shallow layer over laterite conglomerate

Landform: Summit of a lateritic mesa with an east-facing slope

Vegetation: The most characteristic of the larger species was *Casuarina campestris* up to ca 4.5 m tall. Scattered mallees (*Eucalyptus ebbanoensis* and *E. drummondii*) to 6m or more were dominant. The larger shrubs included *Dryandra* sp. aff. *hewardiana*, *Hakea scoparia*, *Microcorys* sp. and *Petrophile shuttleworthiana*. The smaller shrubs included *Acacia semicircinalis* and other wattles, *Gastrolobium spinosum*, *Hypocalymma angustifolium* and *Daviesia* sp.

The present survey was conducted along a wide path that was apparently cleared by a mining company before the area became a reserve. Some species have regenerated well on the path, but not *D. comosa*.

POPULATION DATA

Area Occupied: Extends 0.5 km across the mesa (along the path) and for some distance, possibly 2 km or more, along the mesa

Number of Plants: More than 250 reproductively mature plants were visible along the survey path, but a much greater number occurred further away on each side of the path. No seedlings were seen.

Age Structure: 1 - 3.5 m

Condition: Healthy

Reproductive Stage: Immature fruits

Taxon: *Dryandra comosa*

Population No: 5

Principal Survey Date: 20 November 1980

LOCALITY (Map 6)

Description: Along the PMG access road to the television translator tower, 0.2-0.5 km below the tower and 1.9-2.2 km from the PMG gate on the Wongan Hills - Piawaning road. The PMG gate is 11.4 km north-west of Wongan Hills and 2.2 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 9.8 km, 310°

Latitude and Longitude: 30°50'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

The plants were growing on the upper slopes of a high lateritic hill in thick undisturbed shrubland, dominated by an open mallee woodland, including *Eucalyptus drummondii*

POPULATION DATA

Area Occupied: 0.3 km along the road. The population may extend for 2 km southwards to Drummonds Gully, where the species has been recorded by Kenneally (1977:69).

Other Details: Numerous healthy plants not flowering.

Taxon: *Dryandra comosa*

Population: 6 onwards

Principal Survey Date: 20 November 1980

LOCALITY (Map 9)

Description: In the bushland on the Rogers' property, extending for ca 3 kilometres southwards from a cutting through the hills, which is located ca 0.25 km south of the Wongan Hills - Piawaning road. A track leading to the area starts 9 km north-west of Wongan Hills town centre.

Air Distance and Direction from Wongan Hills: 7 km, 310°

Latitude and Longitude: 30°51'S, 116°39'W

Shire: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers and proposed to become an A class flora and fauna reserve.

HABITAT

Soil: Orange-brown clay and gravel or a shallow layer of soil over laterite conglomerate

Topography: Slopes or summits of hills and breakaways

Vegetation: Usually open mallee woodlands of various species, especially *Eucalyptus drummondii*, *E. ebbanoensis* and *E. eudesmoides*. Other species often present were *Acacia* sp. aff. *semicircinalis*, *Dryandra* sp. aff. *hewardiana*, *Casuarina campestris*. Some areas had once been cleared.

POPULATION DATA

Area Occupied: The various patches and populations of *D. comosa* extended for just over 3 km along the hills and ca 1 km across.

Number of Plants: Ca 50 plants counted but many more present. All reproductively mature.

Condition: Healthy

Reproductive Stage: Immature fruits

Taxon: *Dryandra pulchella*

Population No: 1

Principal Survey Date: 19 August 1980

LOCALITY (Map 6)

Description: On the Wongan Hills - Piawaning road, 11.8 - 12.0 km north-west of Wongan Hills town centre and 1.6 - 1.8 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 10.4 km, 315°

Latitude and Longitude: 30°50'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Road reserve.

HABITAT

Soil: Dark orange-brown clay and gravel mixture.

Landform: Northern slope of a lateritic hill.

Vegetation: The dominant plants were mallees (*Eucalyptus eudesmoides*) up to ca 7 m tall. The shrub layer, including *Dryandra pulchella* was very dense, the most prominent species being *Casuarina campestris*.

POPULATION DATA

Area Occupied: 0.2 km along the road, all but one plant on the south verge.

Number of Plants: 8, all reproductively mature.

Age Structure: 0.9 - 1.7 m

Condition: Healthy

Reproductive Stage: 19 August 1980 - vegetative
29 September 1980 - flower buds
29 October 1980 - flower buds and a few open flowers.
20 November 1980 - in full flower

Seed Set: Low. Most of the old flower heads had set no fruits, a few had 1 fruit and the maximum number of fruits/head observed was 2.

Faunal Activity: Mealy bugs (family Coccidae or Pseudococcidae) on some leaves.

Taxon: *Dryandra pulchella*

Population No: 2

Principal Survey Date: 21 August 1980.

LOCALITY (Map 12)

Description: On the north side of Wilding Rd, 4.4-4.7 km west of the Wongan Hills - Calingiri road and 4.7-5.0 km east of Bailey Rd.

Air Distance and Direction from Wongan Hills: 5.1 km, 290°

Latitude and Longitude: 30°52'S, 116°40'W.

Shire: Wongan-Ballidu.

Land Status: Private land owned by A.J.M. Staples.

HABITAT

Soil: Orange-brown clay and gravel.

Topography: Lower southern slope of a lateritic hill.

Vegetation: A mallee woodland of *Eucalyptus ebbanoensis* (up to ca 6 m tall) with *Casuarina campestris* shrubs (to 3 or 4 m) and smaller shrubs (to 1 or 1.5 m at most), including *Isopogon* sp., *Melaleuca cordata* and *Petrophile shuttleworthiana*.

POPULATION DATA

Area Occupied: 0.3 km along the road.

Number of Plants: Numerous. Only 114 live plants counted, but the whole population probably exceeded 500.

Age Structure: 0.3 - 1 m tall.

Condition: It appeared that over half the plants were dead and many others were in a poor state, presumably as a result of the drought over the last few years.

Reproductive Stage: Vegetative.

Taxon: *Dryandra pulchella*

Population No: 3

Principal Survey Date : 22 August 1980

LOCALITY (Map 12)

Description: At a small gravel pit on the north side of Wilding Rd, 5.3 km W of the Wongan Hills - Calingiri road and 4.1 km east of Bailey Rd

Air Distance and Direction from Wongan Hills: 5.6 km, 290°

Latitude and Longitude: 30°52'S, 116°39'W

Shire: Wongan-Ballidu

Land Status: Private farmland

HABITAT

Soil: Orange-brown clay and gravel.

Topography: Lower southern slope of a lateritic hill.

Vegetation: The dominant plants were scattered mallees (*Eucalyptus ebbanoensis* and *E. drummondii*) up to ca 6 m tall. The taller shrubs included *Casuarina campestris*, *Acacia lasiocalyx*, *Hakea multilineata*, *H. scoparia* and *Dryandra* sp. aff. *hewardiana*. The small shrubs included *Baeckea crispiflora*, *Hibbertia huegelii* and *Chamelaucium drummondii*.

Most of the dryandras were growing in the upper part of the gravel pit which they had successfully colonized, whereas the other species listed were mainly growing on the road verge and a small pocket of bushland left in the otherwise cleared paddock.

POPULATION DATA

Area Occupied: 0.05 km along the road

Number of Plants: 20, all reproductively mature

Age Structure: 0.5-2m tall
1-4m across

Condition: Healthy

Reproductive Stage: One plant was flowering; most were in bud

Taxon: *Dryandra pulchella*

Population No: 4

Principal Survey Date: 29 September 1980

LOCALITY (Map 9)

Description: On the Wongan Hills - Piawaning road, 9.0 - 9.5 km north-west of Wongan Hills town centre, 1.2 - 1.8 km north-west of turnoff to Elphin siding and 4.0 - 4.5 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 8.7 km, 320°

Latitude and Longitude: 30°50'S, 116°39'W

Shire Name: Wongan-Ballidu

Land Status: Road reserve, extending back into private land owned by E.C.M. Rogers.

HABITAT

Soil: Orange-brown clay and gravel.

Topography: North-eastern slope of a lateritic hill.

Vegetation: The dominant mallee species, *Eucalyptus eudesmoides*, was up to ca 6 m tall and very scattered. *Casuarina campestris* (to ca 3 m) was common and the smaller shrubs included *Grevillea paniculata*, several *Acacia* species, *Daviesia* sp. and *D. juncea*. There were also yellow everlastings (*Waitzia acuminata*).

The road verge was cut into the hill on the south-western side when the road was made and has been thickly regenerated with daviesias, some *Dryandra pulchella* plants and other native species.

POPULATION DATA

Area Occupied: 0.5 km along the road, almost all on the south-western side, and extending back into the adjacent bushland.

Number of Plants: 36 reproductively mature plants were counted along the road verges. Further live plants occurred back from the verge.

Condition: The plants on the verge were mostly very healthy although 11 dead plants were noted on the top of the bank of the road cutting. Back from the verge there were numerous plants but most were dead and the remainder were in a poor condition.

Reproductive Stage: 29 September 1980 - flower buds well advanced and one plant had open flowers
27 October 1980 - in full flower with buds and finished flowers
20 November 1980 - still in full flower

Taxon: *Dryandra pulchella*

Population No: 5

Principal Survey Date: 27 October 1980

LOCALITY (Map 4)

Description: 0.3 - 1.0 km (not continuous) due west of the end of a track on P. Conway's property which leads back past the farmhouse to Conway Rd. The distance from the end of this track to the intersection of Conway Rd with the Elphin - Korraling road is 4.7 km

Distance and Direction from Wongan Hills: 12.0 km, 320°

Latitude and Longitude: 30°49'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Partly on A Class Flora and Fauna Reserve No 33530 and partly on private land owned by P. Conway

HABITAT

Soil: Orange-brown pebbly clay, usually quite deep

Landform: The lower east-facing slope of a lateritic mesa, where the 'plateau' merges towards the plain

Vegetation: The dominant plants were mallees, *Eucalyptus ebbanoensis*, up to ca 7m tall with more common *Casuarina campestris* shrubs to ca 3m tall. Smaller shrub species included *Dryandra* sp. aff. *hewardiana* and *Isopogon divergens*.

The species had apparently benefited from the clearance of the path which occurred before the land became a reserve. A few plants on the path may have resprouted after the path was cleared and at least one small seedling was observed on the path.

POPULATION DATA

Area occupied: *D. pulchella* occurred in two patches on either side of a breakaway valley, but these may have formed part of a single population encircling the valley. The combined length of the two patches was 0.4 km.

Number of Plants: Too numerous to count in the short time available. Certainly there were hundreds of plants, including some seedlings.

Age Structure: 15 cm - 2 m

Condition: Plants on or along the path were healthy whereas many of the plants further from the path were dead or in a poor state.

Reproductive Stage: Flowers and buds

Faunal Activity: Mealy bugs observed on some leaves.

Taxon: *Dryandra pulchella*

Population No: 6

Principal Survey Date: 20 November 1980

LOCALITY (Map 6)

Description: Along the PMG access road to the television translator tower, ca 0.8-1.0 km from the tower and 1.4-1.6 km south of the PMG gate on the Wongan Hills - Piawaning road. The PMG gate is 11.4 km north-west of Wongan Hills and 2.2 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 9.3 km, 310°

Latitude and Longitude: 30°51S, 116°38' W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

On the slopes of a high lateritic hill. Other details not recorded.

POPULATION DATA

Area Occupied: At least 0.2 km along the road, possibly extending laterally for as much as 2 km.

Number of Plants: Not counted, but at least 10 plants were visible from the road and there would have been many more present.

Reproductive Stage: Flowering.

Taxon: *Dryandra pulchella*

Population No: 7 onwards

Principal Survey Date: 27 October 1980

LOCALITY (Map 9)

Description: In the bushland on the Rogers' property, extending for ca 3 kilometres southwards from a cutting through the hills, which is located ca 0.25 km south of the Wongan Hills - Piawaning road. A track leading to the area starts 9 km north-west of Wongan Hills town centre.

Air Distance and Direction from Wongan Hills: 7 km, 310°

Latitude and Longitude: 30°51'S, 116°39'W

Shire: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers and proposed to become an A class flora and fauna reserve.

HABITAT

Soil: Orange-brown clay and gravel

Topography: Lower slopes of lateritic hills

Vegetation: Usually open mallee woodlands of various species, especially *Eucalyptus drummondii*, *E. ebbanoensis* and *E. eusdesmoides*. Other species often present were *Casuarina campestris*, *Dryandra* sp. aff. *hewardiana* and *Acacia* sp. aff. *semicircinalis*. Some areas had once been cleared.

POPULATION DATA

Area Occupied: The various patches or populations extended for just under 3 km along the hills and for up to ca 1 km across the hills.

Number of Plants: Very numerous, but only ca 30 counted

Condition: Many dead or presumably dying plants were observed in the undisturbed bushland. The healthiest plants were along the borders of the farmland especially on cleared areas that the species had colonized.

Reproductive Stage: The healthiest plants were flowering.

Taxon: *Eriostemon* sp.

Population No: 1

Principal Survey Date: 29 October 1980

LOCALITY (Map 7)

Description: Ca 0.6 km south-east of the Wongan Hills - Piawaning road, just north of the television translator tower. A track leading towards the site starts 12.3 km north-west of Wongan Hills town centre and 1.3 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 10.1 km, 310°

Latitude and Longitude: 30°50'S, 116°38'W

Shire Name: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

Soil: Reddish brown clay with many small rocks (greenstone and laterite scree).

Landform: Lower northern slopes of a lateritic hill including a creek gully with fairly steep sides and a very gentle slope at the base of the hill.

Vegetation: The 'flat' area was dominated by a few scattered mallees (*Eucalyptus loxophleba* and *E. ebbanoensis*) and *Casuarina acutivalvis*. The smaller shrub species (to ca 1 m) included *Baeckea crispiflora, Acacia orbifolia, A. cliffitoniana, A. pulchella* var. *glaberrima, Grevillea petrophylloides* and *Comersonia pulchella*. The steeper area was dominated by *Casuarina campestris* and *Calothamnus asper* shrubs up to 5 m tall. It also had *Baeckea crispiflora*.

The upper part of the population appeared to have been little disturbed whereas the lower part had evidently been cleared, except for a few trees, and left to regenerate.

POPULATION DATA

Area Occupied: Stretches for 0.3 km along the access track

Number of Plants: 173 counted, including at least 10 seedlings, but probably more plants present on the upper part of the population.

Age Structure: 0.1 - 2 m

Condition: Healthy, apparently surviving the drought much better than *Baeckea crispiflora* and other species at the site.

Reproductive Stage: A few fleshy green fruits, apparently mature, and other fruits may already have fallen.

Taxon: *Gastrolobium glaucum*

Population No: 1

Principal Survey Date: 28 October 1980

LOCALITY (Map 13)

Description: Ca 0.1 km west of Craig Rd and 0.1 - 0.3 km north of the rear entrance to the Department of Agriculture Experimental Farm. The site is 7 km north of Wongan Hills town centre and 2.5 km north of the Wongan Hills - Ballidu road.

Air Distance and Direction from Wongan Hills: 6.0 km, 360°

Latitude and Longitude: 30°51'S, 116°43'W

Shire: Wongan-Ballidu

Land Status: The Department of Agriculture Experimental Farm (Reserve No. 18672).

HABITAT

Soil: Pale yellowish clay-loam with some sand and scattered small pieces of gravel

Landform: A very gentle north-facing slope on the lower part of a hill which is capped with highly gravelly soil

Vegetation: The dominant species were *Casuarina campestris* (up to 3, rarely 4 m tall), *Hakea scoparia* (to 2m) and *Melaleuca* sp. (to 1.5 m). Other shrubs included *Hakea incrassata*.

History: In ca 1970, T.E.H. Aplin (pers. comm.) observed many *G. glaucum* plants growing with *G. hamulosum* on the road verges on either side of Craig Rd. *G. glaucum* was also common in the more disturbed parts of the bushland on the western side of the road. *G. glaucum* no longer occurs on the road verge which has become very weedy although there are still a few *G. hamulosum* plants.

POPULATION DATA

Area occupied: A belt ca 0.2 km long and 0.05 km deep

Number of Plants: 206 counted, including ca 20 seedlings

Age Structure: 0.1 - 1.3 m

Condition: Most plants appeared healthy, some appeared to be under stress and 16 dead plants were noted.

Reproductive Stage: A few fruits were still attached to some of the plants on 28 October 1980.

Taxon: *Gastrolobium hamulosum*

Population No: 1

Principal Survey Date: 1 October 1980.

LOCALITY (Map 13)

Description: On the western road verge of Craig Rd, opposite the rear entrance to the Department of Agriculture Experimental farm. The site is 7 km north of Wongan Hills town centre and 2.5 km north of the Wongan Hills - Ballidu road.

Air Distance and Direction from Wongan Hills: 5.8 km, 360°.

Latitude and Longitude: 30°51'S, 116°43'W.

Shire Name: Wongan-Ballidu.

Land Status: Road reserve.

HABITAT

Soil: Pale yellowish clay-loam with some sand and gravel.

Landform: A very gentle north-facing slope on the lower part of a hill capped with highly gravelly soil.

Vegetation: Various small shrubs (including *Baeckea crispiflora*, *Gastrolobium calycinum* and *Mirbelia spinosa*) with a maximum height of 1 m, interspersed with yellow everlastings (*Podolepis canescens*) and herbaceous weeds, which were very thick in places. The adjacent uncleared vegetation consisted of a thicket of *Casuarina campestris* up to 3 m tall.

History: T.E.H. Aplin (pers. comm.) collected *G. hamulosum* growing intermixed with *G. glaucum* here ca 10 years ago. The gastrolobiums were common in the verges on both sides of the road. The eastern verge is now choked with weeds and the western verge is also becoming weedy at the expense of the native plants.

POPULATION DATA

Area Occupied: A narrow strip of road verge ca 30 m long.

Number of Plants: 4, all reproductively mature.

Age Structure: 14-26 cm high
12-115 cm across

Condition: Healthy.

Reproductive Stage: 20 August 1980 - flowers and buds.

1 October 1980 - immature fruits (on 3 plants); flowers and buds (1 plant).

28 October 1980 - a few mature fruits. Some fruits had probably already split and fallen.

Faunal Activity: 2 October 1980 - a Honey Bee (*Apis mellifera*) visited the flowers, apparently feeding on the nectar and contacting the top of the stamen/style column. A bug (family Miridae) was collected from the flowers.

Taxon: *Grevillea dryandroides*

Population No: 1

Principal Survey Date: 20 August 1980

LOCALITY (Map 2)

Description: On the west side of the Cadoux-Burakin road, 2.5 - 3.3 km north of the Cadoux-Wongan Hills road and 18.3 - 19.1 km south of Kirwan.

Air Distance and Direction from Cadoux: 2.7 km, 5°

Latitude and Longitude: 30°45'S, 117°08'W

Shire: Wongan-Ballidu

Land Status: Road and railway reserve.

HABITAT

Soil: Pale yellow sand-loam.

Landform: Very gentle lower southern slope of a hill.

Vegetation: A very disturbed site with some areas of bare sand and other areas thick with weeds. The dominant species, *Grevillea armigera*, was a shrub up to 2.5 m tall. The smaller species (less than 0.5 m) included *Mirbelia spinosa*, *Boronia coerulescens* and *Dampiera preissii*, but *Grevillea dryandroides* was by far the most common species.

History: The area was obviously cleared some time ago then left to regenerate. A pile of blue metal has been dumped at the extreme southern end of the population, possibly killing a few plants.

POPULATION DATA

Area Occupied: A 0.8 km long strip between the road and the railway line.

Number of Plants: Impossible to count because the species had undergone extensive vetetative reproduction by rhizomes and formed continuous mats over most of the area. A 0.2 km transect of an area where individual plants could be distinguished contained 46 plants in flower, ca 140 plants which were not flowering, and numerous dead plants.

Age Structure: Ca 10-35 cm tall
Up to at least 70 cm wide, excluding the long prostrate flowering stalks.

Condition: On the recently colonized ground, many plants were dead or in poor condition, presumably because of the drought over the last few years. Where the species formed a dense mat it was quite healthy except where it was being choked by weeds.

Reproductive Stage: Some plants just with young flower buds, others both in bud and in flower and a few with flowers but no buds.

Faunal Activity: None observed, but the flowers had copious nectar.

Taxon: *Grevillea dryandroides*

Population No: 2

Principal Survey Date: 20 August 1980

LOCALITY (Map 1)

Description: On the Ballidu-Wongan Hills road, 0.5 - 1.0 km south of Townsend Rd, Ballidu and 11.3 - 11.8 km north of Kondut.

Air Distance and Direction from Ballidu: 1.0 km, 170°

Latitude and Longitude: 30°37'S, 116°46'W

Shire: Wongan-Ballidu

Land Status: Road reserve

HABITAT

Soil: Bright yellow sand-loam

Landform: On the lower southern slopes of a hill and in the valley.

Vegetation: The dominant species were two shrub species, *Acacia signata* (up to 2½ m tall) and *Grevillea armigera* (to 2m), both very scattered. Thickets of *Casuarina acutivalvis* (to 3m) occurred nearby. The varied smaller shrubs and herbs included *Acacia latipes, Melaleuca cordata, Mirbelia spinosa, Baeckea crispiflora, Dampiera preissii, Boronia coerulescens* and *Conospermum stoechadis*. There were patches of bare ground and some fairly weedy patches. Parts of the area had been cleared, for example in and around the small graveyard, but most appeared to have been little disturbed.

POPULATION DATA

Area Occupied: The road verges on both sides of the road for a distance of 0.5 km

Number of Plants: 27

Age Structure: 10-120 cm in diameter, excluding the flowering stalks.

Condition: Few plants were flowering, many looked unhealthy and 17 dead plants were observed.

Reproductive Stage: 20 August 1980 - flowers and buds
1 October 1980 - flowers and buds
29 October 1980 - fruits. Some fruits almost mature, others had already split and fallen.

Faunal Activity: None observed but the flowers had copious nectar.

Taxon: *Grevillea dryandroides*

Population No: 3

Principal Survey Date: 1 October 1980

LOCALITY (Map 1)

Description: On the Ballidu-Bindi Bindi road, 0.9 - 1.3 km west of Townsend Rd, Ballidu and the Ballidu-Wongan Hills road.

Air Distance and Direction from Ballidu: 1.1 km, 260°

Latitude and Longitude: 30°36'S, 116°45'W

Shire: Wongan-Ballidu

Land Status: Road reserve

HABITAT

Soil: Pale yellow sand-loam

Landform: A very gentle west-facing slope on the lower part of a hill.

Vegetation: The dominant plants were scattered shrubs of *Casuarina acutivalvis* (up to 3.5 m tall) and *Grevillea armigera* (to 2.5 m). The many smaller shrubs included *Darwinia purpurea, Verticordia picta, Melaleuca cordata* and *Astroloma serratifolium.*

G. dryandroides occurred mainly in the relatively undisturbed bushland described above, but had also colonized a fire break bordering the adjacent farmland.

POPULATION DATA

Area Occupied: 0.3 km along the road, extending further on the northern verge than on the southern one.

Number of Plants: 36

Age Structure: 10-20 cm tall
10-60 cm across

Condition: Mostly in very poor condition. 33 dead plants were observed.

Reproductive Stage: Only 4 plants were flowering. These had both flowers and buds.

Taxon: *Grevillea dryandroides*

Population No: 4

Principal Survey Date: 3 October 1980

LOCALITY (Map 1)

Description: On the east side of the Ballidu-Dalwallinu road, 2.5 - 2.7 km north of Townsend Rd, Ballidu.

Air Distance and Direction to Ballidu: 2.2 km, 320°

Latitude and Longitude: 30°35'S, 116°45'W

Shire: Wongan-Ballidu

Land Status: Road and railway reserve

HABITAT

Soil: Pale yellow sand-loam

Landform: Fairly low, very gentle slope facing north.

Vegetation: The dominants were tall shrubs of *Grevillea armigera* (up to 3.5m) and *Hakea scoparia* (to 3m). The smaller shrubs included *Melaleuca cordata, Verticordia picta, Baeckea crispiflora* and the herbs included *Glischrocaryon aureum, Dampiera preissii* and a few yellow everlastings. Some areas weedy.

The grevilleas occurred both in the relatively undisturbed bushland described above and on very open ground that had been cleared along the railway line.

POPULATION DATA

Area Occupied: A 0.2 km long strip between the road and railway line.

Number of Plants: 4, all reproductively mature.

Age Structure: 15-40 cm tall
50-90 cm across, excluding the flowering stalks

Condition: Two plants had some dead leaves and 4 dead plants were sighted.

Reproductive Stage: 3 October 1980 - flowers and buds
29 October 1980 - fruits, some almost mature and others already split and fallen.

Seed Set: In a sample of 10 fruits all from the same plant, 8 each contained 2 seeds and 2 were one-seeded. The average seed set was therefore 1.8 seeds/fruit.

Taxon: *Microcorys* sp.

Population No: 1

Principal Survey Date: 27 October 1980

LOCALITY (Map 5)

Description: Ca 1.1 - 1.5 km due west of the end of a track on P. Conway's property which leads back past the farm-house to Conway Rd. The distance from the end of this track to the intersection of Conway Rd with the Elphin - Korraling road is 4.7 km

Air Distance and Direction from Wongan Hills: 12.3 km, 320°

Latitude and Longitude: 30°49'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: A Class Flora and Fauna Reserve No. 33530

HABITAT

Soil: Gravelly soil, apparently forming a shallow layer over laterite conglomerate

Landform: Upper part of a lateritic mesa, with a slight east-facing slope

Vegetation: The dominant plants were scattered mallees (mainly *Eucalyptus ebbanoensis* with a few *E. drummondii*) up to 6m or more tall. *Casuarina campestris* was much more common and up to ca 4.5 m tall. The larger shrubs included *Dryandra comosa*, *Dryandra* sp. aff. *newardiana*, *Hakea scoparia* and *Petrophile shuttleworthiana*, but these rarely occurred on the path. On the path *Microcorys* sp. was one of the most common species, occurring with smaller shrubs such as *Gastrolobium spinosum*, *Hypocalymma angustifolium*, *Acacia semicircinalis* and *Daviesia* sp.

The path was apparently cleared by a mining company before the area became a reserve. The present *Microcorys* sp. population on the path became established after the path was cleared.

POPULATION DATA

Area Occupied: Ca 0.4 km of the path, which was ca 10m wide

Number of Plants: 85

Age Structure: ca 0.3 - 2.5 m

Condition: Healthy

Reproductive Stage: Buds, flowers and young fruits

Taxon: *Microcorys* sp.

Population No: 2

Principal Survey Date: 28 October 1980

LOCALITY (Map 8)

Description: The top of a breakaway in Fowlers Gully, 1.4 km (by a track) south-east of Wilding Rd. The track starts on Wilding Rd, 2 km south of the Wongan Hills-Piawaning road.

Air Distance and Direction from Wongan Hills: 9.3 km, 300°

Latitude and Longitude: 30°52'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

Soil: Virtually solid laterite. The *Microcorys* plants were growing in the rock crevices.

Landform: Summit of a lateritic breakaway.

Vegetation: Dominated by mallees (*Eucalyptus eudesmoides*) up to ca 5 m tall. The shrub species included *Casuarina campestris*, *Petrophile shuttleworthiana*, *Dryandra* sp. aff. *hewardiana* and *Acacia* sp. aff. *semicircinalis*. The site appeared to be completely undisturbed.

POPULATION DATA

Area Occupied: A narrow strip along the edge of the breakaway.

Number of Plants: 16 counted on the closest section of sheet laterite (ca 30 m long) but the population extends much further according to Kevin Kenneally (pers. comm.)

Age Structure: 15 cm - 1.5 m

Condition: Healthy

Reproductive Stage: The smallest plant was still flowering; the remainder had finished flowering.

Taxon: *Microcorys* sp.

Population No: 3

Principal Survey Date: 20 November 1980

LOCALITY (Map 9)

Description: At a breakaway 0.65 km north-west of the eastern exit of a paddock located within the Wongan Hills range on block 2586. The exit is 2.4 km south of the Wongan Hills - Piawaning road.

Air Distance and Direction from Wongan Hills: 6.4 km, 310°

Latitude and Longitude: 30°52'S, 116°40'W

Shire: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers

HABITAT

Soil: Laterite conglomerate over clay

Topography: The edge of a breakaway, facing east

Vegetation: A tall dense undisturbed shrub layer of *Hakea scoparia*, *Petrophile shuttleworthiana*, *Melaleuca radula* and *Santalum acuminatum*, up to 4m. *Acacia* sp. aff. *semicircinalis* and *Dryandra comosa* were also observed at the site.

POPULATION DATA

Area Occupied: Ca 0.05 km along the edge of the breakaway

Number of Plants: 2, widely separated. There may have been a few more plants scattered along the breakaway beyond the section surveyed, but the population was obviously very small.

Age Structure: 1.5 - 3 m

Condition: Healthy

Reproductive Stage: Vegetative

Taxon: *Microcorys* sp.

Population No: 4

Principal Survey Date: 20 November 1980

LOCALITY (Map 8)

Description: By the television translator tower on the summit of a hill, 2.4 km south of the P.M.G. gate on the Wongan Hills - Piawaning road. The PMG gate is 11.4 km north-west of Wongan Hills and 2.2 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 9.8 km, 310°

Latitude and Longitude: 30°50'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

Soil: Laterite conglomerate with little or no top soil.

Topography: Edge of a breakaway, facing north.

Vegetation: The dominants were scattered tall shrubs of *Casuarina acutivalvis* (to 4m) and *Hakea scoparia* (to 3m). The smaller shrubs included *Acacia* sp. aff. *semicircinalis*, *A. shuttleworthii* and *Hibbertia huegelii*.

Part of the area around the television tower had apparently been cleared and left to regenerate.

POPULATION DATA

Area Occupied: A strip ca 0.1 km long along the edge of the breakaway.

Number of Plants: 14

Age Structure: 0.5 - 1.5 m

Condition: Healthy, except for one dead plant

Reproductive Stage: Fruits

Taxon: *Microcorys* sp.

Population No: 5

Principal Survey Date: 20 November 1980

LOCALITY (Map 8)

Description: On the PMG road, 0.85-0.9 km south of the television translator tower and 1.6-1.65 km south of the PMG gate on the Wongan Hills - Piawaning road. The PMG gate is 11.4 km north-west of Wongan Hills and 2.2 km east of Wilding Rd.

Air Distance and Direction from Wongan Hills: 9.4 km, 310°

Latitude and Longitude: 30°51'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by O'Brien

HABITAT

Topography: Upper slopes of a lateritic hill.

Vegetation: Not recorded, but the *Microcorys* plants were growing virtually alone on ground that had been recently cleared. *Dryandra pulchella* occurred nearby.

POPULATION DATA

Area Occupied: 0.05 km along the road.

Number of Plants: 7 reproductively mature, 41 seedlings.

Age Structure: 7cm - 3m

Condition: Healthy

Reproductive Stage: Fruits and flowers, with some buds.

Taxon: *Rhagodia* sp.

Population No: 1

Principal Survey Date: 28 October 1980

LOCALITY (Map 3)

Description: In Monks Well Gully, which starts 3.0 km north-east of the Mt Rupert turnoff from Lake Hinds North Rd and 0.85 km east of Mt Rupert farmhouses. The site is 7.0 km west of Craig Rd via Korraling Rd.

Air Distance and Direction from Wongan Hills: 15.0 km, 325°

Latitude and Longitude: 30°47'S, 116°38'W

Shire: Wongan-Ballidu

Land Status: Private land owned by N.A. Stewart.

HABITAT

Soil: Rich brown clay and small rocks (lateritic scree).

Landform: The base of a creek gully and the steep slopes of the breakaways on either side.

Vegetation: York Gums (*Eucalyptus loxophleba*) up to ca 10 m dominated the valley, with a lower layer (to ca 6.5 m) of *Acacia acuminata*. Other species present included *Anthocercis genistoides*, *Scaevola spinescens*, *Dodonaea larraeoides*, *Melaleuca undulata* and *Clematis* sp., but there was much open ground. *Acacia* sp. aff. *semicircinalis* occurred on the upper scree slopes where the *Rhagodia* species petered out.

The area is a popular picnic spot for the locals and has probably been grazed by stock.

POPULATION DATA

Area Occupied: Probably the whole length of Monks Well Gully, i.e. 0.8 km.

Number of Plants: 53 reproductively mature plants were counted up to a little east of Monks Well, but the species extends much further east up Monks Well Gully.

Age Structure: 0.1 - 0.5 m tall
Up to at least 1 m across

Condition: Healthy

Reproductive Stage: Flowering.

Taxon: *Stylidium coroniforme*

Population No: 1

Principal Survey Date: 30 September 1980

LOCALITY (Map 11)

Description: Along a fence bordering the hot rod racing track, 0.5 km south of the Wongan Hills - Piawaning road. The entrance to the racing track is 6 km north-east of Wongan Hills town centre and 2 km south of the turnoff to Elphin siding.

Air Distance and Direction from Wongan Hills: 5.2 km, 315°

Latitude and Longitude: 30°52'S, 116°41'W

Shire Name: Wongan-Ballidu

Land Status: Private land owned by E.C.M. Rogers.

HABITAT

Soil: Orange-brown laterite conglomerate. Nearby, this has a covering of yellow-grey, somewhat sandy soil.

Topography: Gentle north-facing slope of a hill.

Vegetation: The stylidium was growing on bare ground between *Dampiera eriocephala* plants, with a few small shrubs of *Baeckea crispiflora*, *Gastrolobium spinosum* and *Melaleuca pungens*. This rather open area was encircled by taller shrubs and mallees, the closest being *Dryandra comosa* (up to 3.5 m tall). The mallee species were *Eucalyptus redunca* and *E. pyriformis* (to ca 8 m) and other species present were *Casuarina acutivalvis* (to ca 6 m), *Melaleuca uncinata* and *Acacia nigripilosa*. There are few weeds.

History; The site is on the boundary of a paddock and has been grazed by sheep. It also appeared to have suffered erosion, with much of the sandy topsoil (noted by Erickson and Willis 1966) having been lost.

Mrs Molly Rogers (pers. comm.) observed numerous *S. coroniforme* plants (much taller than the only plant still surviving) in 1963 and 1964, growing intermixed with *Dampiera eriocephala* plants. She attributed the loss of stature of the species to the recent drought (of at least 5 years' duration) and suggested that the drought and sheep grazing could have been responsible for the great reduction in the number of plants.

POPULATION DATA

Area Occupied: A few square centimetres

Number of Plants: 1

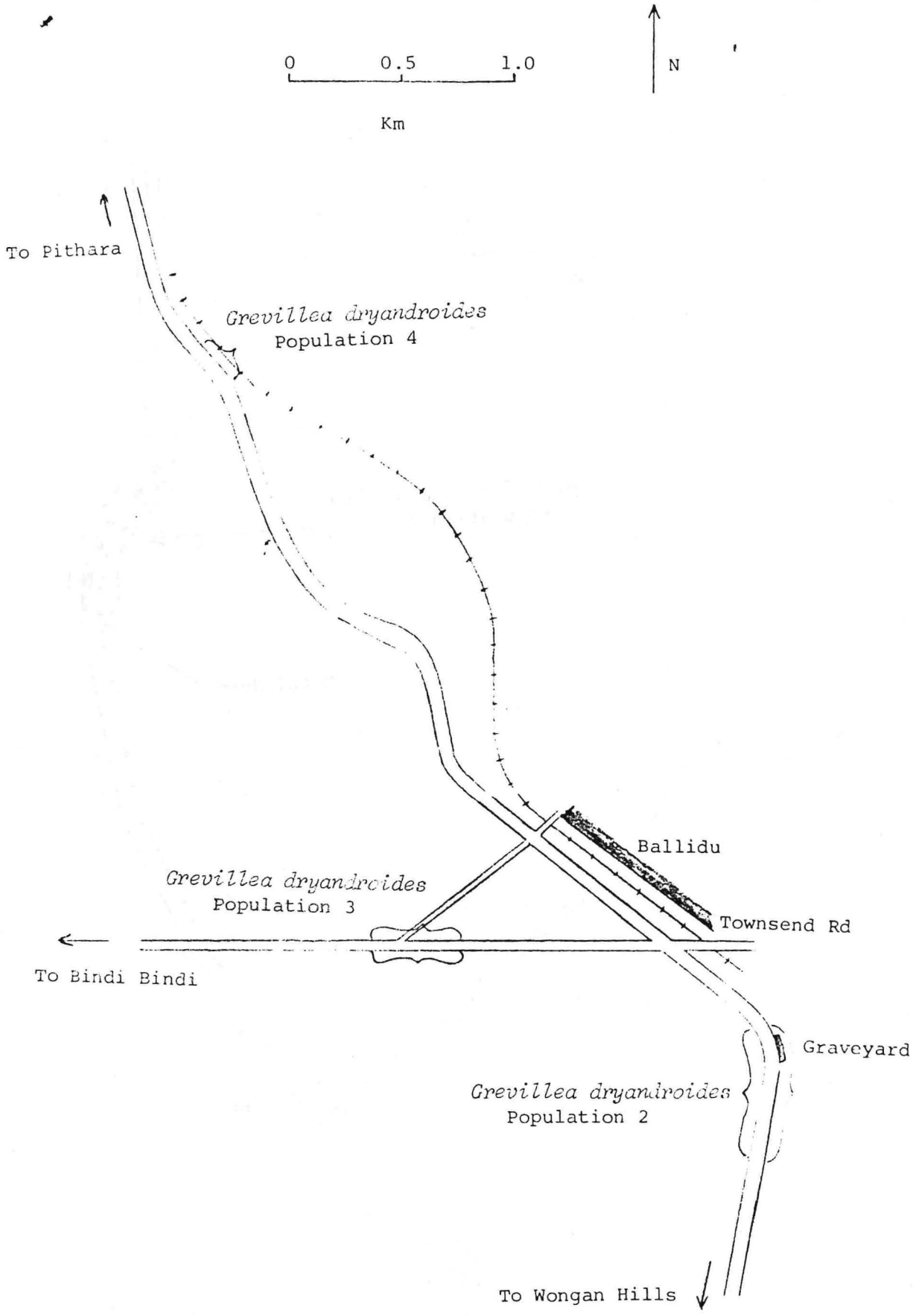
Age Structure: Rosette - 11 cm across and 5 cm high
Flowering stalks - ca 8 cm long
Total height - 11 cm
Total width - 20 cm

Condition: Healthy

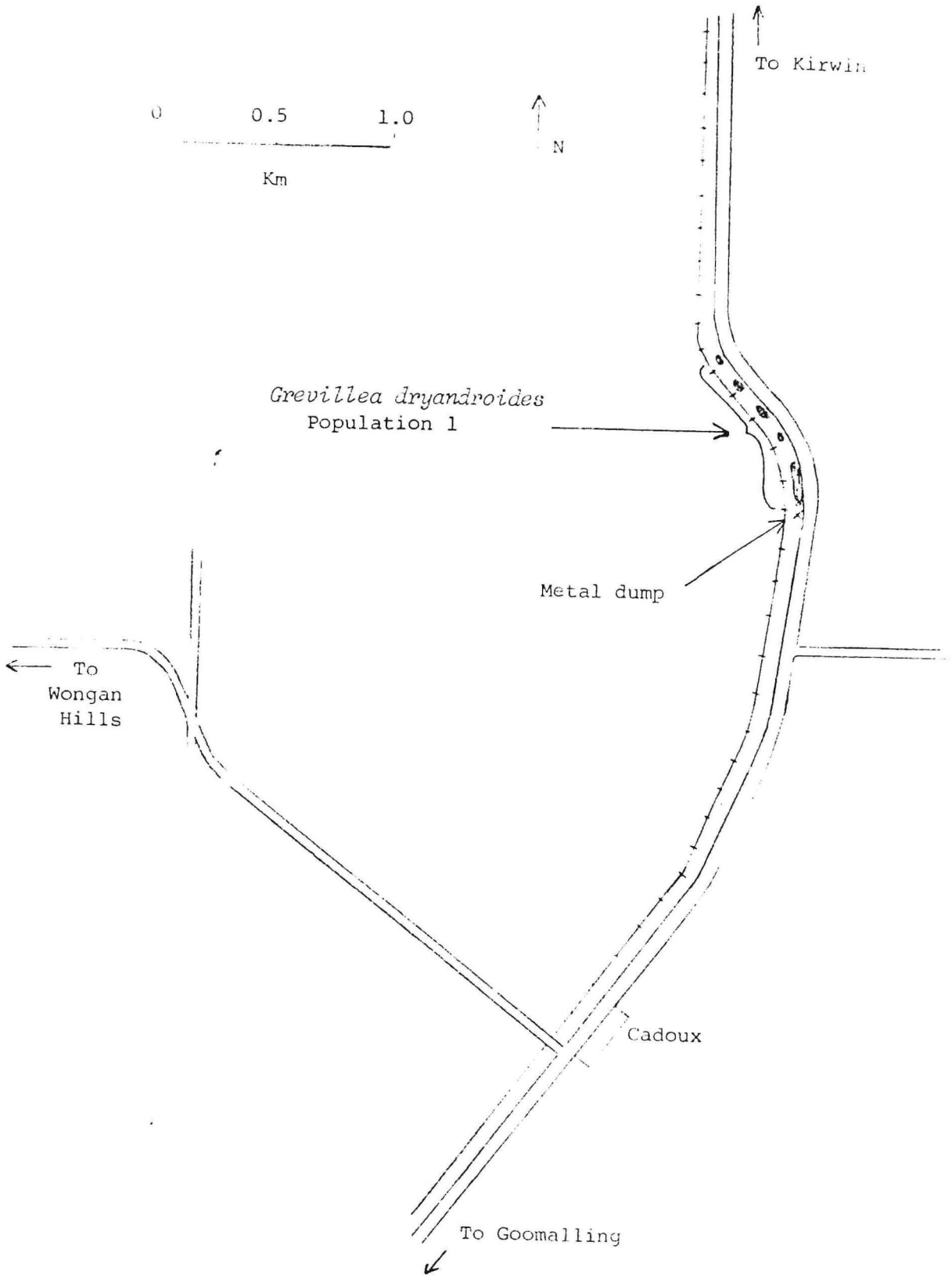
Reproductive Stage: 30 September 1980 - numerous flowers, buds and finished flowers
27 October 1980 - last two flowers open. Numerous immature fruits, some considerably expanded suggesting that they have set seed, most apparently sterile.
20 November 1980 - all the fruits have shrivelled. No seed set.

Faunal Activity: 30 September 1980 and 2 October 1980 - No insects were observed on the flowers but a couple of flowers had been triggered on both occasions.

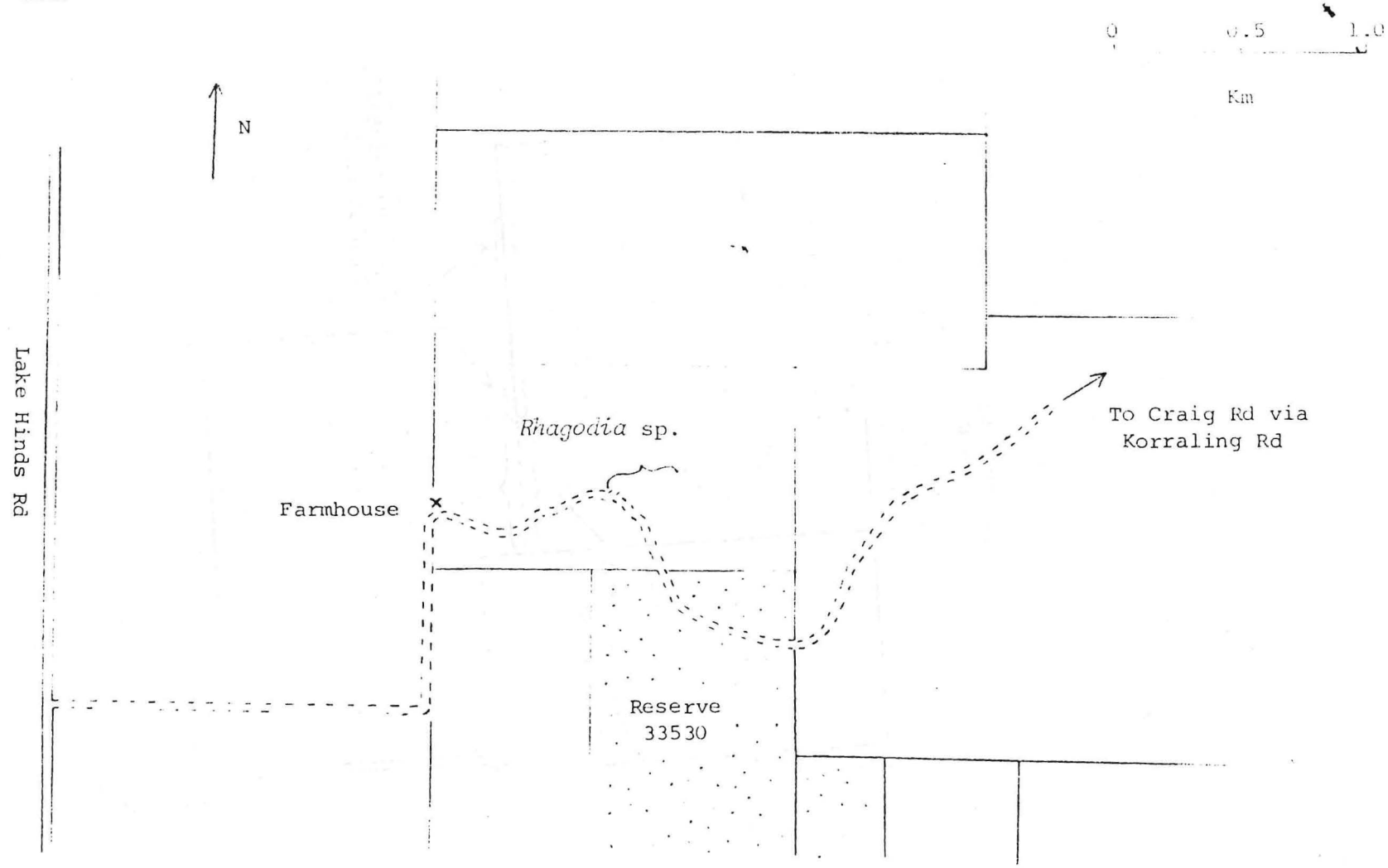
Map 1


0
0.5
1.0
Km
N
To Pithara
Grevillea dryandroides
Population 4
Ballidu
Grevillea dryandroides
Population 3
Townsend Rd
To Bindi Bindi
Graveyard
Grevillea dryandroides
Population 2
To Wongan Hills

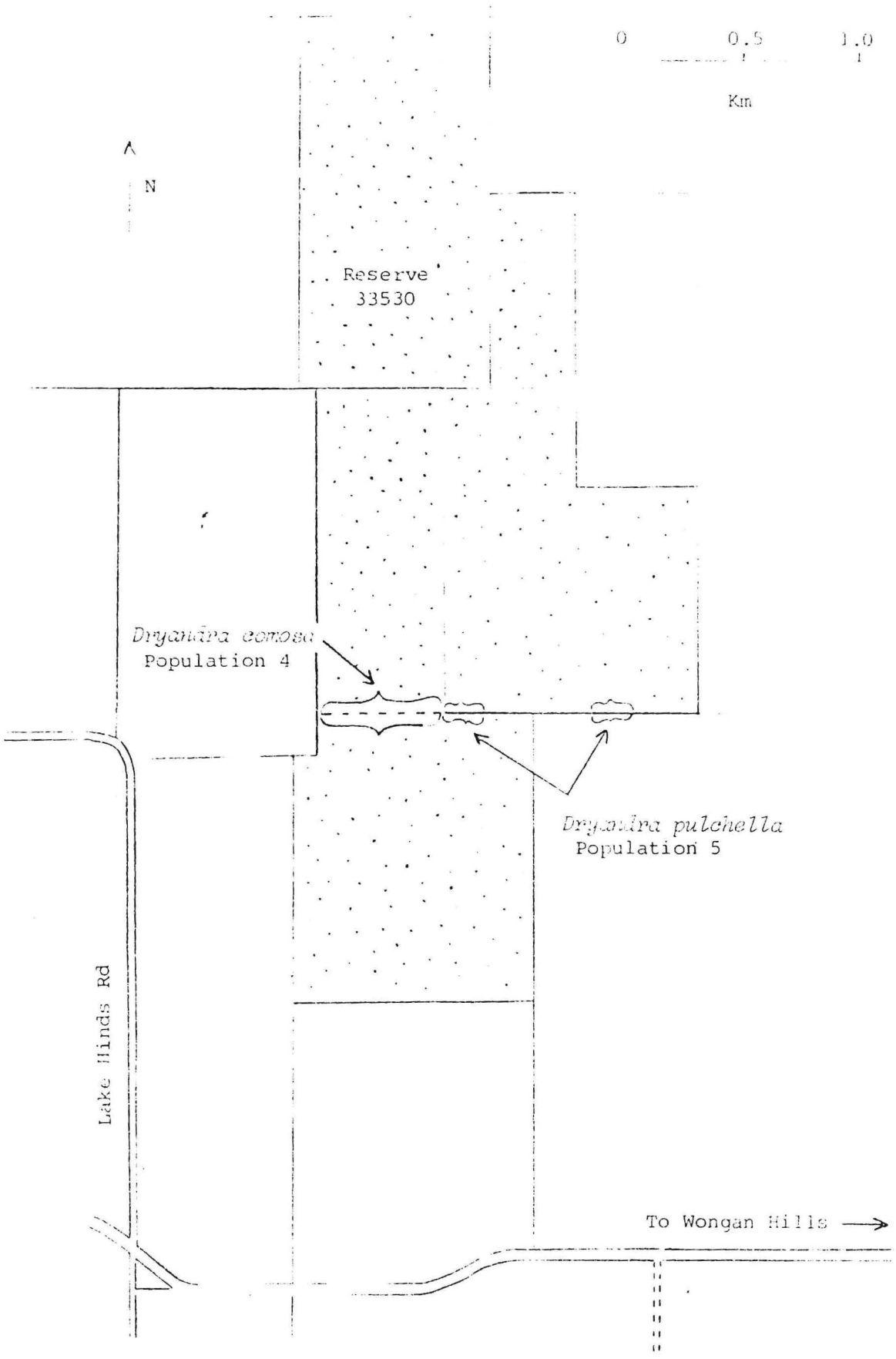
Map 2


To Kirwin
0
0.5
1.0
Km
N
Grevillea dryandroides
Population 1
Metal dump
To
Wongan
Hills
Cadoux
To Goomalling

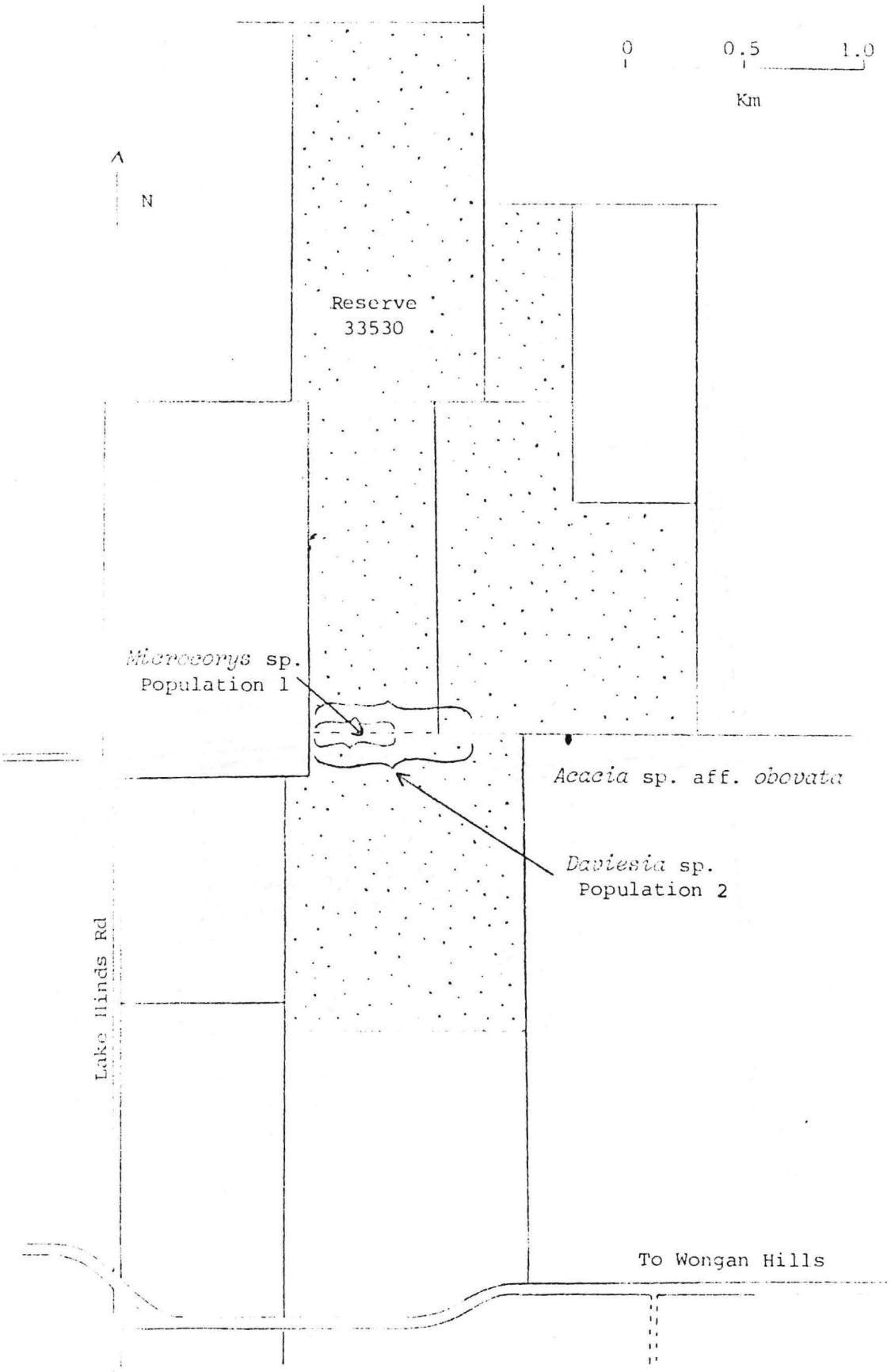
Map 3


0
0.5
1.0
Km
N
Lake Hinds Rd
Rhagodia sp.
Farmhouse
To Craig Rd via
Korraling Rd
Reserve
33530

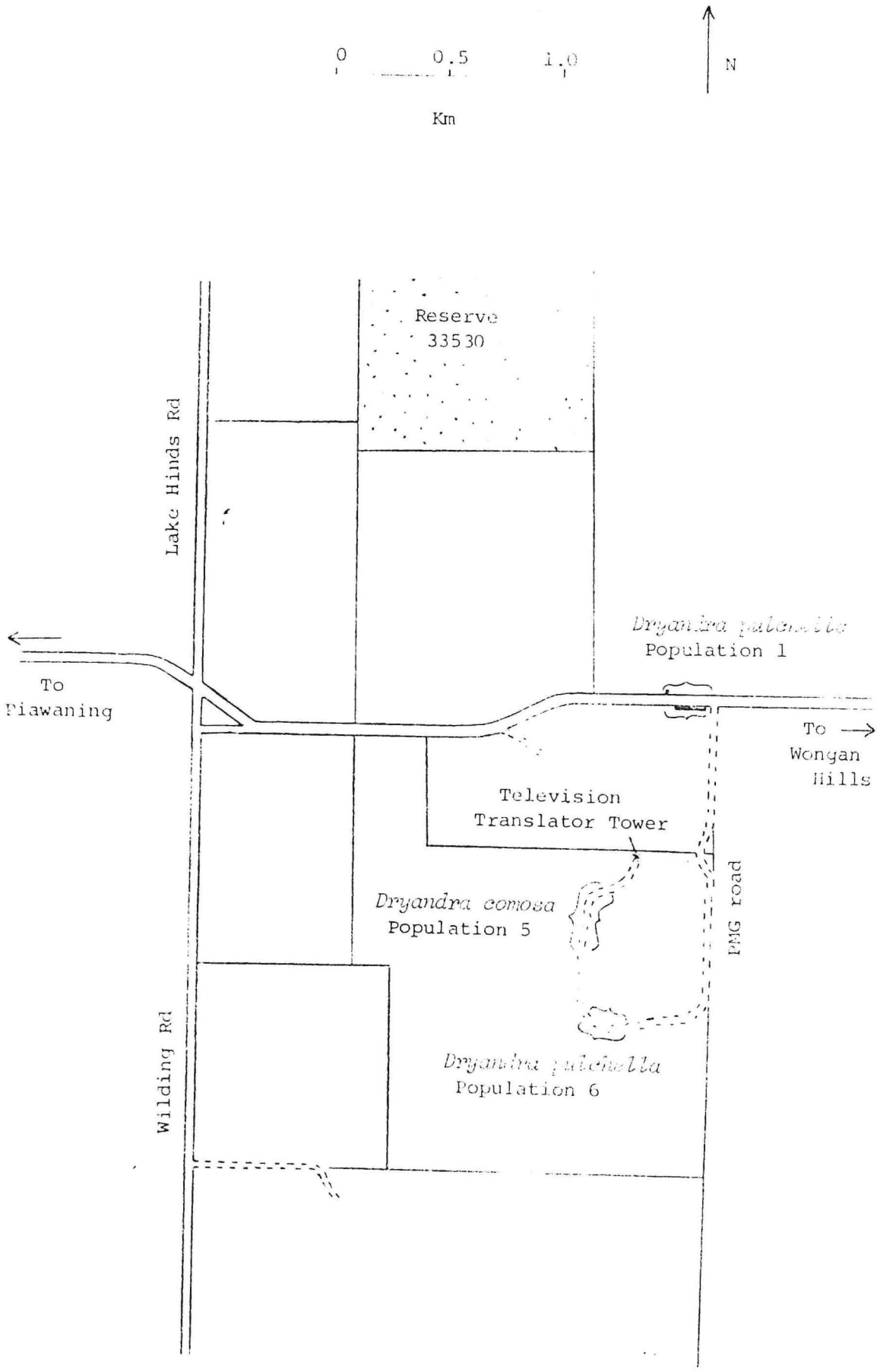
Map 4


0
0.5
1.0
Km
N
Reserve
33530
Dryandra connosa
Population 4
Dryandra pulchella
Population 5
Lake Hinds Rd
To Wongan Hills

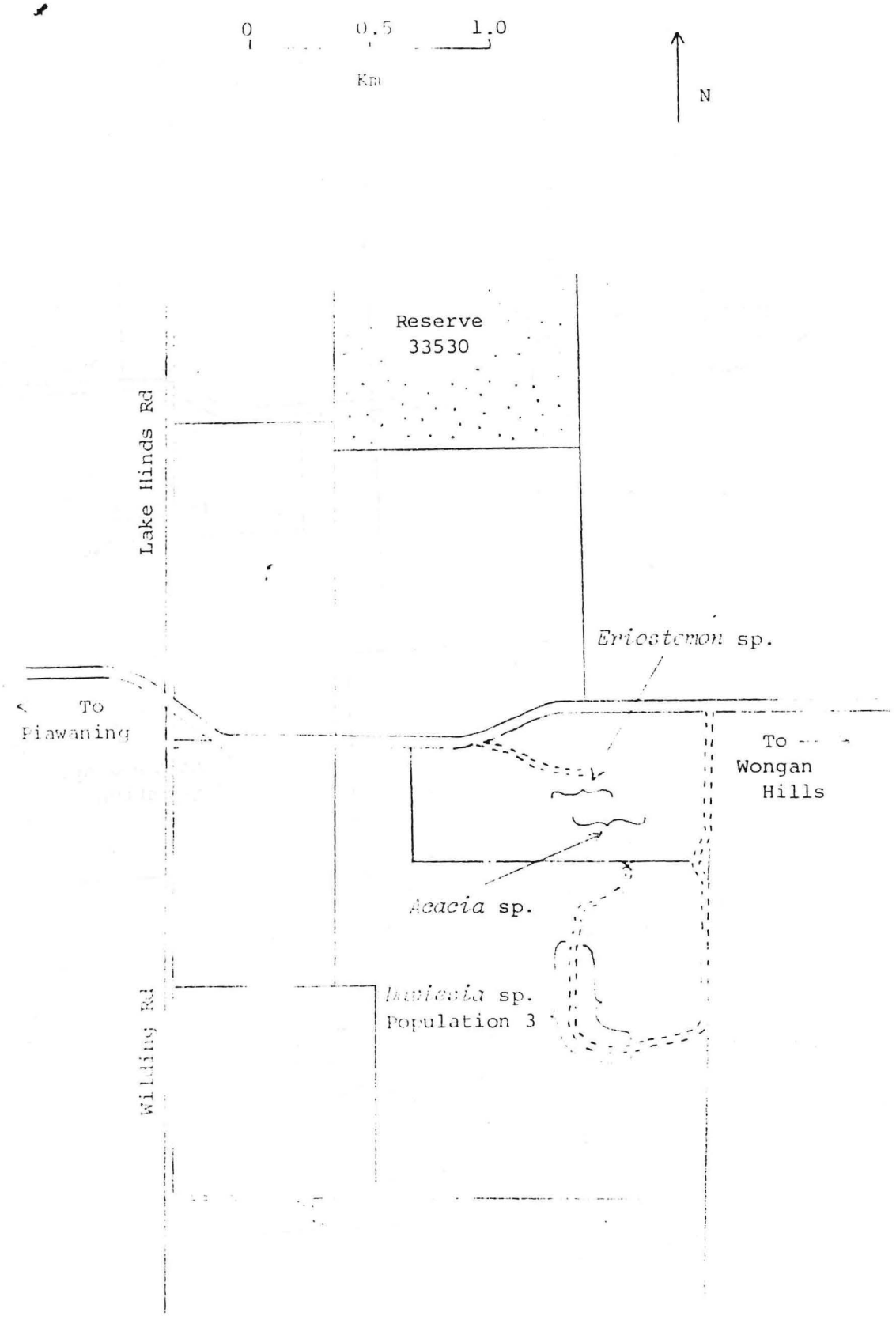
Map 5


0
0.5
1.0
Km
N
Reserve
33530
Microcorys sp.
Population 1
Acacia sp. aff. *obovata*
Daviesia sp.
Population 2
Lake Hinds Rd
To Wongan Hills

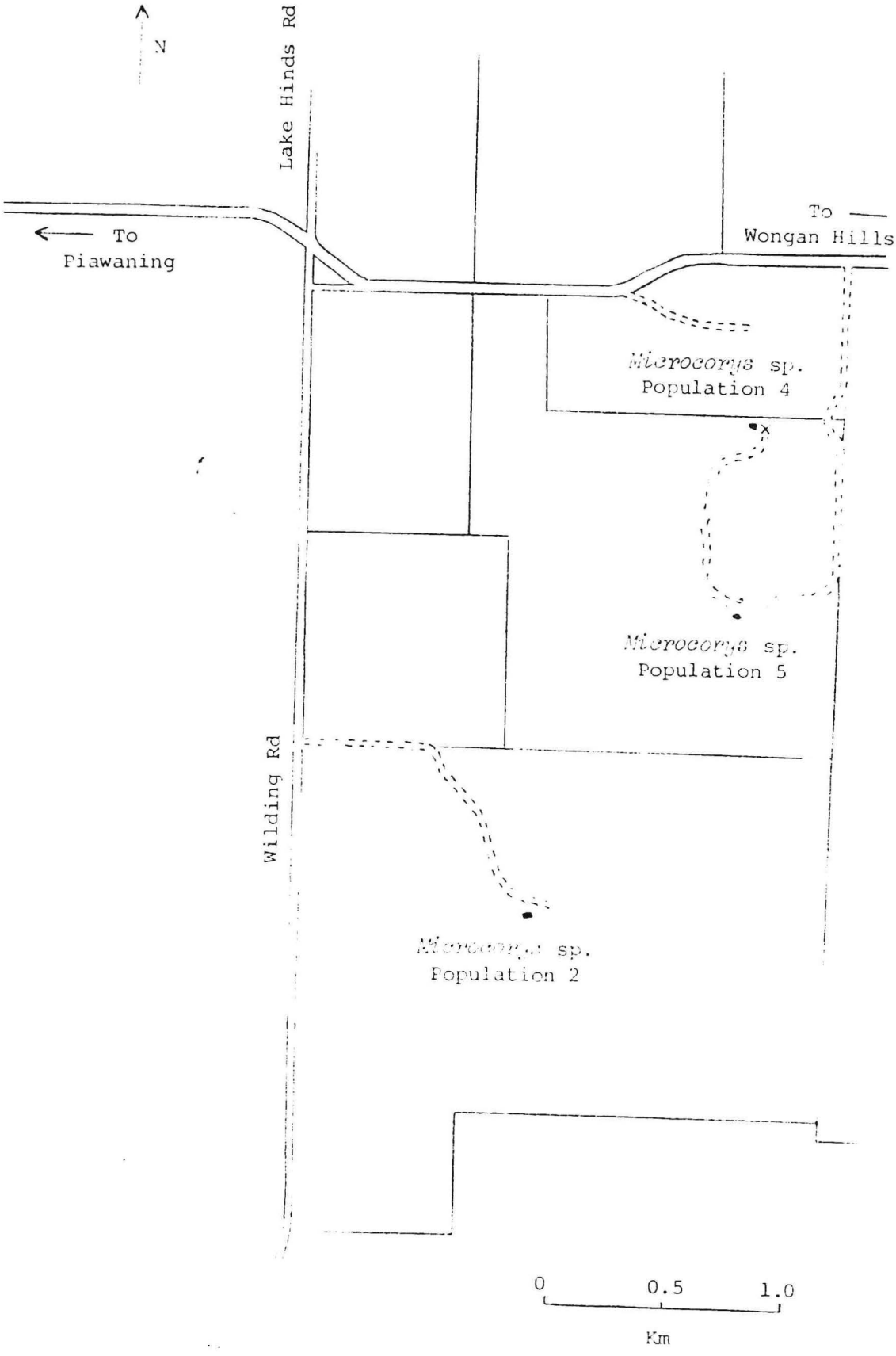
Map 6


0
0.5
1.0
Km
N
Reserve
33530
Lake Hinds Rd
To
Piawaning
Dryandra patchellia
Population 1
To
Wongan
Hills
Television
Translator Tower
Dryandra comosa
Population 5
PMG road
Wilding Rd
Dryandra patchellia
Population 6

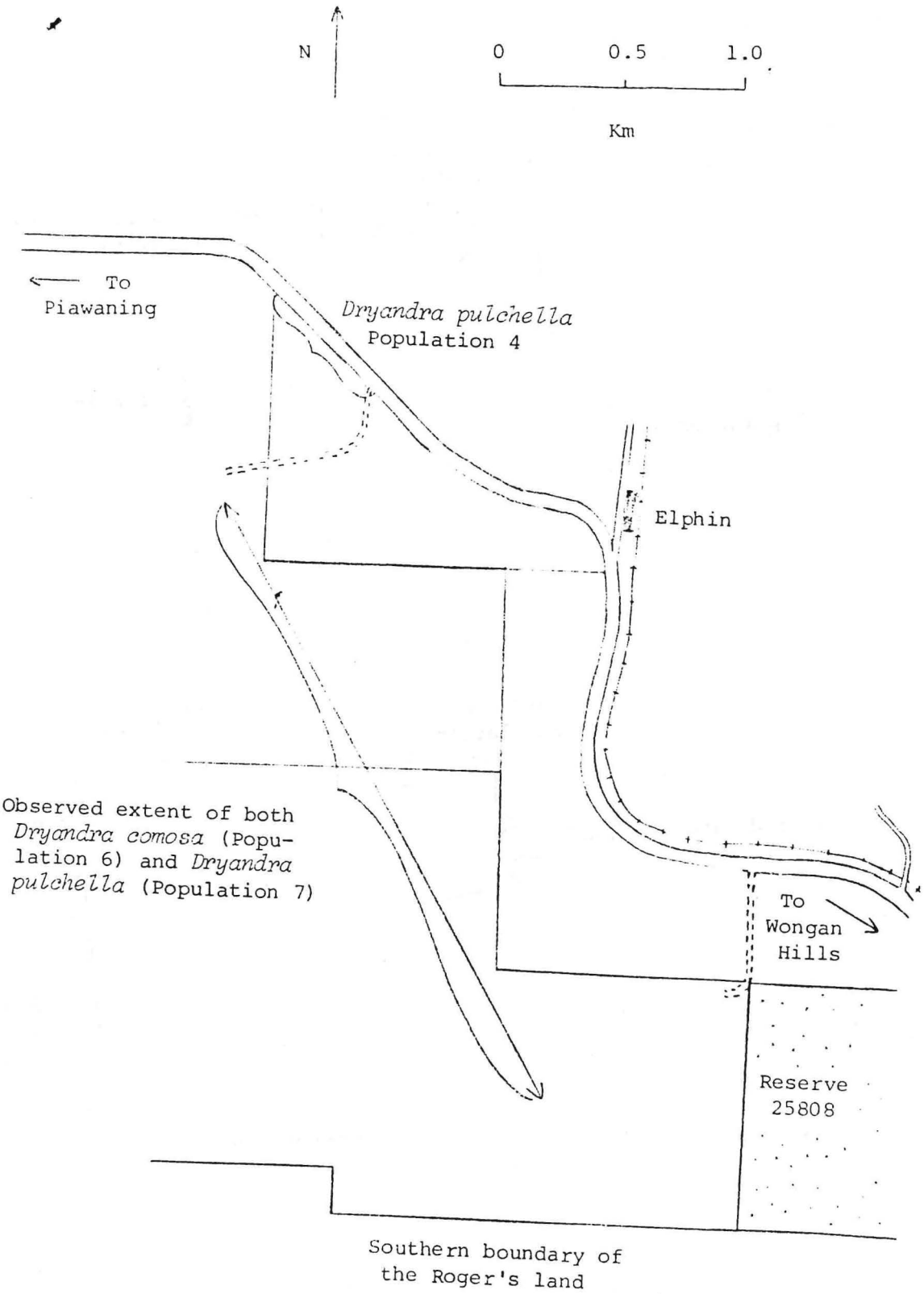
Map 7


0
0.5
1.0
Km
N
Reserve
33530
Lake Hinds Rd
Eriostemon sp.
To
Piawaning
To
Wongan
Hills
Acacia sp.
Wilding Rd
Isolepis sp.
Population 3

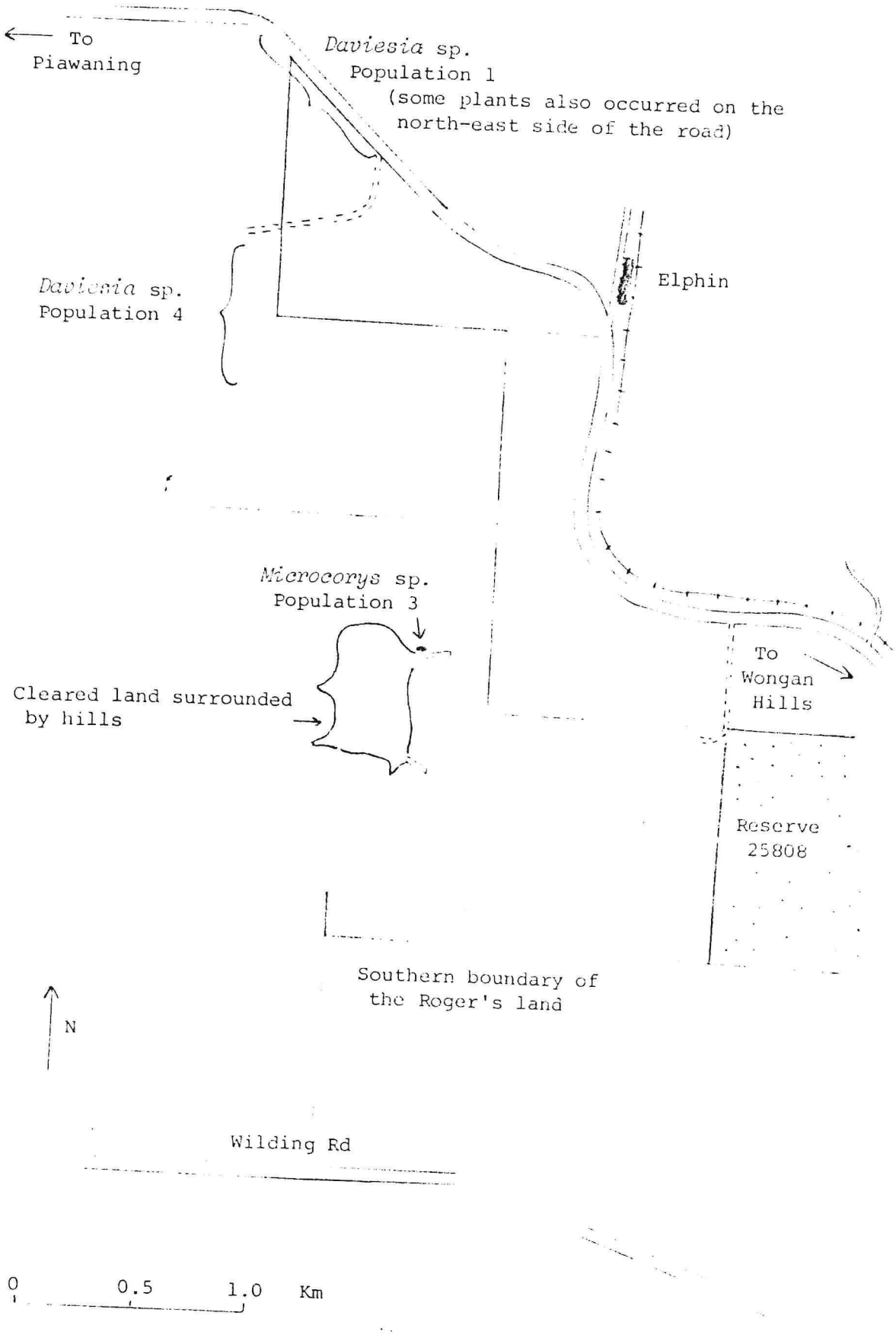
Map 8


N
Lake Hinds Rd
To
Piawaning
To
Wongan Hills
Microcorys sp.
Population 4
Microcorys sp.
Population 5
Wilding Rd
Microcorys sp.
Population 2
0
0.5
1.0
Km

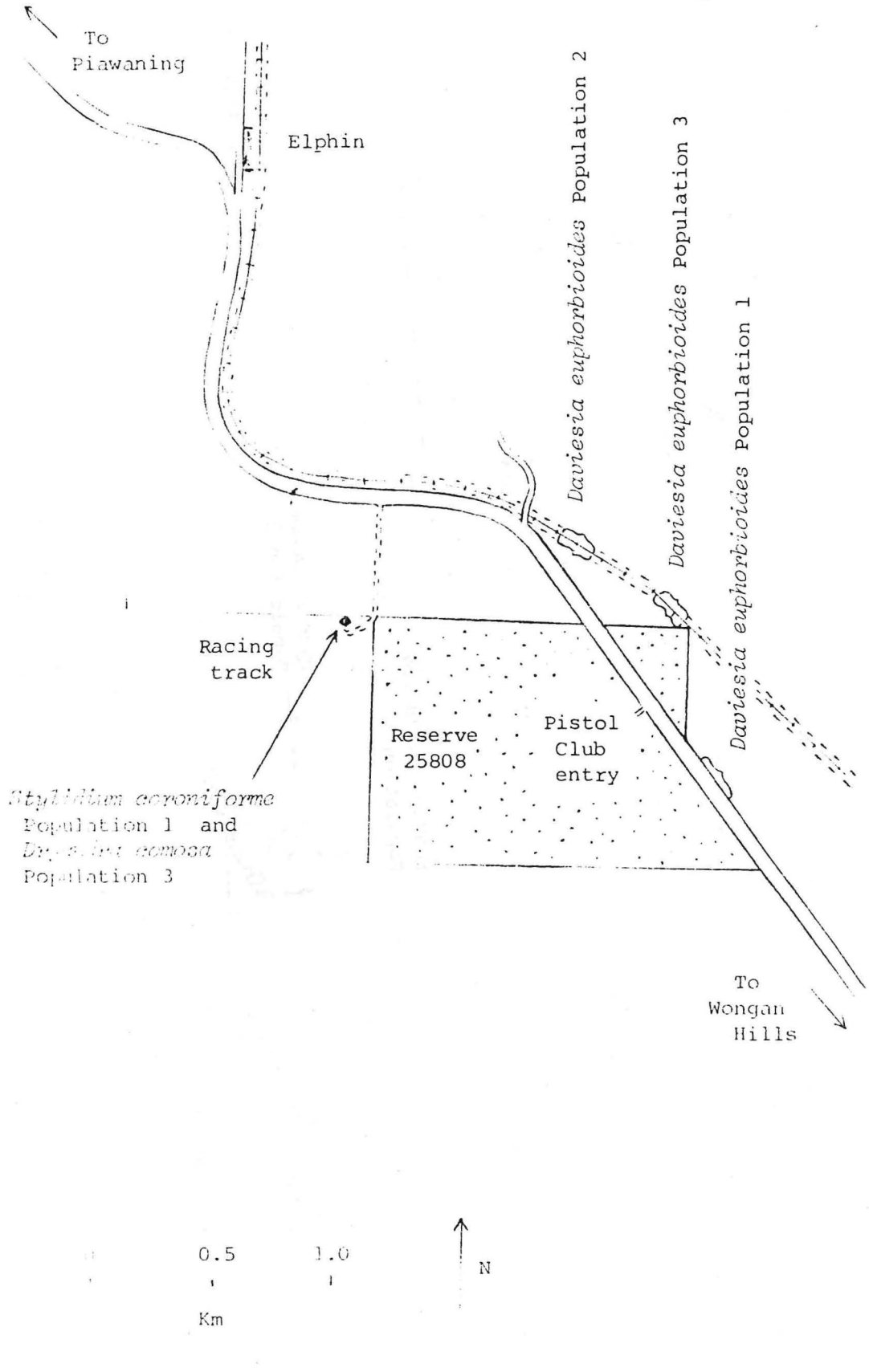
Map 9


N
0
0.5
1.0
Km
To
Piawaning
Dryandra pulchella
Population 4
Elphin
Observed extent of both
Dryandra comosa (Popu-
lation 6) and *Dryandra*
pulchella (Population 7)
To
Wongan
Hills
Reserve
25808
Southern boundary of
the Roger's land

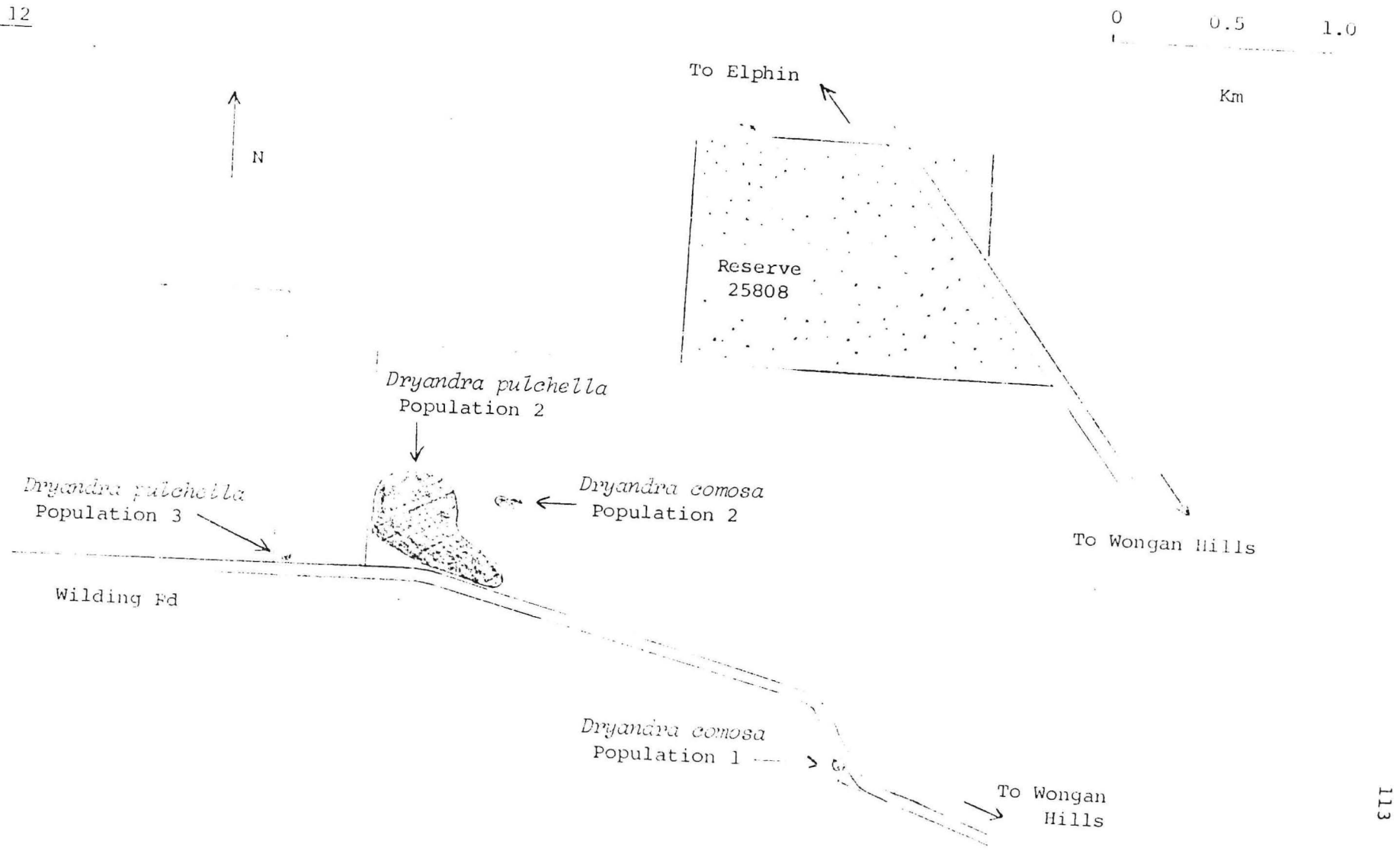
Map 10


To
Piawaning
Daviesia sp.
Population 1
(some plants also occurred on the
north-east side of the road)
Daviesia sp.
Population 4
Elphin
Microcorys sp.
Population 3
Cleared land surrounded
by hills
To
Wongan
Hills
Reserve
25808
Southern boundary of
the Roger's land
N
Wilding Rd
0
0.5
1.0
Km

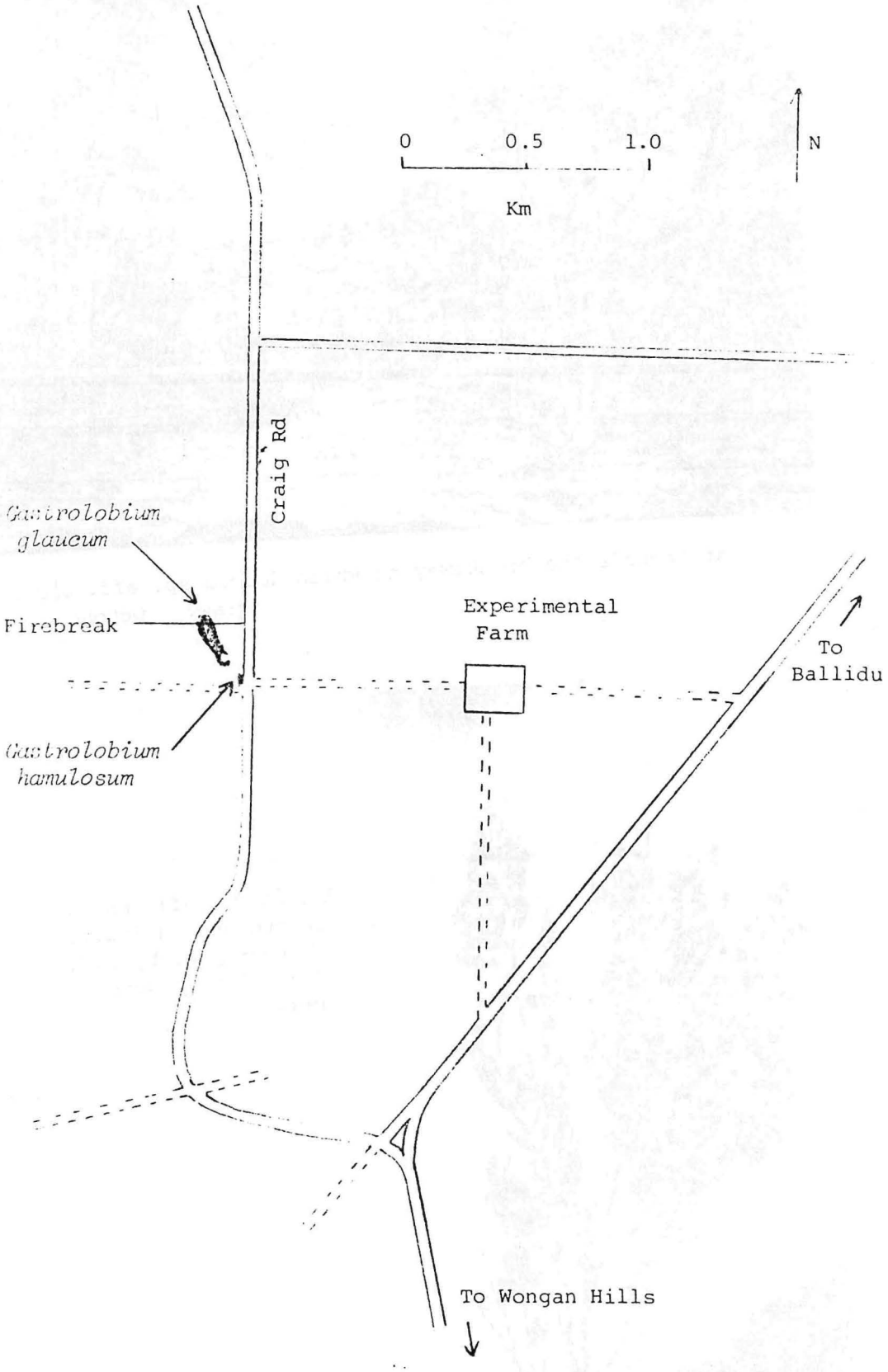
Map 11


To
Piawaning
Elphin
Daviesia euphorbioides Population 2
Daviesia euphorbioides Population 3
Daviesia euphorbioides Population 1
Racing
track
Reserve
25808
Pistol
Club
entry
Stylidium coroniforme
Population 1 and
Dryandra cirsioides
Population 3
To
Wongan
Hills
0.5
1.0
Km
N

Map 12


0
0.5
1.0
Km
N
To Elphin
Reserve
25808
Dryandra pulchella
Population 2
Dryandra pulchella
Population 3
Dryandra comosa
Population 2
To Wongan Hills
Wilding Rd
Dryandra comosa
Population 1
To Wongan
Hills

Map 13


0
0.5
1.0
Km
N
Craig Rd
Gastrolobium glaucum
Firebreak
Gastrolobium hamulosum
Experimental Farm
To Ballidu
To Wongan Hills

Appendix 3. Photographs of Rare Plants and their Habitats.

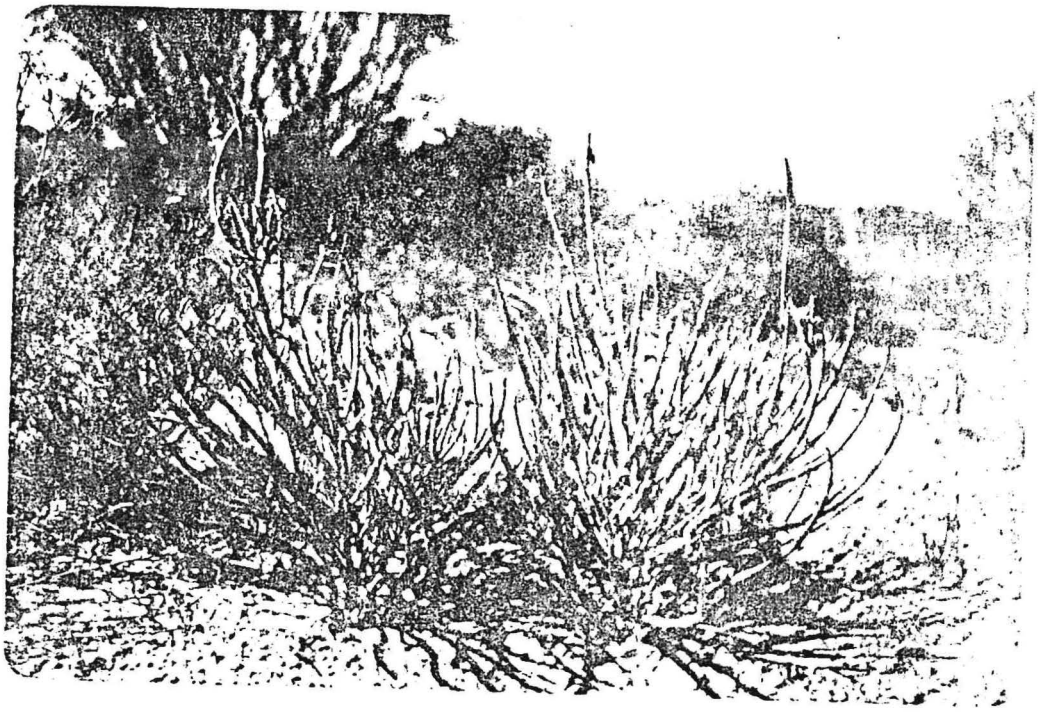
View east towards the breakaway on which *Acacia* sp. aff. *obovata* grew. October 1980.

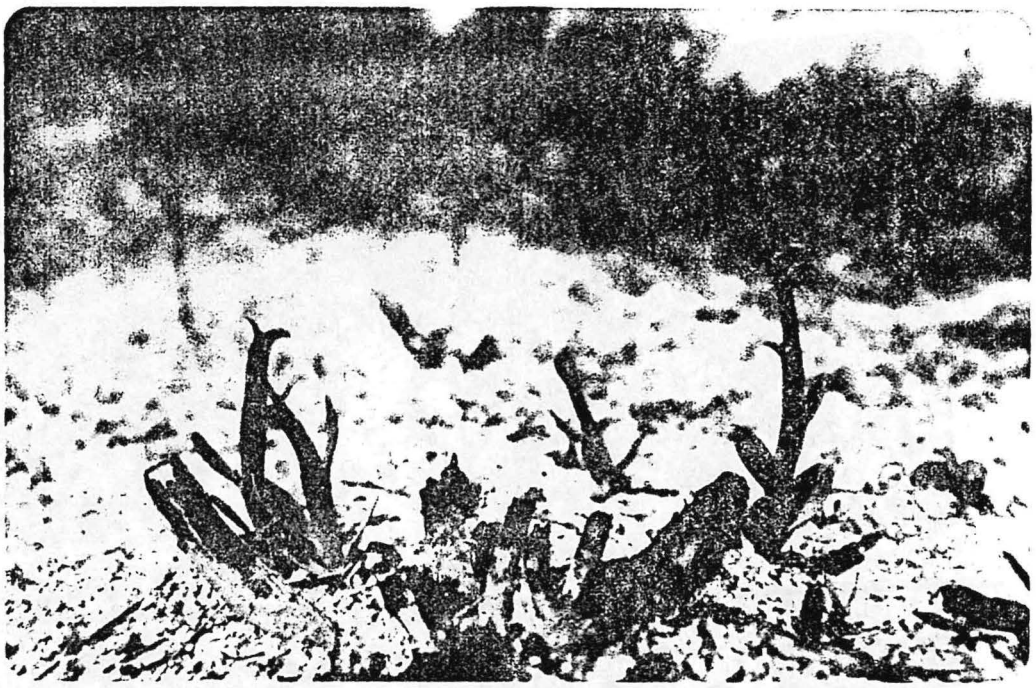
Acacia sp. aff. *obovata* in bud and in fruit. Photographed by K.F. Kenneally in October 1980.

Acacia sp. 2 in flower. August 1980.

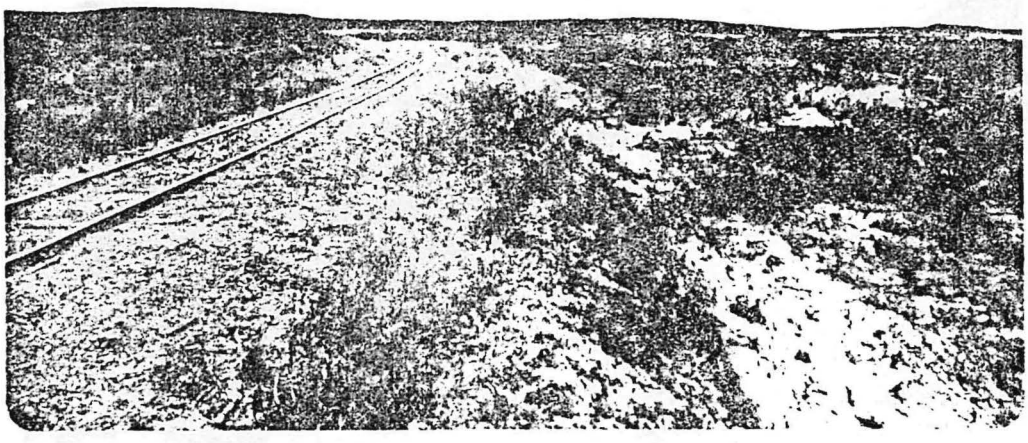
Habitat of *Acacia* sp. 2 in a gully below the television translator tower. August 1980.

Daviesia euphorbioides in fruit (population 1). October 1980.

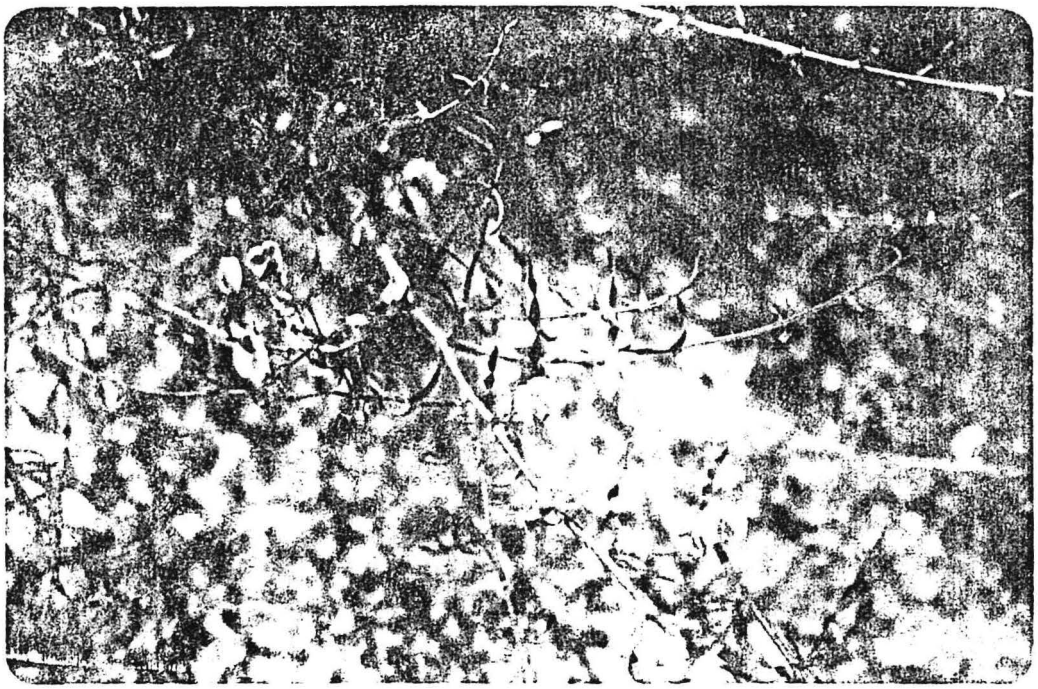




Daviesia euphorbioides seedlings beside the burnt stump of an older plant at population 2. October 1980.



Habitat of *Daviesia euphorbioides* population 3 with the Wongan Hills range visible in the background. October 1980.



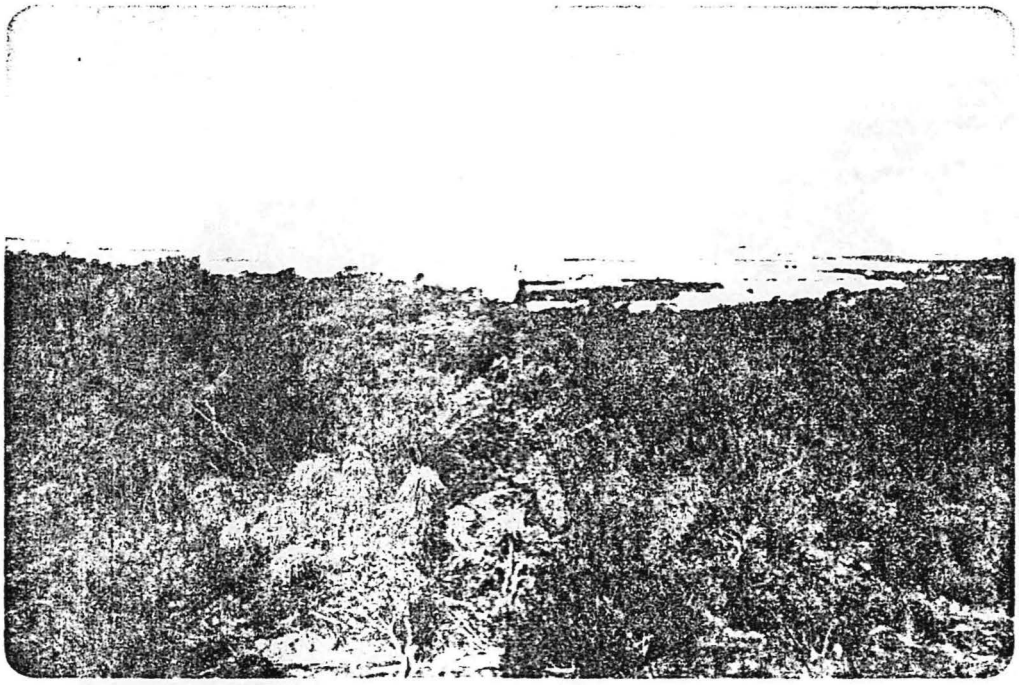
Daviesia sp. in flower at population 1. Its spiralled leaves are distinctive. October 1980.

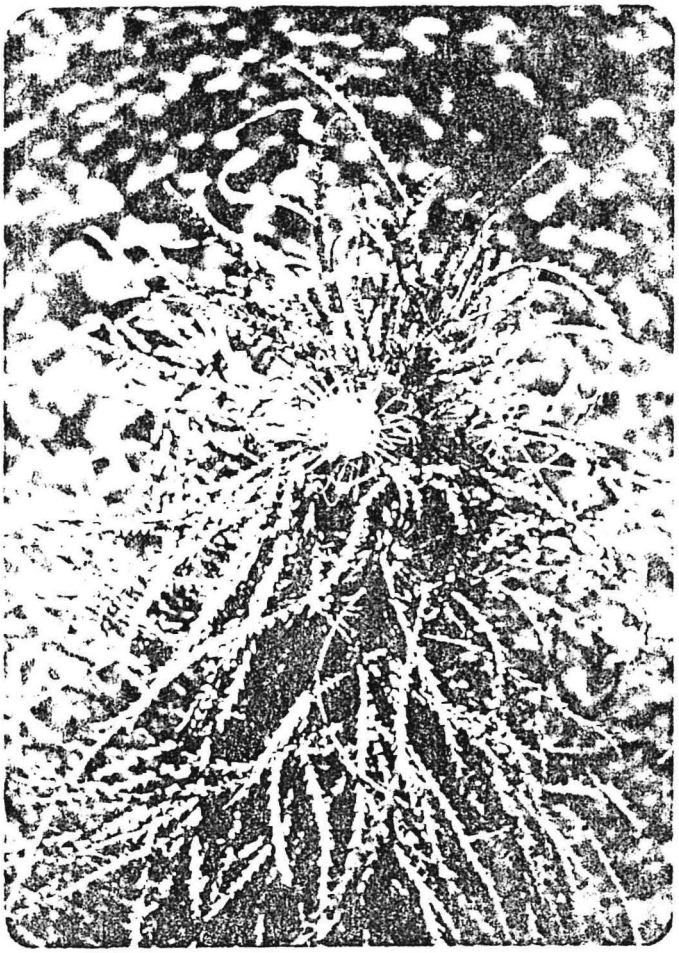
Roadside habitat of *Daviesia* sp. (population 1) and *Dryandra pulchella* (population 4). A flowering daviesia plant is in the foreground but no dryandras are visible. October 1980.

Dryandra comosa in flower. The flowers are generally hidden beneath a dense tangle of very long leaves. October 1980.

View east from Reserve 33530 at the boundary of *D. comosa* population 4 (one large bush on the left) and *D. pulchella* population 5 (several bushes in the foreground). October 1980.

See page 130 for population 3 of *D. comosa*.





Dryandra pulchella flowering (population 4). October 1980.

Population 3 of *Dryandra pulchella* growing at a gravel pit. The dryandras are the sprawling bluish bushes in the centre with a *Eucalyptus drummondii* tree on the right.

See pages 119 and 120 for further populations of *D. pulchella*.

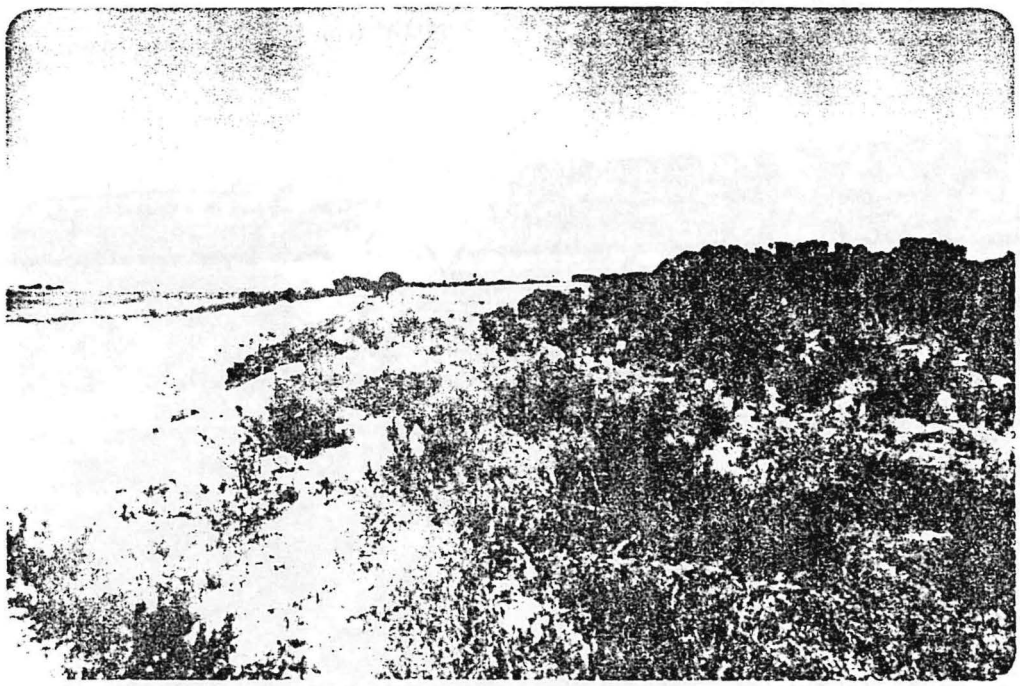
Eremophila sp. flowering. Photographed by K.F. Kenneally in October 1980.

Prostanthera sp. flowering. Photographed by K.F. Kenneally in October 1980.

Gastrolobium glaucum, after flowering had finished. October 1980.

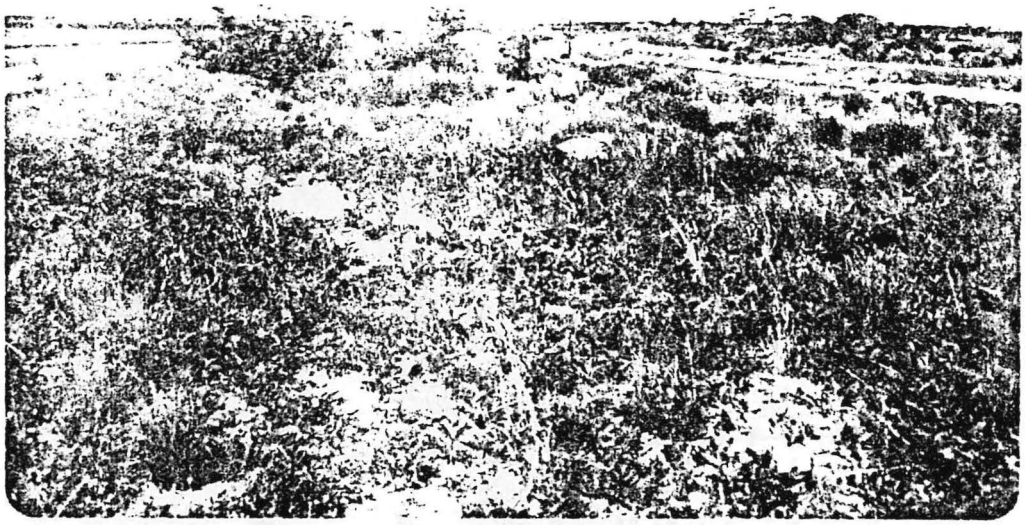
Gastrolobium glaucum's habitat, just west of Craig Road. October 1980.

Gastrolobium hamulosum flowering. October 1980.

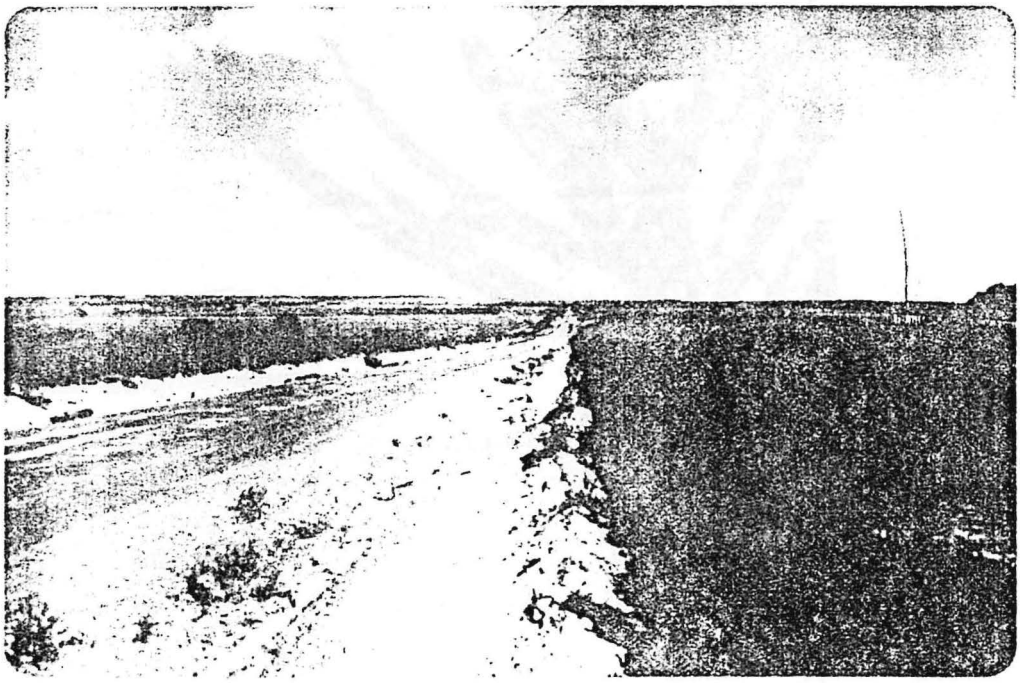


View south of the disturbed road verge where *Gastrolobium hamulosum* grew, with the undisturbed *Casuarina campestris* thicket on the right. October 1980.

Grevillea dryandroides in flower, population 1. August 1980.



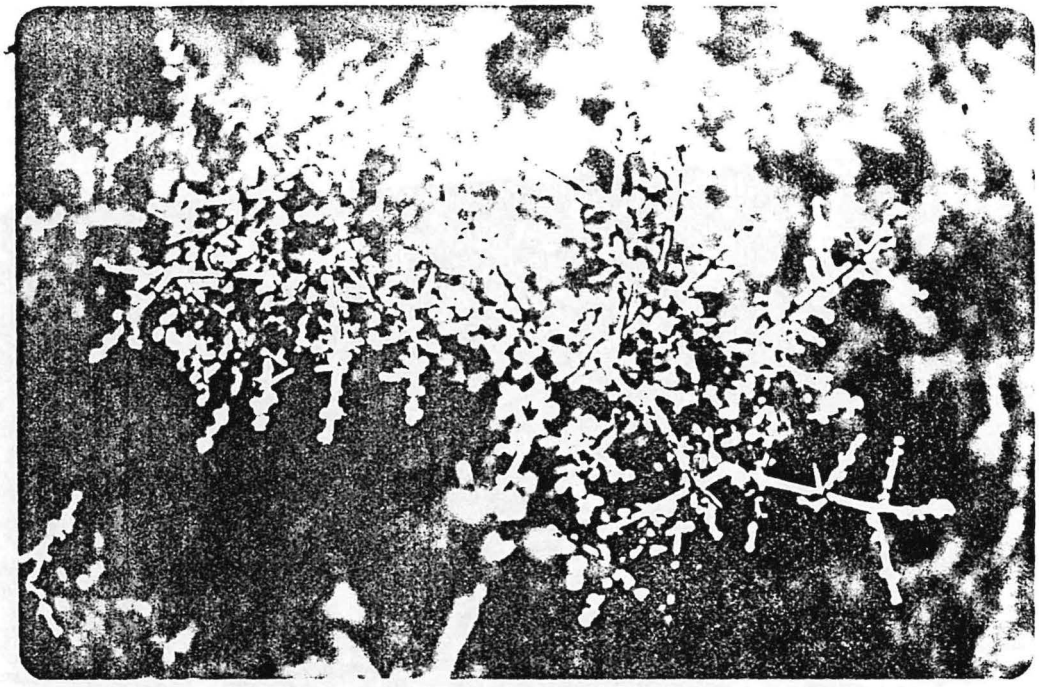
Grevillea dryandroides population 1 on pale yellow sand. View south towards Cadoux, with numerous interconnected plants of *G. dryandroides* in the foreground and several shrubs of *G. armigera* in the background. August 1980.



Habitat of *G. dryandroides* population 3 on bright yellow sand. looking west. October 1980.

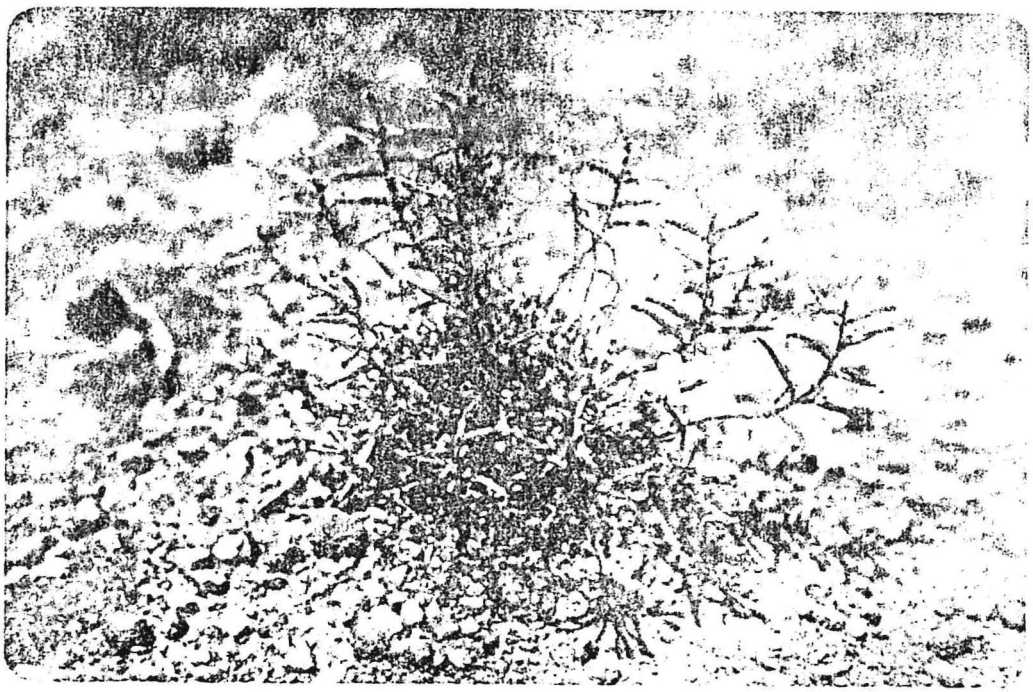
Microcoryis sp. in flower (population 1). Photographed by K.F. Kenneally in October 1980.

Rhagodia sp. in flower. October 1980.



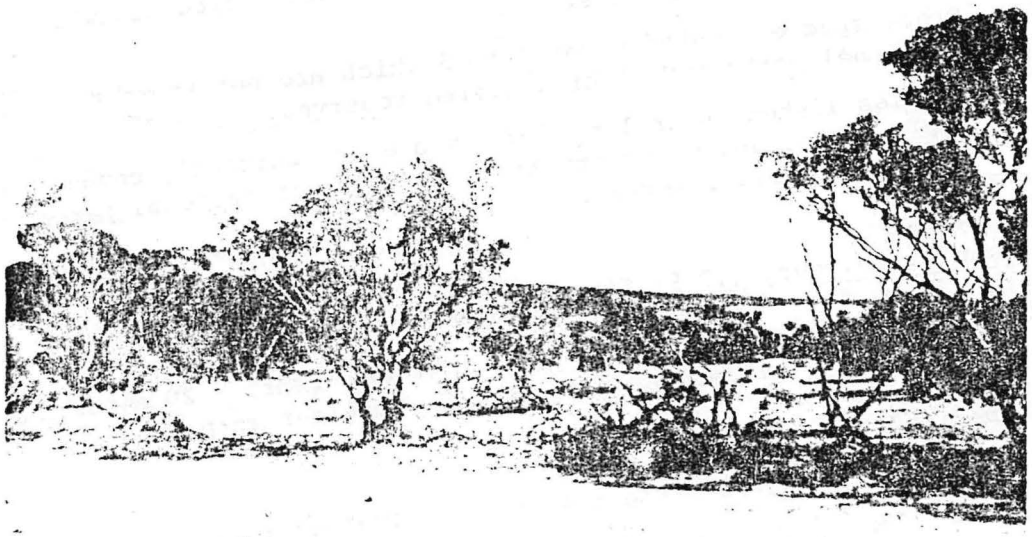
A *Rhagodia* bush growing in Monks Well Gully with *Eucalyptus leucophleba*. October 1980.

Stylidium coroniforme at the end of its flowering season. October 1980.



Looking west at the habitat of *Stylidium coroniforme* and *Dryandra cor*[illegible] population 3. The stylidium occurred among the purple flowered bushes of *Dampiera eriocephala*. *D. cornuta* bushes are in the foreground of the photograph. October 1980.

As above but looking north, with *Eucalyptus pyriformis* in the foreground.



Appendix 4. Comparison of Conservation Status Assessments for Named Wongan Hills Species.

Hartley & Leigh (1979) Classification

Distribution Category (Numerical Code)

1. Species known only from the type collection or type locality. Further study usually needed to ascertain present distribution and taxonomic status.
2. Restricted endemics whose known populations are limited in range (e.g. normally less than 100 km in maximum range).
3. Rare species occurring only in small populations, but over a wider area; often restricted to specific habitats (e.g. sandstone areas, high mountain peaks).
4. Species of geographical importance, especially those with a disjunct distribution in Australia and overseas and listed only if the Australian populations are localized or sparse.
5. Species not fitting closely into the above categories, but considered to be at risk. This includes some once common species which, though still widely distributed, have suffered marked depletions in overall population size.

Conservation Status (Alphabetical Code)

X. Species believed to be extinct. Not collected in recent years.

E. Endangered. Species in serious risk of disappearing from the wild state within one or two decades if present land use and other casual factors continue to operate.

V. Vulnerable. Species not presently endangered but at risk over a longer period or if land use patterns are introduced which would be deleterious to the species.

n. Other species listed under 1 to 5 which are not known to occur in national parks and other declared reserves.

C. Species listed under 1 to 5 which are not currently endangered or vulnerable, and which are known to occur in national parks and other declared reserves.

Marchant & Keighery (1979) Classification

Numerical Code: The number of herbarium specimens. 20 should be regarded as equal to or greater than 20.

Alphabetical Code

A. No specimen in the Western Australian Herbarium

B. Rare (apparently rare and quite restricted in distribution).

C. Represented in the Western Australian Herbarium only by a Type Specimen.

D. Poorly collected (less than 5 collections in the Western Australian Herbarium).

Appendix 4 (Continued)

E. Geographically restricted with a range less than 100 km.

F. Geographically restricted with a range less than 160 km

Species	Hartley & Leigh's Classification		Marchant & Keighery's Classification	
	Published in 1979	Present Study	Published in 1979	Present Study *
Daviesia euphorbioides #	not listed	2 C	not listed	3+ B
Dryandra comosa	3 E	2 C	7 B	5 E
Dryandra pulchella	2 E	2 C	5 E	7 E
Gastrolobium glaucum	2 C	1 E	20 E	3 B
Gastrolobium hamulosum	2 V	3 V	3 D	9 F
Grevillea dryandroides #	3 V	2 V	not listed	4+ E
Stylidium coroniforme	2 C	1 E	3 D	2 B
Verticordia staminosa	3 E	3 E	2 D	3 B

* The number of herbarium specimens given here are not the number of separate sheets (as may have been given in 1979) but the number of different collections.

\# Some herbarium specimens of these species were on loan when these studies were undertaken.