

# Flora and vegetation of Burnerbinmah Station: a study of the plant communities in the Mulga shrublands of the Murchison Region, Western Australia

SUSAN PATRICK<sup>1</sup>

<sup>1</sup>Science Division, Department of Conservation and Land Management, W A Herbarium,  
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983  
Email: suep@calm.wa.gov.au

## SUMMARY

A study was undertaken of the flora and plant communities of Burnerbinmah Station in the Murchison Region of Western Australia. The station lies at the head of the Mongers Lake drainage system, with associated calcrete valley fills and platforms, alluvial plains, sandplains, granite exposures and breakaways.

Thirty-four quadrats were used to define nine community types that were correlated with soil types and topography. A total vascular flora of 551 species was recorded from the station, of which 494 were native and 57 were introduced. *Acacia* is represented by 32 species, Mulga (*A. aneura*) being dominant in many communities. Nine taxa listed on the Department of Conservation and Land Management's priority flora list were found on the station.

## INTRODUCTION

Burnerbinmah Station was purchased by the Department of Conservation and Land Management in 1995, when the pastoral lease was transferred to the Department.

The Station covers about 59 908 hectares and is situated approximately 70 km south-west of Mount Magnet and 270 km due east of Geraldton in Western Australia. It lies within in the Shire of Yalgoo between Yalgoo, Mount Magnet and Paynes Find. This is within the Murchison Region, part of the Eremaean Botanical Province (Beard 1990), and lies on the boundary between the Yalgoo and Murchison Bioregions (Thackway and Cresswell 1995). It has an arid climate of unpredictable summer and winter rainfall but is close to the eastern margin of the South-western Botanical Province (Fig. 1).

Based on figures recorded at Yalgoo (c. 70 km to the north-west), the average annual rainfall is about 250-280 mm (Beard 1976). At Burnerbinmah the mean annual rainfall between 1980 and 1994 was 251 mm. In February 1995, cyclonic storms brought heavy rain to the area and the annual rainfall for Burnerbinmah in that year was 451 mm (Brand 1999).

## HISTORY

The pastoral lease was taken up in 1878, and with seven adjoining leases make the lease as it is today. About 1884 a mud brick home was built at the head of Mongers Lake and is incorporated in the present day homestead. The Station was grazed, mainly with sheep, and some cattle and horses, from the 1890s until de-stocked in 1995.

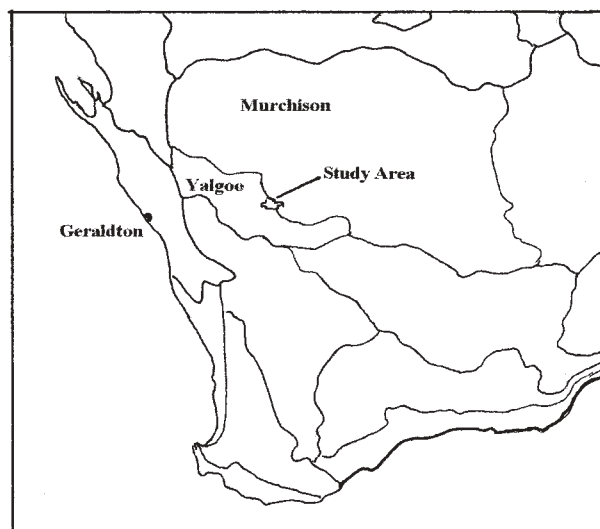


Figure 1. Location of the study area and its position within the Austin Bioregion.

A few plant collections were made by R.A.Saffrey in 1969, when some specimens were taken as vouchers for *Arid Shrubland Plants of Western Australia*, 2<sup>nd</sup> edn (Mitchell & Wilcox 1994). J.S.Beard made some collections in 1973 during fieldwork for the vegetation survey of the region (Beard 1976). A.L.Payne and A.M.E.Van Vreeswyk made further collections in 1993 during fieldwork for the inventory and condition survey of the Sandstone-Yalgoo-Paynes Find area (Payne *et al.* 1998). Voucher specimens for regeneration monitoring trials of Sandalwood (*Santalum spicatum*) have been taken by J.E.Brand since 1996, as part of ongoing work on Sandalwood at Burnerbinmah (Brand 1999; Patrick *et al.* 1997/8).

## GEOLOGY

Mongers Lake runs southwards through the station, roughly bisecting it. Calcrete is deposited along the northern section of this drainage line and along another on the south-western corner of the station. Surrounding the lake are alluvial deposits of sand and clay deposited in drainage channels and on floodplains. The land rises from the lake floor at 300 m to 378 m on the eastern side and 358 m on the western side. Alluvial and colluvial deposits of transported clay, sand and lithic fragments occur mainly on the western side. Yellow sandplain is found throughout the station, with some red colluvial sand on plateau remnants. There are also smaller areas of residual deposits, sand, clay and duricrust and deposits of laterite on top of breakaways. Granitoid rocks also provide relief. There are large outcrops of adamellite to granodiorite rocks, particularly on the south-western side, and smaller outcrops of adamellite and granite throughout (Baxter *et al.* 1983).

## VEGETATION AND LANDFORMS

There have been few detailed botanical studies of specific areas in the Murchison Region. Davies (1970) published a list of c. 200 taxa for Mileura Station which is situated c. 250 km north of Burnerbinmah. The terrain there is flat with some laterite breakaway scarps and granite tors. The vegetation is less diverse, mainly Mulga (*Acacia aneura*) shrubland, with some saltbush on floodplains but with no spinifex sandplains.

Eighty taxa were listed in an annotated list of the angiosperms of Lakeside Station (Kenneally 1968) which lies 120 km north of Burnerbinmah, with a similar annual rainfall. The vegetation is predominantly Mulga, with a larger range of species on breakaways.

The vegetation on Burnerbinmah Station is mainly representative of the arid zone flora but it is close to the eastern limit of the South-West Botanical Province. The vegetation of the Murchison Region is predominantly Mulga low woodland on plains, reduced to scrub on hills (Beard 1990). Low woodlands of Mulga, often rich in ephemerals, dominate the vegetation of the Murchison Bioregion, and the Yalgoo Bioregion has open woodlands and scrub of Mulga, *Callitris-Eucalyptus salubris* and bowgada (*Acacia ramulosa* var. *linophylla*) (Thackway and Cresswell 1995).

The predominance of the Mulga association through the station is reflected by a rich assemblage of *Acacia* species, at 32 taxa the largest number for any genus recorded there.

The vegetation map for the Murchison (Beard 1976) shows that the station lies across a rainfall boundary, approximately the 250 mm isohyet. Beard recorded Mulga woodland predominating on the drier eastern side and mixed *Acacia* scrub with scattered Mulga on the western side. This major division is also reflected in the area being the south-western edge of the distribution of most species of *Triodia*.

Eight land types are represented with a total of twelve component land systems (Payne *et al.* 1998) (Table 1). The upper reaches of the Mongers Lake wetland complex form a broad valley. Other landforms include breakaways, granite hills and exposures, salt lakes and calcareous plain. One gorge has permanent freshwater and there are areas of sandplain. A wide range of plant communities results from this diversity, including Mulga low woodlands in the broad valleys and, less commonly, mallee woodlands. *Acacia* shrubland occurs on shallow soils associated with granite exposures. Spinifex sandplain on the eastern side of the station is replaced by mixed spinifex and sedgeland on the red sandplains of the western side. There are freshwater and saline wetlands. Open Mulga with bluebush (*Maireana* spp) and saltbush (*Atriplex* spp) and also bluebush, saltbush and samphire (*Halosarcia*) shrublands are associated with the salt lakes.

## WILDLIFE MANAGEMENT PROGRAMS FOR RARE AND POORLY KNOWN FLORA

The work was undertaken as part of a wildlife management program for rare and priority (poorly known) flora in the Department of Conservation and Land Management (CALM) Geraldton District.

The district runs inland nearly 600 km, and thirty seven Threatened Flora and 264 Priority Flora are recorded for it. Most of the Threatened Flora occur on the wetter coastal strip, and in the inland pastoral section where many species of Priority Taxa occur there were no conservation reserves until the purchase of Burnerbinmah. It was therefore important to determine which Threatened and Priority Taxa occur on Burnerbinmah and to learn more about the vegetation of the area.

In 1996 the opportunity arose to survey the flora on Burnerbinmah as part of a Landscape Expedition. These expeditions are offered by the CALM publication *Landscape*, in association with The University of Western Australia's Extension Program. They provide expedition members with an opportunity to work on CALM research projects, to promote wider co-operation in addressing conservation and land management challenges in Western Australia.

## METHODS

### Participants

Three Landscape Expeditions worked on the Station, in September 1996, August 1997 and October 1998 with a total of 29 participants. An expedition with the Western Australian Naturalists' Club at Easter, March 1997, also gathered information. In total, twenty two days were spent on the work.

TABLE 1

Land types and systems of the Sandstone-Yalgoo-Paynes Find Rangeland Survey (Payne *et al.* 1998), represented on Burnerbinmah Station, with quadrats established on each system.

<b>Land Type 4.</b>	Breakaways, stony plain and sandy surfaced plain on granite with Mulga shrubland and minor halophytic shrubland quadrats	
She –Sherwood	Breakaways, kaolinised footslopes and extensive gently sloping plains on granite	A4 A5 A6 B3 B5 C3 C4 C5
Wag –Waguin	Undulating sandy plain and stripped surface with small breakaways on laterite and granite	A1 C7
<b>Land Type 6.</b>	Plain with gritty surface and low tors and domes on granite with acacia shrubland	
Chl –Challenge	Gently undulating plain with occasional hills, tors and low breakaways on granite	no quadrats established
<b>Land Type 12.</b>	Sandplain with grassy acacia shrubland	
Kal –Kalli	Level to gently undulating plain of red sand over laterite	A3 A9 A11 B2 B10 C2 C10
<b>Land Type 13.</b>	Wash plain on hardpan with Mulga shrubland	
Ham –Hamilton	Plains on hardpan and granite with narrow, incised drainage lines	A12
Tin –Tindalarra	Very gently inclined wash plain with narrow saline drainage tracts	B11 C11
Wod –Woodline	Nearly level sandy surfaced plain over hardpan	A8 B7 C8
<b>Land Type 14.</b>	Wash plain and sandy tracts on hardpan, with Mulga and wanderrie grasses	
Yng –Yanganoo	Wash plain with concentrated drainage zones and sandy tracts	No quadrats established
<b>Land Type 17.</b>	Alluvial plain with saline soil and predominantly halophytic shrubland	
Ero –Ero	Tributary flood plain on hardpan	A7 B4 C6
<b>Land Type 18.</b>	Calcreted drainage plain with mixed halophytic and non-halophytic shrubland	
Cun –Cunyu	Calcrete platform, narrow drainage floor, and fringing wash plain	A2 B1 C1
Mil –Mileura	Calcrete platform and alluvial plain with saline soil	B6 B8
<b>Land Type 20.</b>	Salt lakes and fringing alluvial plain with halophytic shrubland	
Car –Carnegie	Salt lake with fringing alluvial plain, kopi dunes and sandy banks	A10 B9 C9

## Quadrats and land systems

It was considered most effective to set up permanent 20 x 20 metre quadrats and to sample them according to the methods of Bushland Plant Survey (Keighery 1994). This provided a method of collecting a larger range of species than might otherwise be obtained by opportunistic collections alone, when some, particularly very small ephemeral species, might be overlooked. The method of thorough sampling also provided a record of all Priority taxa present, some of which might have been missed by opportunistic sampling. It also provided a permanent record for specific sites which could be monitored in the future when the effects of reduced grazing might become more apparent. The size of quadrats was increased from the 10 x 10 metres recommended in Bushland Plant Survey which is designed for recording in the South West Botanical Province. The larger quadrat size, 20 x 20 metres, was required to record sufficient species in the more arid conditions of the Eremaean Botanical Province where plants are more widely spaced.

Quadrats were established in three types of plant community at each site, by selecting localities where a range of plant communities was present on one land system (Fig. 2). Six land types were sampled in this way, and ten land systems.

In September 1996, 28 quadrats were established. In 1997, 25 of the 28 quadrats were resampled during summer. In August 1997, all were resampled and 6 more quadrats were established. Another opportunity to collect further data arose in October 1998, when a third

Landscape Expedition combined astronomy and botany. The range of recording times from early to late spring and in summer increased the opportunity of finding a larger range of species in flower. On each visit the group worked in three teams, denoted as A, B or C. Quadrats completed by each were then numbered consecutively so that each quadrat had a unique name.

As a result 22 days were spent establishing quadrats, in resurvey and opportunistic collections. Thirty four quadrats were established over two years, 28 in 1996, and of these 25 were sampled four times and four three times. The six quadrats, which were established in 1997, were sampled twice.

As the terrain was not generally very rugged, most study locations were reached by vehicle along tracks, but two land types were not sampled by quadrat establishment, each of which has only one land system represented on the Station. Yanganoo is poorly represented, as is Challenge, which in addition is rugged and difficult to access. General botanical collection was undertaken at other localities apart from those where the quadrats were set up, and Challenge was sampled in this way, by traverse on foot.

## Quadrat recording

All quadrats were set up using an optical square to ensure correct corner angles and were permanently marked with four steel fence droppers. Position of each quadrat was recorded by using a global positional system (GPS) unit.

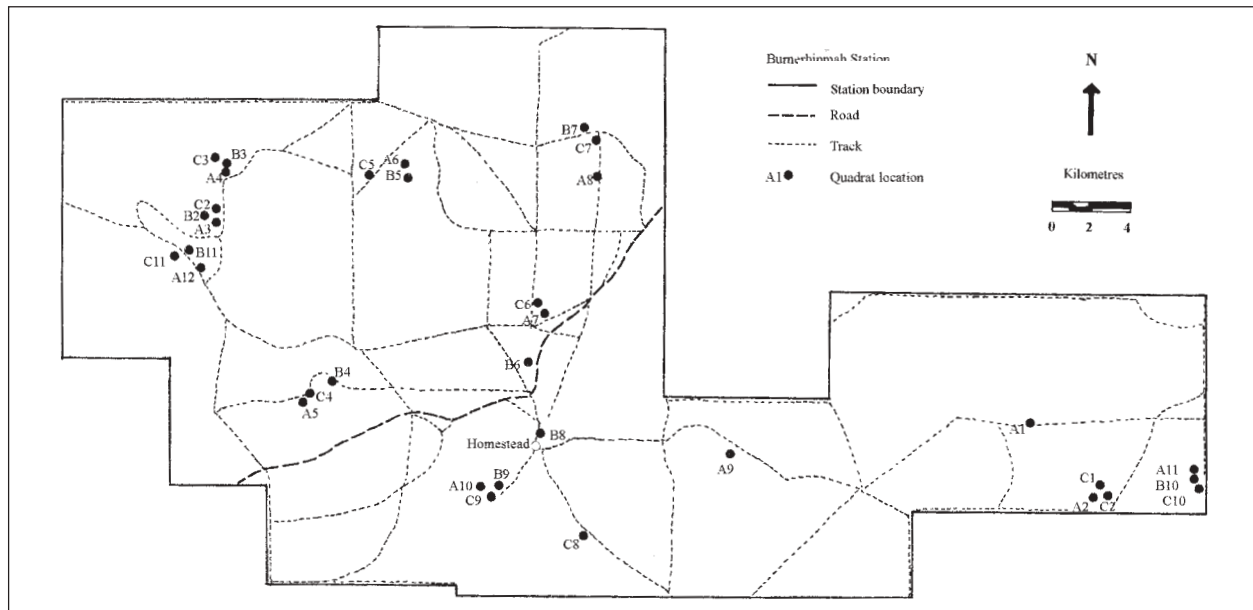


Figure 2. Study area showing location of survey sites.

Distance on ground from nearest landmark was also recorded. Photographic records were made at each visit using fixed points. During recording at each quadrat, lengths of rope were placed between the corner pegs to mark the boundaries, then removed at the conclusion of recording.

All taxa found flowering within each quadrat were collected as well as those from the surrounding area not represented within. Soil descriptions were recorded in 1998 by W.M. McArthur (unpublished), at all but two of the quadrats. Quadrat location, site data, vegetation structure (Muir 1977; Aplin 1979), cover and site condition were obtained, with a list of species for each stratum. At the end of each day specimens were pressed for later identification.

In addition, a manilla folder was used at each quadrat to fix a small piece of each species under plastic tape. After identification these specimens provide a quick reference so that on later visits only those species were collected that had not been found in flower previously.

Thirty nine further sites were sampled opportunistically.

The site and species classifications used the Czekanowski coefficient and 'unweighted pair-group mean average' fusion method (UPGMA; Sneath and Sokal 1973) using the PATN software package (Belbin 1993).

Nomenclature follows Paczkowska and Chapman (2000) and current usage at the Western Australian Herbarium (PERTH).

## RESULTS

A list of taxa (species, subspecies and varieties) for the station was compiled from the specimens collected on these expeditions. With the aid of three volunteers, 612 voucher specimens were added to the collections of the Western Australian Herbarium and a reference herbarium was

assembled for the station. The work also extends other monitoring programs in the region, and provides a data set for future assessment of grazing reduction on the vegetation.

## Floristic analysis

A total of 551 taxa was recorded on Burnerbinmah station. The list was compiled from taxa found within and near the 34 quadrats, from opportunistic collections and from confirmed records held in PERTH. Of these 494 (89.6%) were native and 57 introduced (Appendix 1).

The largest families represented were the Asteraceae (78 native taxa, 6 introduced), Chenopodiaceae (49 native taxa, 2 introduced) and Mimosaceae (32 taxa). Several other families were represented by large numbers of taxa (Table 2). The most common genera were *Acacia* (32 taxa), *Eremophila* (25 taxa), *Maireana* (14 taxa), *Ptilotus* (13 taxa) and *Rhodanthe* (12 taxa).

TABLE 2

Largest flora families represented on Burnerbinmah.

FAMILY	NO. OF NATIVE TAXA	NO. OF INTRODUCED TAXA
Asteraceae	78	6
Chenopodiaceae	49	2
Mimosaceae	32	0
Poaceae	31	14
Myoporaceae	25	0
Myrtaceae	22	0
Brassicaceae	10	7
Papilionaceae	15	1
Amaranthaceae	15	0
Goodeniaceae	14	0
Proteaceae	13	0
Cyperaceae	12	0
Solanaceae	11	1
Malvaceae	10	1
Aizoaceae	8	2

## Rare and Priority species

One of the aims of the work was to find Declared Rare and Priority taxa on the station. The decision to set up quadrats proved successful in that several very small, poorly known species listed as Priority taxa (Atkins 2001) were collected in the quadrats, and these may well have been overlooked had collecting been limited to opportunistic searches.

Nine priority taxa were found on the station (Table 3). For all except *Dicrasyllis linearifolia* these were the first records on conservation lands. Those for *Dicrasyllis linearifolia*, *Myriocephalus nudus* and *Goodenia neogoodenia* were south of their previously recorded ranges, whilst that of *Hyalosperma stoveae* extended its known range to the west, that of *Lepidium merrallii* to the north and that of *Myriocephalus nudus* to the south. *Gunniopsis rubra* was added to the Priority list in 1997 as Priority 1, after its discovery on the Station brought to attention its poorly known status. *Hyalosperma stoveae* was listed as Priority 1 in 1996, its discovery on Burnerbinmah was the fifth collection for the species, and the second in Western Australia. *Lepidium merrallii* was also listed as Priority 1 in 1996, the collection on Burnerbinmah station being the fifth collection for the species, and the first in the Geraldton District. *Phlegmatospermum drummondii* was gazetted as Rare when discovered here in 1997, but this discovery and a collection from north of Kalbarri in 1995 showed that this small, annual species was much more widespread than originally thought and it is now listed as Priority 3. *Goodenia pusilliflora* was listed as Priority 1 in 1996, but several recent collections, including five populations found on Burnerbinmah have resulted in its removal from the Priority List.

TABLE 3  
Priority Flora found during the survey indicating the number of populations located.

TAXON	PRIORITY LISTING	NO. OF POPULATIONS	QUADRATS
<i>Cryptandra imbricata</i>	3	4	B7, B10, C10
<i>Dicrasyllis linearifolia</i>	3	1	-
<i>Euryomyrtus patrickiae</i>	3	1	A3, C2
<i>Goodenia neogoodenia</i>	4	4	A7
<i>Gunniopsis rubra</i>	3	3	A1, B5, C5
<i>Hyalosperma stoveae</i>	2	1	B2, C8
<i>Lepidium merrallii</i>	2	1	-
<i>Myriocephalus nudus</i>	1	1	B4
<i>Phlegmatospermum drummondii</i>	3	1	A11

## Biogeographical plant occurrences of significance

The location of the station close to the boundary of the Eremaean and South-west Botanical Provinces is reflected in the large number of taxa which are represented on the station at or near the limit of their ranges in Western Australia (Appendix 1).

Forty eight taxa were found at or near the south-western limit of their known range and 11 taxa were found on the station as a south-western extension of their known range. Similarly, the records of 51 taxa were at or near the north-eastern limit of their range and those of 16 taxa were an extension of their range to the north-east. Nine taxa were at the northern limit of their range and six taxa were a northern extension of their range, whilst 20 taxa were at the southern limit of their range and six taxa were southerly extensions of their range. Only four taxa were at the easterly limit of their range, but 17 taxa were at the westerly limit of their range and three taxa were westerly extensions of their range. Records of three taxa were at the north-western limit of their range and those of five were an extension of their range to the north-west. However, the record of only one taxon was a range extension to the south-east. This was of *Paracaleana lyonsii* ms, previously known only from an area some 300 km to the north-west of Burnerbinmah, in the southern Carnarvon Basin.

The lack of previous botanical collections in the area is reflected by the large number of range extensions recorded, for 48 taxa, of which 10 are introduced taxa.

## Introduced species

Fifty six taxa of introduced plants were recorded on the station. Previous lack of collections of introduced taxa in this area is indicated by the large proportion which were found to be range extensions, 11 (23%) of the 48 range extensions, whereas of the total list recorded, only 10.3% were introduced taxa.

Eighteen of the 74 families included introduced taxa. Most of these were grasses, 14 of the 45 taxa of Poaceae being introduced. All nine taxa of Caryophyllaceae on Burnerbinmah were introduced. Asteraceae had the highest number of taxa recorded, 84, of which only 6 were introduced. Similarly, Brassicaceae was represented by 17 taxa of which 7 were introduced.

Of these introduced taxa, 15 were recorded only once. Several of these occurred here as extensions to the north west of their known ranges: *Micropterum papulosum*, *Brassica rapa*, *Hornungia procumbens*, *Raphanus raphanistrum*, *Silene nocturna*, *Spergula arvensis*, *Spergula pentandra*, *Chenopodium album*, *Plantago coronopus* subsp. *commutata* and *Zaluzianska divaricata*.

Twenty taxa were at or near the north-eastern limit of their known ranges. *Spergularia media* had not previously been recorded in Western Australia, *Elytrigia repens* was recorded for the second time, whilst *Alopecurus pratensis* and *A. geniculatus* had both been recorded only twice previously in W.A. *Spergularia salina* had been recorded previously only once in the Eremaean Botanical Region.

The introduced annual grass *Pentascistis airoides* occurred most frequently, and was recorded in 22 of the 34 quadrats. *Cuscuta epithymum*, a parasitic twining annual, occurred in 21 quadrats, another annual grass, *Rostraria pumila*, in 15 and a rosetted annual or perennial, *Hypochoeris glabra*, in 14.

*Pentaschistis airoides* is a common, widespread weed particularly on granite rocks, in woodlands, shrublands and on disturbed sites in the south west of the state, from Carnarvon to Kalgoorlie and Balladonia. Burnerbinmah is on the north-western edge of its known range. *Cuscuta epithymum* occurs from north of Kalbarri to Busselton with a few scattered records further inland. *Rostraria pumila* is a common weed of grazed semi-arid woodlands and shrublands from Shark Bay to Eucla. *Hypochaeris glabra* is a common weed of roadsides, agricultural areas and bushland throughout the South-West (Hussey et al. 1997) (Florabase, Western Australian Herbarium (1998).

Frequency of introduced species was lowest on sandy soils, none being recorded in quadrats B2 and C2, in the sedgeland of *Chrystrix distigmata* with *Triodia tomentosa* on yellowish red or reddish brown sand, on the western side of the station. A third quadrat in this sedgeland, A3, on brown sand, had 2% of introduced species. Two quadrats on a sand dune at the eastern end of the station, C10 and B10, on yellowish red fine sand, also had 2%, which was a similar level at B7 in Mulga shrubland on yellowish red sandy loam. A11 in the same area as C10 and B 10 had a higher level of weeds, 7%.

Quadrats in Mulga shrubland generally had lower levels of introduced species as did those around and on granite outcrops. Particularly high levels were recorded in all wet areas and above 20 % in a wash area by a claypan at Corrialgo Pool, in the bottom of the gorge and reaching 30% at A12 on a creekline.

## Vegetation

In the 34 quadrats established on Burnerbinmah Station, 460 taxa were recorded. For the floristic analysis, species occurring in only one quadrat were excluded. As a result the final data set consisted of 295 taxa in 34 sites, of which 132 were perennials. Species richness ranged from 35 to 79 taxa per site, with individual taxa occurring in two to 27 of the 34 sites. The high numbers of taxa recorded are a reflection of the repeated sampling of the quadrats during the spring months, August to October, when the highest numbers of annual species were present. The two-way table (Appendix 2) shows these taxa as 17 groups, A-Q. Taxa in species group L include a high number of annuals and grasses and this group is well represented in most of the community types for this reason.

The dendrogram shows the five major community types recognised in the analysis (Fig. 3) which also shows further subdivision to nine community types.

Community type 1 occurs on the shallow soils of c. pH 6 on rocky areas, breakaways and granite outcrops. Taxa in species group L are typical of community type 1, including *Acacia tetragonophylla*, *Ptilotus obovatus*, *P. gaudichaudii* and a wide range of annual herbs and grasses, including *Brachyscome ciliaris*, *B. ciliocarpa*, *Rhodanthe maryonii*, *Helipterum craspedioides*, *Velleia rosea*, *Pogonolepis muelleriana*, *Crassula colorata*, *Erodium cymorum*, *Pentaschistis airoides* and *Calandrinia eremaea*.

This community occurs largely on land type 4, primarily on the Sherwood land system, with one quadrat A4 at the base of a breakaway, on Waguin.

Community 1a was confined mainly to shallow soils of brown clay loam, sandy clay loam or light brown clay on weathered laterite and weathered granite surfaces. It was less species-rich than 1b, with an average of 49 species per quadrat, but also contained species from group N, including *Acacia aneura*, *A. ayersiana*, *Maireana georgei*, *M. glomerifolia*, *Micromyrtus sulphurea*, *Mirbelia rhagodioides*, *Philotheca brucei*, *Micropterum papulosum*, *Gunniopsis rubra* and *Levenhookia leptantha*.

Community 1b contained an average of 57 species per quadrat and occurs mainly on large granite outcrops on gritty, loamy sands of reddish brown or yellowish red over granite. Taxa in species groups I and J are typical of community 1b, these include: *Acacia acuminata*, *A. burkittii*, *A. quadrimarginea*, *Dodonaea inaequifolia*, *Malleostemon tuberculatus*, *Borya sphaerocephala*, *Goodenia berardiana*, *Tricoryne elatior*, *Caladenia incensa*, *Pterostylis* sp. inland, *Prasophyllum gracile* and *Drosera macrantha* ssp. *eremaea*.

Two quadrats which fall into this community type are atypical. They occurred on flat Mulga plain, with red sandy loam soil over hard pan. However, both had a similar number of species per quadrat, higher than other Mulga sites on the station, and were characterised by a species-rich understorey. C11 on shallow soil of 35 cm depth had 49 taxa, in tall shrubland with a rich representation of grasses and annual herbs. C8 on deeper soil had 56 taxa and had an open cover of shrubs over 1m, with a species rich understorey of shrubs under 1m tall, and of annual herbs and grasses. *Acacia aneura*, *Senna artemisioides* subsp. *filifolia*, *Maireana thesioides*, *Sida atrovirens* and *Monachather paradoxus* were species more typical of the community in these quadrats than in others of type 1 community. These two sites are on the western side of the station, which experiences a higher rainfall than the eastern side where the other Mulga sites were sampled and, presumably for this reason, have a more species-rich understorey.

Community type 2 is confined to Mulga shrubland on flat red, reddish brown, yellowish red sandy loams over hardpan with a pH of 6-6.5. The term 'Mulga' is used here to include not only *Acacia aneura* but other species in the complex, *A. ayersiana* and *A. minyura* (Pedley 2001).

The average species richness in community type 2 was 44 taxa per site. Taxa in species groups L, M and N are characteristic of this community type, including *Acacia aneura*, *A. ayersiana*, *A. minyura*, *A. ramulosa*, *Eremophila glandulifera* ms, *Ptilotus obovatus*, *Pentaschistis airoides*, *Monachather paradoxus*, *Rhodanthe maryonii*, *Brachyscome ciliocarpa*, *Waitzia acuminata*, *Goodenia occidentalis*, *Calandrinia eremaea* and *Crassula colorata*.

Quadrat A9 is an atypical site within type 2 including species group P, dominated by *Callitris glaucophylla* and *A. minyura* and including *Acacia exocarpoides*, *Santalum spicatum*, *Scaevola spinescens*, *Olearia pimeleoides*,

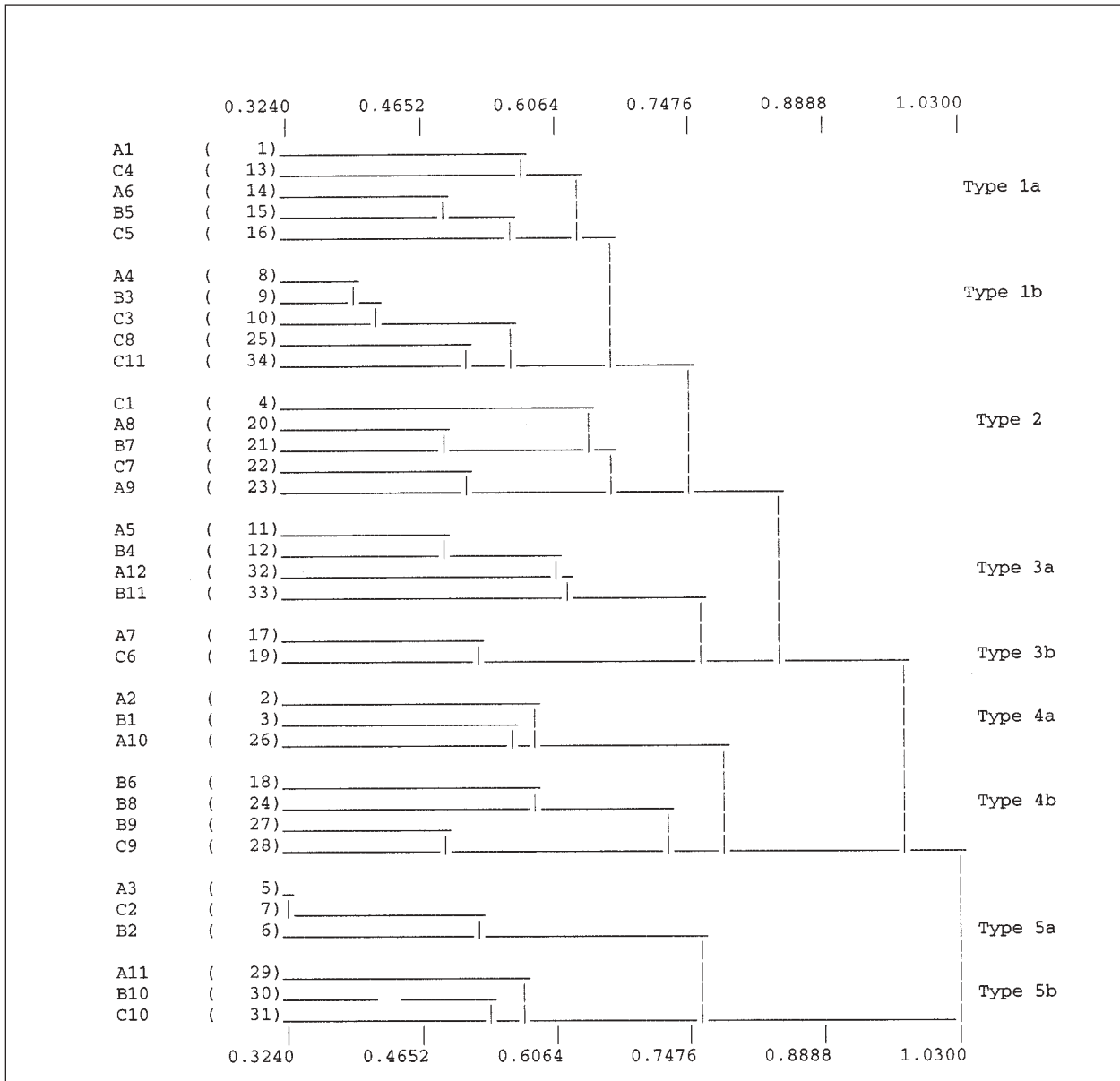


Figure 3. Dendrogram of the sites on Burnerbinmah Station showing the nine group level classification.

*Enchylaena tomentosa*, *Sclerolaena densiflora*, *Chenopodium gaudichaudianum*, *Maireana suaedifolia*, *Tetragonia cristata*, *Thysanotus manglesianus*, *Goodenia pusilliflora*, *Angianthus tomentosus*, *Gnephosis tenuissima* and *Plantago drummondii* which are not found in community type 2 apart from within this site. It is similar to other sites of this community in the good representation of species group M. It was more species rich, with 50 taxa, the other sites having a mean of 42.5 taxa. The soil was more acidic, a clayey fine sand, of pH 5.5.

Community type 3 occurs on wet areas and has a mean of 62 taxa per quadrat. It includes two subgroups, communities of wet drainage lines and of claypans. High numbers of introduced taxa are present in this community: *Sonchus oleraceus*, *Emex australis*, *Anagallis arvensis*, *Erodium cicutarium*, *Hordeum glaucum*, *Centaurea*

*melitensis*, *Silene gallica*, *Pentastichis airoides*, *Cuscuta epithymum* and *Hypochaeris glabra* being represented in both subcommunities. Some introduced taxa were found only in the communities of drainage lines, *Polycarpon tetraphyllum*, *Avena fatua* and *Osteospermum clandestinum*. Others, including *Acetosa vesicaria*, *Sisymbrium erysimoides* and *Spergularia rubra*, were found mainly around claypans.

Community type 3 species as a whole is characterised by shrubland with *Acacia tetragonophylla*, *Exocarpos aphyllus*, *Dodonaea viscosa* and *Pittosporum phylliracoides* over *Ptilotus obovatus*, and a number of annual species found in species group L, *Rhodanthe maryonii*, *Brachyscome ciliocarpa*, *Crassula colorata*, *Calotis multicaulis*, *Helipterum craspedioides*, *Velleia rosea*, *Calotis hispidula*, *Cephalopterum drummondii*.

Community type 3a occurs on drainage lines on brown gritty sand, of pH 6.5 where recorded. It includes species groups B, I and L, including *Solanum lasiophyllum*, *Atriplex semilunaris*, *Cyperus gymnocaulos*, *Eriachne pulchella*, *Wahlenbergia gracilentia*, *Nicotiana occidentalis* subsp. *hesperis*, *Calandrinia ptychosperma*, *Haloragis trigonocarpa* and *Trachymene ornata*.

Community type 3b around claypans on reddish brown sandy loam over clay of pH 9 includes taxa in species group C, D and F. The community has open shrubland with *Acacia victoriae*, *A. tysonii*, *Exocarpos aphyllus*, *Melaleuca uncinata*, *Scaevola spinescens*, *Senna artemisioides* subsp. *filifolia*, *Rhagodia eremaea*, *Solanum orbiculatum*, *Pimelea microcephala*, *Maireana pyramidata*, *Atriplex amnicola*, *Eremophila maculata*, *Bergia perennis* subsp. *exigua*, *Marsilea drummondii* and many annuals, *Spergularia rubra*, *Plagiobothrys plurisepalus*, *Brachyscome lineariloba*, *Agrostis avenacea*, *Peplidium* sp. C, *Ranunculus pentandrus*, *Rhodanthe propinqua*, *R. stricta* and *Schoenia cassiniana*.

Community type 4 occurs on yellowish red sandy or clayey loams with a high pH of 8.5-9.5, sometimes associated with calcrete or gypsum. The vegetation is generally more salt tolerant than that of community 3 and is associated with the main drainage channels of Mongers Lake. The sites had a mean of 44 taxa. It separates into two groups: type 4a on low rises around lakes and type 4b on the flats of drainage zones.

Community type 4a has a very open shrub storey with a rich assemblage of annual herbs and grasses. Species groups A, E, F and L were well represented in this community. Perennial species include *Eremophila pantonii*, *Eriochiton sclerolaenoides*, *Zygophyllum fruticosum*, *Enchylaena tomentosa*, *Senna artemisioides* subsp. *filifolia*, *Ptilotus divaricatus*, *Sclerolaena densiflora*, *Abutilon malvifolium* and *Ptilotus obovatus*. Annual species include *Ptilotus exaltatus*, *Bromus arenarius*, *Brachyscome ciliaris*, *Goodenia mimuloides*, *Erodium cygnorum*, *Cephalopterum drummondii*, *Angianthus tomentosus* and *Euphorbia drummondii*.

In community type 4b *Acacia victoriae*, *A. tysonii*, *Maireana trichoptera*, *Zygophyllum compressum*, *Z. auranticum*, *Frankenia fecunda*, *Solanum orbiculatum*, *Rhagodia preissii*, *Didymanthus roei*, *Halosarcia halocnemoides*, *H. indica* subsp. *bidens*, *H. pterygosperma* subsp. *denticulata* and *Sclerostegia tenuis* were more typical of the perennial species, including species of group Q.

Community type 5 occurs on sand plains and dunes and had a mean of 39 taxa per quadrat. Perennial species of this community type include *Acacia ramulosa*, *A. jamesiana*, *Micromyrtus flaviflora*, *Aluta aspera*, *Amphipogon caricinus*, *Stylidium induratum*, *Brunonia australis* and *Thysanotus manglesianus*. Common annual species include *Erodium cygnorum*, *Goodenia occidentalis*, *Lawrencella davenportii*, *Velleia hispida*, *Bellida graminea* and *Gnephosis tenuissima*. The community divides into two subgroups. Type 5a, on the western side of the station grows on gentle sloping areas, of loose brown, reddish brown or yellowish red sand over clayey sand over hard

pan with pH 5.5. Species in group O largely define this type. It has perennial species including *Acacia coolgardiensis* subsp. *coolgardiensis*, over *Anthotroche pannosa*, *Euryomyrtus patrickiae*, *Keraudrenia integrifolia*, *Euryomyrtus maidenii*, *Chrysitrix distigmata*, *Triodia tomentosa* and *Thysanotus rectantherus*.

Type 5b occurs on the eastern side of the station, on reddish brown to yellowish red fine sand over hardpan with pH 5.5-7. In this area the sand forms dunes. Perennial species of this community are mainly in species group P. Typical species include *Eucalyptus hypochlamydia*, *Callitris glaucophylla*, *Acacia ligulata*, *Bossiaea walkeri*, *Cryptandra imbricata*, *Rhagodia preissii*, *Triodia rigidissima*, *Ptilotus obovatus* and *Solanum lasiophyllum*.

## DISCUSSION

*Acacia* species occurred in 10 of the 17 species groups. They occurred most frequently on the shallow soils of granites and breakaways and in Mulga shrubland on sandplains and dunes. They also occurred less frequently on drainage lines and claypans, but were less frequent or absent on saline soils.

The current list of 551 taxa recorded for the station has improved knowledge of the Yalgoo and Murchison Bioregions. Asteraceae, Chenopodiaceae and Mimosaceae were the largest families represented and *Acacia* was the most common genus. This reflects the predominance of Mulga and mixed *Acacia* shrubland across the station, with halophytic shrubland on saline soils.

The results of the work on priority taxa shows the lack of previous botanical survey in the area. None had been found before on the station. Six of the nine taxa found are small annual species. Two of these were found at more than one locality on the station and they are all relatively widespread in their distribution, but poorly collected. The three shrub species are also relatively widespread in distribution and one was found at more than one locality on the station. Three of the species found were downgraded in their priority status as a result of the work, which has also resulted in removal of a tenth, *Goodenia pusilliflora*, from the Priority list.

The high number of records of biogeographical significance indicates not only the position of the station near the boundary of the Eremaean and South-West Botanical Provinces, but also the lack of previous plant collections in this area, of both native and introduced species.

The number of weeds recorded for the area was higher at 10.3% of the total list than that of 4.1% found during flora and vegetation studies of the southern Carnarvon Basin (Keighery *et al.* 2000). However, the same families—Poaceae, Caryophyllaceae, Brassicaceae and Asteraceae—had the highest number of weed species and, similarly, the highest levels were found in wet areas along creek lines and around claypans.



The community groups of the study area correlate well with substrate and topographical positions. Briefly, community type 1 occurred on shallow soils of rocky areas, large granite exposures and breakaways and was species-rich.

Community type 2 was less species-rich, occurring on sandy loams over hardpan in Mulga shrubland. Two of the quadrats in Mulga shrubland were more species rich, occurring on the wetter western side of the station and were more closely allied with community type 1.

Community types 3 and 4 both occurred in damp areas. Type 3 included freshwater creekline and claypan communities and was very species-rich, whilst type 4 had fewer species and included claypan communities and sites around Mongers Lake on more saline soils.

Community type 5 occurred on red/brown sands, and was the least species-rich. *Triodia* species are part of the community, which occurs both on the eastern and western sides of the station, but this separation results in two sub communities.

Thorough sampling within quadrats provided information on many small, poorly collected plants which might have been overlooked during general collecting. This method of sampling also increased the number of Priority taxa that were found during the survey, as six of the nine species were small and may not otherwise have been found.

The four visits at different seasons produced significant numbers of new records, with plants in flower at each visit which had not been identified previously.

A comparison of the five major community groups identified in the study, with the land types and component land systems defined by Payne *et al.* (1998) is shown in

Table 4. The quadrats covered six of the eight land types represented on the station and ten of the twelve component land systems. The five major community types were represented by between one and four of the six land types. Community types four and five gave best correlation with the ten land systems. This classification also describes fifty major habitat types split into ten habitat groups. The other three community types showed better correlation on comparison with the ten habitat groups and component thirty four major habitat types represented on the station.

## ACKNOWLEDGMENTS

The following people are thanked for assistance. Identifications were made in their particular field of expertise by Bruce Maslin, Barbara Rye, Malcolm Trudgen, Stan Webster and Paul Wilson, whilst Neil Gibson undertook the site and species classifications. Bill MacArthur recorded the soil descriptions.

Daphne Edinger and Steve Toole were co-leaders of the Landscape Expeditions. Gilbert Marsh was a team leader on two expeditions and completed a major part of the identification work with Daphne Edinger at the Western Australian Herbarium, where Rosslyn Pavy processed the specimens. Twenty nine Landscape expeditioners took part in the work, which would not otherwise have been possible. Thirty three members of the Western Australian Naturalists Club, using their own resources, helped complete sampling during summer, when a Landscape Expedition was not feasible.

The former lessees, Don and Rhonda Anderson, living at the homestead as manager/caretakers, provided much advice from their extensive knowledge of the area.

TABLE 4

Comparison of the five major community types identified in the study with the land types and component land systems defined by Payne *et al.* (1998).

LAND TYPE/ LAND SYSTEM	SITE GROUPS				
	1	2	3	4	5
<b>Mulga shrublands and halophytic shrublands on breakaways, stony and sandy surfaced plains on granite</b>					
Sherwood	7		1		
Waguin	1	1			
<b>Grassy Acacia shrublands on sandplains</b>					
Kalli		1			6
<b>Mulga shrublands on wash plains on hardpan</b>					
Hamilton			1		
Tindalarra	1		1		
Woodline	1	2			
<b>Halophytic shrublands on alluvial plains with saline soils</b>					
Ero			3		
<b>Mixed halophytic and non-halophytic shrublands on calcreted drainage plains</b>					
Cunyu		1		2	
Mileura				2	
<b>Halophytic shrublands around saltlakes and fringing alluvial plains</b>					
Carnegie				3	

## REFERENCES

- Atkins, K.J. (2001). *Declared Rare and Priority Flora List for Western Australia*. Department of Conservation and Land Management, Perth.
- Aplin, T.E.H. (1979). The Flora. In *Environment and Science* (B.J.O'Brien, ed.), p. 67. University of Western Australia Press, Nedlands.
- Baxter, J.L., Lipple, S.L. and Marston, R.J. (1983). *Kirkalocka, Western Australia: 1:250 000 Geological Series, Explanatory Notes*. Geological Survey of Western Australia, Perth.
- Beard, J.S. (1976). *Vegetation Survey of Western Australia: Murchison: 1:1 000 000 Vegetation Series*. University of Western Australia Press, Nedlands.
- Beard, J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst.
- Belbin, L. (1993). *PATN: Pattern Analysis Package*. CSIRO Division of Wildlife and Ecology, Canberra.
- Brand, J.E. (1999). Ecology of Sandalwood (*Santalum spicatum*) near Paynes Find and Menzies, Western Australia: size structure and dry-sided stems. *Rangeland Journal* **21**, 220-228.
- Davies, S.J.J.F. (1970). *A List of Plants and Animals found at Mileura, Western Australia Lat. 26°22'S, Long. 117°20'E*. Division of Wildlife Research Technical Memorandum no. 3. CSIRO, Canberra.
- Green, J.W. (1985). *Census of the Vascular Plants of Western Australia*. Department of Agriculture, Perth.
- Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). *Western Weeds: a Guide to the Weeds of Western Australia*. The Plant Protection Society of Western Australia, Victoria Park.
- Keighery, B. (1994). *Bushland Plant Survey. A Guide to Plant Community Survey for the Community*. Wildflower Society of Western Australia, Nedlands.
- Keighery, G.J., Gibson, N., Lyons, M.N. and Burbidge, A.H. (2000). Flora and vegetation of the southern Carnarvon Basin, Western Australia. In *Biodiversity of the southern Carnarvon Basin* (A.H. Burbidge, M.S. Harvey and N.L. McKenzie, eds), pp. 79-139. *Records of the Western Australian Museum* Supplement **61**, 77-154.
- Kenneally, K.F. (1968). An annotated list of angiosperms of Lakeside Station, Cue, Western Australia. *The Western Australian Naturalist* **10**, 182-189.
- Mitchell, A.A. and Wilcox, D.G. (1994). *Arid Shrubland Plants of Western Australia*, 2<sup>nd</sup> edn. University of Western Australia Press, Nedlands, and Department of Agriculture, Western Australia.
- Muir, B.G. (1977). *Biological Survey of the Western Australian Wheatbelt, part 2, Vegetation and Habitat of Bendering Reserve. Records of the Western Australian Museum, Supplement 3*.
- Munsell Color Co. (1954). *Soil Color Charts*. Munsell Color Co., Baltimore.
- Northcote, K.H. (1971). *A Factual Key for the Recognition of Australian Soils*. Rellim, Adelaide.
- Paczkowska, G. and Chapman, A.R. (2000). *The Western Australian Flora: a Descriptive Catalogue*. Wildflower Society of Western Australia, Nedlands, Western Australian Herbarium, CALM, [Perth], and Botanic Gardens & Parks Authority, [West Perth].
- Patrick, S.J., Brand, J. and Meinema, M. (1997/8). Murchison Haven. *Landscape* **13** (2), 42-48.
- Payne, A.L., Van Vreeswyk, A.M.E., Pringle, H.J.R., Leighton, K.A. and Hennig, P. (1998). *An Inventory and Condition Survey of the Sandstone-Yalgoo-Paynes Find area, Western Australia*. Technical Bulletin no. 90. Agriculture Western Australia, South Perth.
- Pedley, L. (2001). *Acacia aneura*. In *Flora of Australia*, vol. 11B, *Mimosaceae, Acacia part 2* (A.E. Orchard and A.J.G. Wilson, eds), pp. 314-322. Australian Biological Resources Study, Canberra, and CSIRO Publishing, Melbourne.
- Sneath, P.H.A. and Sokal, R.R. (1973). *Numerical Taxonomy: the Principles and Practice of Numerical Classification*. Freeman, San Francisco.
- Thackway, R. and Cresswell, I.D. (eds) (1995). *An Interim Biogeographical Regionalisation for Australia: a Framework for establishing the National System of Reserves*, version 4.0. Australian Nature Conservation Agency, Canberra.
- Western Australian Herbarium (1998). *Florabase: Information on the Western Australian flora*. Department of Conservation and Land Management, Perth <http://www.calm.wa.gov.au/science/florabase.html> (accessed 2001).

## APPENDIX 1

## Flora list for Burnerbinmah Station

This list includes all taxa from the sampling quadrats, the opportunistic collections and unconfirmed records from the Western Australian Herbarium (PERTH). Nomenclature follows Paczkowska and Chapman (2000) and current usage at PERTH.

(ms denotes a manuscript name, \* indicates an introduced taxon).

**Family: Adiantaceae**

*Cheilanthes adiantoides* poorly collected, 2<sup>nd</sup> record for W.A.

*Cheilanthes austrotenuifolia*  
*Cheilanthes lasiophylla*  
*Cheilanthes sieberi* subsp. *sieberi*

**Family: Aizoaceae**

*Gunniopsis quadrifida*  
*Gunniopsis rodwayi*  
*Gunniopsis rubra*

Priority 3 species, north-eastern limit of range

*Gunniopsis septifraga*  
\**Mesembryanthemum nodiflorum*

northern limit of main range

\**Micropterum papulosum*

northern extension of range

*Tetragonia cristata*  
*Tetragonia eremaea*  
*Tetragonia moorei*

southern limit of range  
western range extension  
poorly collected, western range extension

*Tetragonia tetragonioides*

north-western range extension

**Family: Amaranthaceae**

*Alternanthera nodiflora*  
*Gomphrena* sp. 'Belele' (D.W.Goodall 3215)  
*Ptilotus chamaecladus*

poorly collected

*Ptilotus divaricatus*  
*Ptilotus drummondii*  
*Ptilotus exaltatus*  
*Ptilotus exaltatus* var. *villosus*  
*Ptilotus gaudichaudii*  
*Ptilotus gomphrenoides*

south-western limit of main range

southern extension of range

*Ptilotus grandiflorus* var. *grandiflorus*  
*Ptilotus macrocephalus*

near southern limit of range

*Ptilotus obovatus*  
*Ptilotus polystachyus*

south-western extension of range

*Ptilotus schwartzii*  
*Ptilotus* sp. S.Patrick 2787

undescribed species

**Family: Anthericaceae**

*Arthropodium curvipes*

north-eastern range extension

*Arthropodium dyeri*  
*Dichopogon capillipes*

north-eastern limit of range

*Laxmannia arida*

western limit of range

*Thysanotus manglesianus*  
*Thysanotus pyramidalis*  
*Thysanotus rectantherus*

north-eastern limit of range

*Tricoryne elatior*

north-eastern range extension

**Family: Apiaceae**

*Daucus glochidiatus*  
*Hydrocotyle pilifera* var. *glabrata*

near northern limit of range

*Trachymene ceratocarpa*  
*Trachymene cyanopetala*  
*Trachymene ornata*  
*Trachymene pilosa*

north-eastern limit of range

**Family: Asclepidaceae**

*Marsdenia australis*

south-western limit of range

*Rhyncharrhena linearis*

**Family: Asphodelaceae**

*Bulbine semibarbata*

**Family: Asteraceae**

*Actinobole uliginosum*  
*Angianthus tomentosus*  
\**Arctotheca calendula*

north-eastern limit of range

*Asteridea atrixioides*  
*Bellida graminea*  
*Brachyscome cheilocarpa*  
*Brachyscome ciliaris*  
*Brachyscome ciliolepis*  
*Brachyscome lineariloba*  
*Brachyscome perpusilla*  
*Brachyscome pusilla*  
*Calocephalus ?knappii*  
*Calocephalus multiflorus*  
*Calotis hispidula*  
*Calotis multicaulis*  
\**Centaurea melitensis*  
*Cephalopterum drummondii*  
*Ceratogyne obionoides*  
*Chthonocephalus pseudevax*  
\**Cotula bipinnata*

northern limit of range  
southern limit of range

north-eastern limit of range  
near north-eastern limit of range

*Cotula cotuloides*

*Cratystylis subspinescens*  
*Dielitzia tysonii*  
*Erymophyllum ramosum*  
*Gilberta tenuifolia*  
*Gilruthia osbornei*  
*Gnephosis angianthoides*

near north-eastern limit of range  
near southern limit of range

*Gnephosis arachnoidea*

*Gnephosis brevifolia*  
*Gnephosis tenuissima*  
*Helipterum craspedioides*

near south-western limit of range

*Hyalochlamys globifera*

north-eastern limit of range

*Hyalosperma glutinosum* subsp. *venustum*

*Hyalosperma glutinosum* subsp. *glutinosum*

north-eastern limit of main range

## APPENDIX 1 (continued)

<i>Hyalosperma stoveae</i>	Priority 2 species, 5 <sup>th</sup> collection, 2 <sup>nd</sup> in W.A.	<b>Family: Boryaceae</b> <i>Borya sphaerocephala</i>	north-eastern limit of range
* <i>Hypochoeris glabra</i>	near north-eastern limit of range	<b>Family: Brassicaceae</b> * <i>Brassica rapa</i>	near north-eastern limit of range
<i>Isoetopsis graminifolia</i>	near western limit of range	* <i>Brassica tournefortii</i> <i>Harmsiodoxa brevipes</i>	poorly collected, north-eastern limit of range
<i>Kippistia suaedifolia</i>	western limit of range	* <i>Hornungia procumbens</i>	north-eastern extension of range
<i>Lawrencella davenportii</i>		<i>Lepidium merrallii</i>	Priority 2 species, 3 <sup>rd</sup> collection in W.A., north-eastern extension of range
<i>Lawrencella rosea</i>		<i>Lepidium muelleri-ferdinandii</i>	near south-western limit of range
<i>Lemooria burkittii</i>	near south-western limit of range	<i>Lepidium oxytrichum</i>	near south-western limit of range
<i>Millotia myosotidifolia</i>		<i>Lepidium phlebopetalum</i>	
<i>Millotia perpusilla</i>		<i>Menkea australis</i>	
<i>Minuria cunninghamii</i>		<i>Phlegmatospermum drummondii</i>	Priority 3 species, 6 <sup>th</sup> collection, north-eastern limit of range
<i>Myriocephalus guerinae</i>	Priority 1 species, 5 <sup>th</sup> collection.	* <i>Raphanus raphanistrum</i>	north-eastern extension of range
<i>Myriocephalus nudus</i>		* <i>Sisymbrium erysimoides</i> * <i>Sisymbrium irio</i> * <i>Sisymbrium orientale</i> <i>Stenopetalum anfractum</i>	near south-western limit of range
<i>Myriocephalus oldfieldii</i> ms		<i>Stenopetalum filifolium</i>	
<i>Myriocephalus pygmaeus</i>	near south-western limit of range	<i>Stenopetalum lineare</i>	near western limit of range
<i>Myriocephalus rudallii</i>		<b>Family: Caesalpiniaceae</b> <i>Senna artemisioides</i> subsp. <i>filifolia</i> <i>Senna artemisioides</i> subsp. <i>petiolaris</i> <i>Senna</i> sp. 'Austin' (A.Strid 20210)	
<i>Olearia pimeleoides</i>		<b>Family: Campanulaceae</b> <i>Wahlenbergia communis</i> <i>Wahlenbergia gracilentia</i> <i>Wahlenbergia preissii</i>	north-eastern limit of range
* <i>Osteospermum clandestinum</i>	near north-eastern limit of range	<i>Wahlenbergia tumidifruca</i>	
<i>Pluchea dentex</i>	southern limit of main range	<b>Family: Caryophyllaceae</b> * <i>Polycarpon tetraphyllum</i>	near north-eastern limit of range
<i>Podolepis canescens</i>		* <i>Silene gallica</i> var. <i>gallica</i>	near north-eastern limit of range
<i>Podolepis capillaris</i>		* <i>Silene nocturna</i>	north-eastern extension of range
<i>Podolepis kendallii</i>		* <i>Spergula arvensis</i>	north-eastern extension of range
<i>Podolepis lessonii</i>		* <i>Spergula pentandra</i>	north-eastern extension of range
<i>Podotheca gnaphalioides</i>		* <i>Spergularia diandra</i> * <i>Spergularia media</i> * <i>Spergularia rubra</i> * <i>Spergularia salina</i>	1 <sup>st</sup> record for W.A.
<i>Pogonolepis muelleriana</i>		<b>Family: Casuarinaceae</b> <i>Casuarina obesa</i>	
<i>Pogonolepis stricta</i>		<b>Family: Centrolepidaceae</b> <i>Centrolepis eremica</i> <i>Centrolepis polygyna</i>	north-eastern extension of range
<i>Quinqueremulus linearis</i>	near southern limit of range		
<i>Rhodanthe battii</i>			
<i>Rhodanthe chlorocephala</i> subsp. <i>splendida</i>			
<i>Rhodanthe citrina</i>			
<i>Rhodanthe haigii</i>	near western limit of range		
<i>Rhodanthe heterantha</i>	northern extension of range		
<i>Rhodanthe humboldtiana</i>	near southern limit of range		
<i>Rhodanthe laevis</i>			
<i>Rhodanthe maryonii</i>			
<i>Rhodanthe polycephala</i>	near north-eastern limit of range		
<i>Rhodanthe propinqua</i>	near south-western limit of range		
<i>Rhodanthe pygmaea</i>			
<i>Rhodanthe stricta</i>			
<i>Schoenia cassiniana</i>			
<i>Senecio glossanthus</i>			
<i>Siloxerus multiflorus</i>	near north-eastern limit of range		
* <i>Sonchus oleraceus</i>			
<i>Sondottia connata</i>			
<i>Streptoglossa cylindriceps</i>	south-western limit of range		
<i>Tietkensia corrickiae</i>	south-western extension of range		
<i>Trichanthodium exile</i>			
<i>Trichanthodium skirrophorum</i>			
<i>Triptilodiscus pygmaeus</i>	near western limit of range		
<i>Waitzia acuminata</i>			
<i>Waitzia nitida</i>			
<b>Family: Boraginaceae</b> <i>Omphalolappula concava</i> <i>Plagiobothrys plurisepalus</i>	2 <sup>nd</sup> collection in WA Herbarium		

## APPENDIX 1 (continued)

**Family: Chenopodiaceae**

<i>Atriplex amnicola</i>	
<i>Atriplex bunburyana</i>	
<i>Atriplex codonocarpa</i>	
<i>Atriplex holocarpa</i>	
<i>Atriplex semilunaris</i>	
<i>Atriplex vesicaria</i>	
* <i>Chenopodium album</i>	northern extension of range
<i>Chenopodium curvispicatum</i>	south-western limit of range
<i>Chenopodium gaudichaudianum</i>	near southern limit of range
<i>Chenopodium melanocarpum</i>	
* <i>Chenopodium murale</i>	
<i>Chenopodium saxatile</i>	south-western extension of range
<i>Didymanthus roei</i>	
<i>Dysphania glandulosa</i>	south-western extension of range
<i>Einadia nutans</i>	south-western extension of range
<i>Enchylaena lanata</i>	north-eastern limit of range
<i>Enchylaena tomentosa</i>	
<i>Eriochiton sclerolaenoides</i>	
<i>Halosarcia fimbriata</i>	
<i>Halosarcia halocnemoides</i>	undescribed subspecies
<i>Halosarcia indica</i> subsp. <i>bidens</i>	
<i>Halosarcia pterygosperma</i>	
<i>Halosarcia pterygosperma</i> subsp. <i>denticulata</i>	southern extension of range from Shark Bay
<i>Halosarcia syncarpa</i>	north-eastern limit of range
<i>Maireana amoena</i>	
<i>Maireana carnososa</i>	
<i>Maireana convexa</i>	near south-western limit of range
<i>Maireana diffusa</i>	northern extension of range
<i>Maireana georgei</i>	south-western limit of main range
<i>Maireana glomerifolia</i>	
<i>Maireana planifolia</i>	
<i>Maireana planifolia</i> x <i>villosa</i>	
<i>Maireana pyramidata</i>	
<i>Maireana suaedifolia</i>	western limit of range
<i>Maireana thesioides</i>	
<i>Maireana trichoptera</i>	
<i>Maireana triptera</i>	
<i>Maireana villosa</i>	near southern limit of range
<i>Rhagodia drummondii</i>	
<i>Rhagodia eremaea</i>	south-western limit of range
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	
<i>Salsola tragus</i>	
<i>Sclerolaena burbidgeae</i>	
<i>Sclerolaena densiflora</i>	near south-western limit of range
<i>Sclerolaena diacantha</i>	
<i>Sclerolaena eriacantha</i>	south-western range extension
<i>Sclerolaena eurotioides</i>	
<i>Sclerolaena gardneri</i>	
<i>Sclerolaena lanicuspis</i>	near southern limit of range
<i>Sclerolaena uniflora</i>	
<i>Sclerostegia moniliformis</i>	north-western extension of range
<i>Sclerostegia tenuis</i>	poorly collected, north-western extension of range

**Family: Chloanthaceae**

<i>Dicrastylis linearifolia</i>	Priority 3 species, southern extension of range
<i>Spartothamnella teucriflora</i>	south-western extension of range

**Family: Colchicaceae**

*Wurmbea ?densiflora*

**Family: Convolvulaceae**

*Convolvulus erubescens*  
*Convolvulus remotus*  
*Porana ?sericea*

**Family: Crassulaceae**

*Crassula colorata*  
*Crassula colorata* var. *acuminata*  
*Crassula exserta* northern limit of range

**Family: Cupressaceae**

*Callitris glaucophylla*

**Family: Cuscutaceae**

\**Cuscuta epithymum*

**Family: Cyperaceae**

*Chrysitrix distigmatosa* north-eastern limit of range

*Cyperus alterniflorus*  
*Cyperus gymnocaulos*  
*Cyperus rigidellus* near southern limit of range

*Cyperus squarrosus* south-western limit of range

*Cyperus vaginatus*  
*Isolepis congrua*  
*Lepidosperma* sp.  
*Schoenus humilis*  
*Schoenus nanus* north-eastern limit of range

*Schoenus subaphyllus*  
*Schoenus variicellae*

**Family: Droseraceae**

*Drosera bulbosa* subsp. *major* poorly recorded, 3<sup>rd</sup> record for W.A.

*Drosera indica* south-western range extension

*Drosera macrantha* subsp. *eremaea* poorly recorded

**Family: Elatinaceae**

*Bergia perennis* subsp. *exigua* southern limit of range

**Family: Epacridaceae**

*Leucopogon* sp. 'Clyde Hill' (M.A.Burgman 1207) north western limit of range

**Family: Euphorbiaceae**

*Euphorbia drummondii*  
*Euphorbia ?tannensis* subsp. *eremophila* near south-western limit of range

*Pseudanthus intricatus* ms  
*Stachystemon* sp.

**Family: Frankeniaceae**

*Frankenia fecunda*  
*Frankenia ?glomerata*

*Frankenia interioris* var. *parviflora* Priority 1 species, bridges range between north and south-west north-western extension of range

## APPENDIX 1 (continued)

<i>Frankenia laxiflora</i>			<b>Family: Lamiaceae</b>	
<i>Frankenia pauciflora</i>			<i>Hemigenia</i> sp. 'Edah' (J.W.Green 1601)	
<i>Frankenia sessilis</i>	near western limit of range		<i>Hemigenia</i> sp. 'Paynes Find' (A.C.Beaglehole 49138)	
			<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>	
<i>Frankenia setosa</i>			<i>Prostanthera patens</i>	eastern limit of range
<b>Family: Gentianaceae</b>				
<i>Centaurium clementii</i>	southern extension of range		<b>Family: Lobeliaceae</b>	
			<i>Isotoma petraea</i>	
<b>Family: Geraniaceae</b>			<i>Lobelia heterophylla</i>	
* <i>Erodium aureum</i>			<i>Lobelia winfridae</i>	
* <i>Erodium cicutarium</i>	near north-eastern limit of range			
<i>Erodium cygnorum</i>			<b>Family: Loranthaceae</b>	
			<i>Amyema fitzgeraldii</i>	near southern limit of range
<b>Family: Goodeniaceae</b>			<i>Amyema nestor</i>	
<i>Brunonia australis</i>			<i>Lysiana casuarinae</i>	
<i>Dampiera roycei</i>	western limit of range			
<i>Goodenia berardiana</i>			<b>Family: Malvaceae</b>	
<i>Goodenia havilandii</i>			<i>Abutilon cryptopetalum</i>	south-western limit of range
<i>Goodenia mimuloides</i>	Priority 4 species, southern extension of range		<i>Abutilon malvifolium</i>	5 <sup>th</sup> record for W.A., south-western limit of range
<i>Goodenia neogoodenia</i>			<i>Abutilon oxycarpum</i>	south-western limit of range
<i>Goodenia occidentalis</i>			<i>Alyogyne pinoniana</i>	
<i>Goodenia pinnatifida</i>			<i>Lawrencia glomerata</i>	
<i>Goodenia pusilliflora</i>	northern limit of range		<i>Lawrencia helmsii</i>	south-western limit of range
<i>Scaevola chrysopogon</i> × <i>restiacea</i>				
<i>Scaevola spinescens</i>			* <i>Malva parviflora</i>	
<i>Velleia glabrata</i>	south-western limit of range		<i>Sida atrovirens</i> ms	
<i>Velleia hispida</i>	south-western limit of range		<i>Sida calyxhymenia</i>	
<i>Velleia rosea</i>			<i>Sida fibulifera</i>	
			<i>Sida ?intricata</i>	poorly collected
<b>Family: Gyrostemonaceae</b>				
<i>Gyrostemon ramulosus</i>			<b>Family: Marsileaceae</b>	
			<i>Marsilea drummondii</i>	
<b>Family: Haloragaceae</b>				
<i>Gonocarpus nodulosus</i>			<b>Family: Mimosaceae</b>	
<i>Haloragis odontocarpa</i>	near south-western limit of range		<i>Acacia acuminata</i>	north-eastern limit of main range
<i>Haloragis trigonocarpa</i>	near south-western limit of range		<i>Acacia acuminata</i> subsp. <i>acuminata</i>	north-eastern limit of main range
<i>Myriophyllum decussatum</i>	near southern limit of range		<i>Acacia aneura</i>	near south-western limit of range
			<i>Acacia aneura</i> × <i>craspedocarpa</i>	
<b>Family: Hydrocharitaceae</b>			<i>Acacia assimilis</i> subsp. <i>assimilis</i>	north-eastern limit of range
<i>Ottelia ovalifolia</i>	northern and inland extension of range		<i>Acacia aulacophylla</i>	
			<i>Acacia ayersiana</i>	near south-western limit of range
<b>Family: Hypoxidaceae</b>			<i>Acacia burkittii</i>	near south-western limit of range
<i>Hypoxis glabella</i>	north-eastern extension of range		<i>Acacia coolgardiensis</i> subsp.	north-eastern limit of main range
			<i>coolgardiensis</i>	
<b>Family: Juncaceae</b>			<i>Acacia coolgardiensis</i> subsp. <i>effusa</i>	
* <i>Juncus bufonius</i>	north-eastern limit of main range		<i>Acacia ?coriacea</i>	southern extension of range
<i>Juncus flavidus</i>	poorly collected, northern extension of range		<i>Acacia craspedocarpa</i>	south-western limit of range
<i>Juncus pallidus</i>	north-eastern extension of range		<i>Acacia eremaea</i>	
			<i>Acacia exocaroides</i>	
<b>Family: Juncaginaceae</b>			<i>Acacia fragilis</i>	northern extension of range
<i>Triglochin calcitrapa</i>			<i>Acacia grasbyi</i>	near south-western limit of range
<i>Triglochin centrocarpa</i>			<i>Acacia jamesiana</i>	near south-western limit of range
<i>Triglochin mucronata</i>			<i>Acacia ?kempeana</i>	near south-western limit of range
<i>Triglochin nana</i>			<i>Acacia ligulata</i>	
<i>Triglochin protuberans</i>	poorly collected, 4 <sup>th</sup> collection		<i>Acacia longispinea</i>	south-western limit of range
<i>Triglochin</i> sp. A Flora of Australia (G.J.Keighery 2477)				
<i>Triglochin</i> sp. B Flora of Australia (P.G.Wilson 4294)				

## APPENDIX 1 (continued)

<i>Acacia masliniana</i>			<i>Micromyrtus flaviflora</i>	
<i>Acacia minyura</i>		near south-western limit of range	<i>Micromyrtus sulphurea</i>	
			<i>Thryptomene decussata</i>	south-western limit of range
<i>Acacia murrayana</i>				
<i>Acacia quadrimarginea</i>			<i>Thryptomene mucronulata</i>	
<i>Acacia ramulosa</i>				
<i>Acacia ramulosa</i> var. <i>linophylla</i>		near south-western limit of range	<b>Family: Nyctaginaceae</b>	
			<i>Boerhavia ?coccinea</i>	
<i>Acacia resinosa</i>		northern limit of range	<b>Family: Ophioglossaceae</b>	
<i>Acacia rhodophloia</i>		near south-western limit of range	<i>Ophioglossum lusitanicum</i>	
<i>Acacia ?stowardii</i>			<b>Family: Orchidaceae</b>	
<i>Acacia tetragonophylla</i>			<i>Caladenia hirta</i>	
<i>Acacia tysonii</i>			<i>Caladenia incensa</i> ms	
<i>Acacia victoriae</i>			<i>Paracaleana lyonsii</i> ms	large south-eastern extension of range
<b>Family: Myoporaceae</b>				
<i>Eremophila alternifolia</i>		near south-western limit of range	<i>Prasophyllum gracile</i>	near north-eastern limit of range
<i>Eremophila compacta</i>			<i>Pterostylis</i> sp. 'inland'	north-eastern limit of range
<i>Eremophila eriocalyx</i>			(A.C. Beauglehole 11880)	
<i>Eremophila forrestii</i>			<i>Thelymitra sargentii</i>	north-eastern limit of range
<i>Eremophila georgei</i>				
<i>Eremophila gibbosa</i>		north-western extension of range	<b>Family: Orobanchaceae</b>	
			<i>*Orobanche minor</i>	north-eastern limit of range
<i>Eremophila glandulifera</i> ms				
<i>Eremophila granitica</i>			<b>Family: Oxalidaceae</b>	
<i>Eremophila ?jucunda</i>		south-western limit of range	<i>*Oxalis corniculata</i>	
			<i>*Oxalis pes-caprae</i>	north-eastern limit of range
<i>Eremophila latrobei</i> subsp. <i>latrobei</i> ms				
<i>Eremophila longifolia</i>			<b>Family: Papilionaceae</b>	
<i>Eremophila mackinlayi</i>		southern limit of range	<i>Bossiaea walkeri</i>	
<i>Eremophila maculata</i>			<i>Gastrolobium laytonii</i>	
<i>Eremophila maculata</i> subsp. <i>brevifolia</i> ms			<i>Glycine canescens</i>	
<i>Eremophila miniata</i>			<i>Jacksonia arida</i> ms	
<i>Eremophila muelleriana</i>			<i>Mirbelia ramulosa</i>	
<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> ms			<i>Mirbelia rhagodioides</i>	
<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>			<i>Swainsona affinis</i>	
<i>Eremophila pantonii</i>			<i>Swainsona campestris</i>	large range extension from south-east W.A.
<i>Eremophila platycalyx</i>				
<i>Eremophila punicea</i>			<i>Swainsona gracilis</i>	
<i>Eremophila ?rostrata</i>		Priority 1 species	<i>Swainsona ?halophila</i>	
<i>Eremophila serrulata</i>			<i>Swainsona oroboides</i>	near western limit of range
<i>Eremophila shonae</i> subsp. <i>shonae</i> ms		southern limit of range		
<i>Eremophila spuria</i> ms		southern limit of range	<i>Swainsona ?paucifoliolata</i>	
			<i>Swainsona perlonga</i>	poorly collected, eastern limit of range
<b>Family: Myrtaceae</b>				
<i>Aluta aspera</i>			<i>Swainsona rostellata</i>	near south-western limit of range
<i>Callistemon phoeniceus</i>			<i>Templetonia egena</i>	
<i>Calytrix divergens</i>		near southern limit of range	<b>Family: Phormiaceae</b>	
			<i>Dianella revoluta</i>	
<i>Darwinia capitellata</i>				
<i>Eucalyptus hypochlamydea</i>		near northern limit of range	<b>Family: Pittosporaceae</b>	
			<i>Bursaria occidentalis</i>	
<i>Eucalyptus kochii</i> subsp. <i>amaryssia</i> ms.		north-western edge of range	<i>Pittosporum phylliraeoides</i>	
<i>Eucalyptus leptopoda</i> subsp. <i>arctata</i>			<b>Family: Plantaginaceae</b>	
<i>Eucalyptus oldfieldii</i>			<i>*Plantago coronopus</i> subsp. <i>commutata</i>	north-eastern extension of range
<i>Eucalyptus pileata</i>		northern limit of range	<i>Plantago debilis</i>	near northern limit of range
<i>Euryomyrtus maidenii</i> ms		near western limit of range	<i>Plantago drummondii</i>	
<i>Euryomyrtus patrickiae</i>		Priority 3 species, near western edge of range	<b>Family: Poaceae</b>	
			<b>Agrostis avenacea</b>	
<i>Homalocalyx thryptomenoides</i>			<i>*Alopecurus geniculatus</i>	3 <sup>rd</sup> record for W.A.
<i>Malleostemon roseus</i>		small-flowered form	<i>*Alopecurus pratensis</i>	poorly recorded, northern range extension
<i>Malleostemon tuberculatus</i>		near north-eastern limit of range		
<i>Melaleuca eleuterostachya</i>		near north-eastern limit of range		
<i>Melaleuca lateriflora</i> subsp. <i>acutifolia</i> ms				
<i>Melaleuca ?xerophylla</i>		large south-western range extension		

## APPENDIX 1 (continued)

<i>Amphibromus nervosus</i>		<b>Family: Portulacaceae</b>	
<i>Amphipogon caricinus</i>		<i>Calandrinia disperma</i>	2 <sup>nd</sup> and 3 <sup>rd</sup> records for W.A.
<i>Aristida contorta</i>			
<i>Austrodanthonia caespitosa</i>		<i>Calandrinia eremaea</i>	
<i>Austrostipa elegantissima</i>		<i>Calandrinia granulifera</i>	
<i>Austrostipa flavescens</i>	north-eastern limit of range	<i>Calandrinia polyandra</i>	
		<i>Calandrinia primuliflora</i>	
<i>Austrostipa nitida</i>		<i>Calandrinia ptychosperma</i>	
<i>Austrostipa scabra</i>		<i>Calandrinia</i> sp. 'Bungalbin' (G.J.Keighery & N.Gibson 1656)	3 <sup>rd</sup> record for W.A., southern range extension
<i>Austrostipa trichophylla</i>			
* <i>Avena fatua</i>	near north-eastern limit of range	<i>Calandrinia</i> sp. 'Coolcalalaya' (G.J.Keighery & N.Gibson 698)	3 <sup>rd</sup> record for W.A., south-eastern range extension
* <i>Briza minor</i>	north-eastern limit of range		
<i>Bromus arenarius</i>		<b>Family: Primulaceae</b>	
<i>Bromus ?rubens</i>	north-eastern limit of range	* <i>Anagallis arvensis</i>	
		* <i>Anagallis arvensis</i> var. <i>caerulea</i>	
<i>Cymbopogon ambiguus</i>		<i>Samolus repens</i>	
* <i>Ehrharta longiflora</i>	near north-eastern limit of range		
<i>Enneapogon caerulescens</i>		<b>Family: Proteaceae</b>	
<i>Eragrostis dielsii</i>		<i>Grevillea acacioides</i>	near north-western limit of range
<i>Eragrostis eriopoda</i>	south-western limit of range		
		<i>Grevillea deflexa</i>	near south-western limit of range
<i>Eragrostis falcata</i>	near western limit of range		
		<i>Grevillea eriostachya</i>	near north-eastern limit of range
<i>Eragrostis kennedyae</i>	southern extension of range	<i>Grevillea excelsior</i>	
<i>Eragrostis lanipes</i>	south-western limit of range	<i>Grevillea hakeoides</i> subsp. <i>stenophylla</i>	near eastern limit of range
<i>Eragrostis pergracilis</i>		<i>Grevillea juncifolia</i>	
<i>Eriachne flaccida</i>	near south-western limit of range	<i>Grevillea levis</i>	near eastern limit of range
<i>Eriachne helmsii</i>	near south-western limit of range	<i>Grevillea obliquistigma</i>	
		<i>Grevillea pityophylla</i>	
<i>Eriachne ovata</i>		<i>Grevillea sarissa</i>	near western limit of range
<i>Eriachne pulchella</i>	south-western limit of range		
		<i>Hakea minyma</i>	
* <i>Hordeum glaucum</i>		<i>Hakea preissii</i>	
* <i>Lamarkea aurea</i>	eastern limit of main range	<i>Hakea recurva</i>	
		<i>Persoonia</i> sp.	
<i>Monachather paradoxus</i>		<b>Family: Ranunculaceae</b>	
<i>Paspalidium clementii</i>	south-western limit of main range	<i>Ranunculus pentandrus</i> var. <i>platycarpus</i>	western extension of range
* <i>Pentaschistis airoides</i>	near north-eastern limit of range	<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>	north-eastern limit of range
* <i>Polypogon monspeliensis</i>			
* <i>Rostraria cristata</i>	north-eastern limit of range	<b>Family: Rhamnaceae</b>	
		<i>Cryptandra imbricata</i>	Priority 3 species
* <i>Rostraria pumila</i>			
* <i>Schismus barbatus</i>		<b>Family: Rubiaceae</b>	
<i>Thyridolepis mitchelliana</i>	near western limit of range	<i>Psydrax latifolia</i>	south-western extension of range
<i>Thyridolepis multiculmis</i>	near southern limit of range		
		<b>Family: Rutaceae</b>	
<i>Tragus australianus</i>		<i>Philotheca brucei</i>	
<i>Triodia rigidissima</i>	near western limit of main range	<i>Philotheca brucei</i> subsp. <i>brevifolia</i>	
		<i>Philotheca tomentella</i>	
<i>Triodia scariosa</i>		<b>Family: Santalaceae</b>	
<i>Triodia tomentosa</i>	near western limit of range	<i>Exocarpos aphyllus</i>	
		<i>Leptomeria preissiana</i>	
* <i>Vulpia muralis</i>	north-eastern limit of range	<i>Santalum acuminatum</i>	
		<i>Santalum spicatum</i>	
* <i>Vulpia myuros</i> var. <i>myuros</i>	northern limit of range		
		<b>Family: Sapindaceae</b>	
<b>Family: Polygalaceae</b>		<i>Alectryon oleifolius</i>	bridges gap in range between populations of north-west and south-east
<i>Comesperma integerrimum</i>			
<b>Family: Polygonaceae</b>			
* <i>Acetosa vesicaria</i>			
* <i>Emex australis</i>			
<i>Muehlenbeckia florulenta</i>			



## APPENDIX 1 (continued)

*Dodonaea inaequifolia*  
*Dodonaea microzyga* var. *acrolobata*  
*Dodonaea viscosa*  
*Dodonaea viscosa* subsp. *mucronata*  
*Dodonaea viscosa* subsp. *angustissima*

**Family: Scrophulariaceae**

*Glossostigma diandrum*  
*Glossostigma drummondii*  
 \**Parentucellia latifolia* near north-eastern limit  
 of range

*Peplidium muelleri* southern limit of range  
*Peplidium* sp. C Evol.Fl.Fauna Arid Aust. southern limit of range  
 (N.T.Burbidge & A.Kanis 8158)

\**Zaluzianskya divaricata* north-eastern extension  
 of range

**Family: Solanaceae**

*Anthotroche pannosa*  
*Duboisia hopwoodii*  
*Nicotiana cavicola*  
*Nicotiana occidentalis* subsp. *hesperis*  
*Nicotiana occidentalis* subsp. *obliqua*  
*Nicotiana rosulata* subsp. *rosulata*  
*Nicotiana rotundifolia*  
*Solanum cleistogamum*  
*Solanum lasiophyllum*  
 \**Solanum nigrum*

*Solanum orbiculatum*  
*Solanum orbiculatum* subsp. *orbiculatum*

**Family: Sterculiaceae**

*Brachychiton gregorii*  
*Keraudrenia integrifolia*  
*Rulingia luteiflora*

**Family: Stylidiaceae**

*Levenhookia leptantha*  
*Stylidium induratum* western limit of range  
*Stylidium longibracteatum*

**Family: Thymelaeaceae**

*Pimelea microcephala*

**Family: Urticaceae**

*Parietaria cardiostegia*

**Family: Zygophyllaceae**

*Zygophyllum auranticum*  
*Zygophyllum compressum* south-western limit of  
 range

*Zygophyllum eremaeum*  
*Zygophyllum fruticosum*  
*Zygophyllum glaucum*  
*Zygophyllum ovatum*  
*Zygophyllum simile*

APPENDIX 2

Sorted two-way table of the Burnerbinmah sites showing species occurrence (rows) by community type (site codes appear as columns).

	COMMUNITY TYPE									
	1a	1b	2	3a	3b	4a	4b	5a	5b	
	ACABC	ABCCC	CABCA	ABAB	AC	ABA	BBBC	ACB	ABC	SPECIES GROUPS
	14655	43381	18779	5411	76	211	6899	322	111	
		1		21		0			100	
<i>*Sonchus oleraceus</i>			*	****	**		* *			
<i>*Erodium cicutarium</i>			*	**	**		*			
<i>*Emex australis</i>				***	**	**				
<i>*Hordeum glaucum</i>				***	*	* *	**			A
<i>Nicotiana occidentalis ssp. hesperis</i>				** *	*	*	*			
<i>Swainsona rostellata</i>				** *	*	*	*			
<i>Goodenia pusilliflora</i>	**	*	*	*	**	*				
<i>Senecio glossanthus</i>	*			*	*		**		*	
<i>*Arctotheca calendula</i>				*	*					
<i>Ptilotus macrocephalus</i>				*	*					
<i>*Centaurea melitensis</i>				***	*					
<i>*Silene gallica var. gallica</i>				***	*					
<i>*Cotula bipinnata</i>				**	*					
<i>Atriplex semilunaris</i>				**		*				
<i>*Polycarpon tetraphyllum</i>				**						
<i>Cyperus gymnocaulos</i>				**						
<i>Wahlenbergia communis</i>				**						
<i>*Avena fatua</i>		*		**					*	
<i>Daucus glochidiatus</i>				**			*		*	
<i>Hyalochlamys globifera</i>				*	*					
<i>Wahlenbergia gracilentia</i>			*	** *	*					
<i>Rhodanthe chlorocephala ssp. splendida</i>			*	*	*				*	B
<i>*Solanum nigrum</i>	*			*	*					
<i>Gnephosis brevifolia</i>	**			*	*					
<i>Rhyncharhena linearis</i>			**	*	*					
<i>*Vulpia myuros var. myuros</i>	*		*	*	*					
<i>Eriachne flaccida</i>	*			**	*					
<i>Eriachne ovata</i>	*			**	*					
<i>Rhodanthe pygmaea</i>	*			*	*					
<i>Acacia exocarpoides</i>			*	*	*					
<i>Calandrinia ptychosperma</i>		*		***	*					
<i>Triglochin calcitrapa</i>				**	*					
<i>Ptilotus chamaecladus</i>				**	*		*			
<i>Chenopodium melanocarpum</i>				**	*					
<i>Cyperus alterniflorus</i>				**	*					
<i>Swainsona oroboides</i>				**	*					
<i>Sida fibulifera</i>		*		*	*					
<i>*Acetosa vesicaria</i>					*		**			
<i>Acacia victoriae</i>					*		**			
<i>Tetragonia eremaea</i>					*		*			
<i>Lepidium phlebopetalum</i>	*				*		**			
<i>*Sisymbrium erysimoides</i>					*	**	*			
<i>Rhagodia eremaea</i>					*	*				
<i>*Oxalis corniculata</i>					*	*				
<i>Exocarpos aphyllus</i>					*	**				
<i>Myriocephalus oldfieldii ms</i>					*	*				
<i>Pimelea microcephala</i>					*	*				
<i>Dodonaea viscosa</i>				*	*	*	*			*
<i>Pittosporum phylliraeoides</i>				*	*	*				
<i>Maireana pyramidata</i>					*	*				
<i>*Spergularia rubra</i>	*				**					
<i>Plagiobothrys plurisepalus</i>	*				**					
<i>Gnephosis arachnoidea</i>	*				*					
<i>Hyalosperma glutinosum ssp. glutinosum</i>	**				*					
<i>Atriplex amnicola</i>	*	*			**					
<i>Brachyscome lineariloba</i>			*		**					
<i>Agrostis avenacea</i>					**					

APPENDIX 2 (continued)

Bergia perennis ssp. exigua				**						
Marsilea drummondii				**						
Peplidium sp. C Evol.Fl.Fauna Arid Aust.				**						D
Ranunculus pentandrus var. platycarpus				**						
Rhodanthe propinqua				**						
Rhodanthe stricta				**						
Acacia tysonii				*			**			
Cratystylis subspinescens				*			*			
Eremophila maculata				*				*		
Gnephosis angianthoides				*			*			
Melaleuca uncinata				*		*				
Swainsona affinis		*		*						
Tetragonia moorei			*	*						
<hr/>										
*Erodium aureum							*	*	*	
Rhodanthe haigii							*	*		
Sclerolaena uniflora							*		*	
Maireana trichoptera							*	*	*	
Ptilotus exaltatus							**	**	*	
Trichanthodium skirrophorum			*				*	**	*	
*Raphanus raphanistrum							**	*		
Salsola tragus							***	*		
Eremophila pantonii							**	*		
Eriochiton sclerolaenoides							**			E
*Silene nocturna	*						***			
Eragrostis dielsii	*						**	**	**	
*Hornungia procumbens							*	*		
Rhagodia drummondii							*	*		
Asteridea athrixioides							*	***		
Lawrenzia glomerata								***		
Trichanthodium exile								****		
Zygophyllum compressum								**		
Zygophyllum auranticum							*	**		
<hr/>										
Angianthus tomentosus		*		*	*		**	***		
Frankenia fecunda		*						**	*	
Omphalolappula concava		*					*	***	*	*
Zygophyllum fruticosum		*					***	*		*
Sclerolaena diacantha		* *					*	*		
Bromus arenarius							*	*	***	*
Enchylaena tomentosa				*			*	*	*	
Senna artemisioides ssp. filifolia			**				*	*	*	*
Scaevola spinescens	*			*			**	*	*	*
Solanum orbiculatum			*		*		**	*	*	
Goodenia pinnatifida	*		*				*	*	*	
Ptilotus divaricatus		*					*	***		
Sclerolaena densiflora	*	*	*	*			*	***		
Swainsona gracilis	*						*	**		
<hr/>										
*Mesembryanthemum nodiflorum	*			*			*			
Tetragonia cristata	*			**	*		*			
Calandrinia disperma				**	*					
Plantago drummondii				*	*			*		
Eremophila platycalyx		*		*					*	
Triglochin mucronata				*					*	
<hr/>										
Abutilon oxycarpum		*					*			
Triglochin sp.B Flora of Australia (P.G.)	*						*			
Chenopodium gaudichaudianum				*			*			
Maireana amoena		*					*			
Grevillea acacioides				*					*	
Podotrochea gnaphalioides							*		*	
Hyalosperma stoveae		*							*	
<hr/>										
*Anagallis arvensis	*	**	*			****	**	*		
Pogonolepis stricta	**	*				**	**	*		
Abutilon cryptopetalum	*	*				*	*			
Myriocephalus pygmaeus	*	**	*			*	*			
Abutilon malvifolium	*	*	*			*		**		
*Vulpia muralis	**	**								
Nicotiana rotundifolia	*	**	**	*						

APPENDIX 2 (continued)

Aristida contorta	****	*****			*	*	*				
Eriachne pulchella	****	*****			**	*					
Austrostipa trichophylla	**	* ** *	*		*	*					*
Podolepis lessonii	*****	*** *	*		*	*					*
Cheilanthes sieberi ssp. sieberi	*	*** *	*		*	*					
Drosera bulbosa ssp. major	**	** *	*		*	*					
Acacia acuminata		* *			**	*			*		*
Haloragis trigonocarpa		***			***	*			*		*
Schoenus. variicellae		*			**	*			*		*
Trachymene pilosa	**	***			*	*			*		*
Centrolepis eremica		*			*	*			*		*
Dodonaea inaequifolia		**			*	*			*		*
Isolepis congrua	*	**			*	*			*		*
Paspalidium clementii		*			**	*			*		*
Acacia burkittii		** *			*	*			*		*
Podolepis kendallii		* *			*	*			*		*
Calandrinia granulifera		* *		*	*	*			*		*
<hr/>											
Acacia quadrimarginea	*	***									
Borya sphaerocephala	*	***									
Caladenia incensa ms		***									
Drosera macrantha ssp. eremaea		*** *									
Goodenia berardiana		*** *									
Hydrocotyle pilifera var. glabrata		***							*		
Pterostylis sp. inland (A.C.Beauglehole)		** *									
Tricoryne elatior		*** *									*
Crassula exserta	*	*									
Malleostemon tuberculatus		**									
Thryptomene mucronulata	*	**									
Gonocarpus nodulosus		**			*	*					
Parietaria cardiostegia		**			*	*					
Hyalosperma glutinosum ssp. venustum		* *			*	*					
Rhodanthe battii	*	**			*	*					
Brachyscome pusilla		*							*		
Millotia myosotidifolia		*									*
Erymophyllum ramosum	*	*									
Goodenia havilandii	*	*									
Wahlenbergia preissii	*	*									
Prasophyllum gracile		**									
<hr/>											
*Osteospermum clandestinum					**	*					
Mirbelia ramulosa		*			**	*					
Calandrinia primuliflora		*			*	*					
Lawrencella rosea		*			*	*					
Grevillea pityophylla		*			*	*					
<hr/>											
*Cuscuta epithymum	*	*	*	*	*	*	*	*	*	*	*
Austrostipa scabra	** *	***	*	*	*	*	*	*	*	*	*
Brachyscome ciliaris		**	*	*	*	*	*	*	*	*	*
Erodium cygnorum	*	*	*	*	*	*	*	*	*	*	*
*Pentaschistis airoides	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Calandrinia eremaea	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Rhodanthe maryonii	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Brachyscome ciliocarpa	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Crassula colorata	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
Calotis multicaulis	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *	** *
Acacia tetragonophylla	**	*****	** *	** *	** *	** *	** *	** *	** *	** *	** *
Ptilotus obovatus	***	*****	** *	** *	** *	** *	** *	** *	** *	** *	** *
*Rostraria pumila	*	*	**	**	*	**	**	**	**	**	**
Austrostipa elegantissima		** *	** *	** *	** *	** *	** *	** *	** *	** *	** *
*Hypochoeris glabra	***	*** *	*	*	*	*	*	*	*	*	*
Helipterum craspedioides	*****	** *	*	*	*	*	*	*	*	*	*
Solanum lasiophyllum	**	** *	*	*	*	*	*	*	*	*	*
Trachymene ornata	* **	****	** *	** *	** *	** *	** *	** *	** *	** *	** *
Velleia rosea	* **	****	** *	** *	** *	** *	** *	** *	** *	** *	** *
Calotis hispidula	** *	****	*	*	*	*	*	*	*	*	*
Pogonolepis muelleriana	*** *	****	*	*	*	*	*	*	*	*	*
Cephalopterum drummondii	* **	****	**	**	**	**	**	**	**	**	**
Euphorbia drummondii	*	** **	*	*	*	*	*	*	*	*	*
Actinobole uliginosum	**	** **	*	*	*	*	*	*	*	*	*
Calandrinia polyandra	*	** *	*	*	*	*	*	*	*	*	** *

I

J

K

L

APPENDIX 2 (continued)

<i>Plantago debilis</i>	** *	*	*	*	*	*	*	*	*	*
<i>Calocephalus multiflorus</i>	** **			**				*	*	*
<i>Goodenia mimuloides</i>	**	*	*	**		*	*	****		*
<i>Ptilotus gaudichaudii</i>	*	**	**	*		*		*		*
<i>Podolepis capillaris</i>	*	*	*	*	*		**	**		*
-----										
<i>Acacia coolgardiensis subsp. effusa</i>	*			*	*					
<i>Eragrostis lanipes</i>		*		**						
<i>Quinqueremulus linearis</i>				***						
<i>Myriocephalus guerinae</i>				***					*	
<i>Thyridolepis multiculmis</i>	*			**					*	
<i>Acacia ramulosa</i>	*	*	*	*	*	*	*		*	*
<i>Lobelia winfridae</i>	** **		***	**	*					***
<i>Chthonocephalus pseudevax</i>	***	*	***	**					*	*
<i>Eremophila glandulifera ms</i>		*	*	*****					*	
<i>Podolepis canescens</i>	**	*	*	**					*	*
<i>Goodenia occidentalis</i>		*	*	****	*	*			***	**
<i>Lawrencella davenportii</i>	*	*		***					**	***
<i>Velleia hispida</i>	**	*	*	**					***	**
<i>Monachather paradoxus</i>		*	**	*	***				**	*
<i>Waitzia acuminata</i>	*		*	***	*		*		*	*
<i>Eragrostis eriopoda</i>		*	*	*				*	*	
<i>Maireana suaedifolia</i>		*	*	*			*			
<i>Santalum spicatum</i>	*	*		*	*		*			
-----										
<i>*Micropterum papulosum</i>	*****									
<i>Gunniopsis rubra</i>	* **									
<i>Triptilodiscus pygmaeus</i>	**									
<i>Austrodanthonia caespitosa</i>	**		*					*		
<i>Isoetopsis graminifolia</i>	* *		*			*				
<i>Lemooria burkittii</i>	** *					*		*		
<i>Acacia aneura</i>	***		**						*	
<i>Maireana planifolia</i>	**		***							
<i>Eremophila punicea</i>	**	**	**	*	*					
<i>Maireana carnosa</i>	* **	**	***	*				*		
<i>Acacia ayersiana</i>	* **	*	*	*						
<i>Dichopogon capillipes</i>	***	**	*	*						
<i>Sclerolaena gardneri</i>	*	*	*	*						
<i>Sida calyxhymenia</i>	*		*	*			*			
<i>Dielitzia tysonii</i>	*	*	**	*		*				
<i>Schoenia cassiniana</i>	* *	*	**	*		**			*	
<i>Acacia ?coriacea</i>	*		*	*						
<i>Acacia craspedocarpa</i>		*	*	*						
<i>Spartothamnella teucriffloa</i>		*	***	*						
<i>Eremophila georgei</i>			**	**						
<i>Maireana thesioides</i>		**	*	*						
<i>Sida atrovirens ms</i>		*	**	*						
<i>Acacia minyura</i>	*		*	*						
<i>Velleia glabrata</i>	*					*				
<i>Levenhookia leptantha</i>	* *		*	*						
<i>Ptilotus schwartzii</i>	*		*	*						
<i>Ptilotus drummondii</i>	*	*	*	*						
<i>Maireana georgei</i>	**									
<i>Maireana glomerifolia</i>	**									
<i>Micromyrtus sulphurea</i>	* *									
<i>Mirbelia rhagodioides</i>	* *									
<i>Philothea brucei</i>	* *									
-----										
<i>Acacia coolgardiensis subsp. coolgardien</i>									**	
<i>Anthrotroche pannosa</i>									**	
<i>Chrysitrix distigmatosa</i>									**	
<i>Euryomyrtus patrickiae</i>									**	
<i>Keraudrenia integrifolia</i>									**	
<i>Aluta aspera</i>									***	*
<i>Rhodanthe citrina</i>									**	*
<i>Euryomyrtus maidenii ms</i>									**	
<i>Thysanotus rectantherus</i>									***	
<i>Triodia tomentosa</i>									***	
<i>Amphipogon caricinus</i>									**	**
<i>Stylidium induratum</i>									***	*
<i>Gilberta tenuifolia</i>	*								***	*

M

N

O

APPENDIX 2 (continued)

<i>Acacia jamesiana</i>					*	*
<i>Micromyrtus flaviflora</i>					**	**
<i>Bellida graminea</i>					***	***
<i>Thysanotus manglesianus</i>		*			***	* *
<i>Gnephosis tenuissima</i>	*	*			***	**
<i>Ceratogyne obionoides</i>		*			***	*
<i>Trachymene ceratocarpa</i>		**			**	*
<i>Rhodanthe polycephala</i>	*				*	
<hr/>						
<i>Acacia ligulata</i>					**	**
<i>Bossiaea walkeri</i>					***	***
<i>Ptilotus grandiflorus</i> var. <i>grandiflorus</i>					***	***
<i>Triodia rigidissima</i>					***	***
<i>Brunonia australis</i>					*	***
<i>Cryptandra imbricata</i>		*				**
<i>Ptilotus polystachyus</i>						**
<i>Eucalyptus hypochlamydea</i>					*	**
<i>Stenopetalum filifolium</i>					*	*
<i>Rhagodia preissii</i> ssp. <i>preissii</i>					**	***
<i>Haloragis odontocarpa</i>		***			**	* ***
<i>Zygophyllum eremaeum</i>					*	*
<i>Callitris glaucophylla</i>						* *
<i>Dianella revoluta</i>		*	*			*
<i>Olearia pimeleoides</i>			*		*	*
<i>Marsdenia australis</i>		*	*			
<i>Stenopetalum anfractum</i>		*	*			
<i>Eremophila eriocalyx</i>		*				*
<i>Maireana planifolia</i> x <i>villosa</i>		*				*
<i>Lobelia heterophylla</i>		*				*
<hr/>						
<i>Didymanthus roei</i>					**	
<i>Eragrostis kennedyae</i>					**	
<i>Halosarcia halocnemoides</i>					**	
<i>Halosarcia indica</i> ssp. <i>bidens</i>					**	
<i>Halosarcia pterygosperma</i> ssp. <i>denticulata</i>					***	
<i>Rhodanthe heterantha</i>					**	
<i>Sclerostegia tenuis</i>					**	
<i>Sondottia connata</i>					**	
<i>Minuria cunninghamii</i>		*			**	

P

Q