

# Vegetation and flora of Arakoola Nature Reserve, North Western Slopes, New South Wales

John T. Hunter

23 (Lot 75) Kendall Rd, Invergowrie, NSW 2350, AUSTRALIA. Email: flora@austarnet.com.au

**Abstract:** The vegetation of Arakoola Nature Reserve (3189 ha), 29°17'S, 150°48'E, 100 km north-west of Inverell, in north western New South Wales is described. Seven vegetation communities are defined based on flexible UPGMA analysis of cover-abundance scores of all vascular plant taxa. These communities are mapped based on ground-truthing, air photo interpretation and geological substrate. They are: 1) Community 1: *Eucalyptus albens* (White Box) – *Eucalyptus melanophloia* (Silver-leaved Ironbark) Basalt Woodland, Community 2: *Angophora leiocarpa* (Smooth-barked Apple) – *Corymbia dolichocarpa* (Long-fruited Bloodwood) Sandstone Woodland, Community 3: *Angophora leiocarpa* (Smooth-barked Apple) – *Eucalyptus macrorhyncha* (Red Stringybark) Woodland, Community 4: *Chloris truncata* (Windmill Grass) Grassland, Community 5: Herbfield/Sedgeland, Community 6: *Eucalyptus camaldulensis* (Red Gum) – *Eucalyptus melliodora* (Yellow Box) Riparian Woodland, Community 7: *Angophora floribunda* (Rough-barked Apple) – *Callistemon viminalis* (Weeping Bottlebrush) Riparian Woodland.

There are 23 taxa considered significant within Arakoola Nature Reserve including the twining herb *Desmodium campylocaulon* and the shrub *Pomaderris queenslandica* (listed as Endangered under the NSW *Threatened Species Conservation Act*), and the grasses *Dichantheum setosum* and *Bothriochloa biloba*, and the perennial herbs *Goodenia macbarroni* and *Thesium australe* (all listed as Vulnerable under the *TSC Act*). A comprehensive species list of about 450 plant species is given for the Nature Reserve.

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## Introduction

Arakoola Nature Reserve (29°17'S, 150°48'E) lies 2 km south from Coolatai and 100 km north-west of Inverell (Fig. 1), on the northern end of the Mastermans Range. Arakoola is within the North Western Slopes botanical region and straddles the current boundary between the Brigalow Belt South and the Nandewar Bioregions. Before gazettal, the land was maintained under two titles, *Sylvan* and *Arakoola*. The local government area is primarily the Inverell Shire, although a small portion of the *Sylvan* section of the reserve is in the Yallaroi Shire. Arakoola, in the county of Burnett, parish of Coolatai, comprises 3189 ha within the Graman 1: 50 000 9039, II and III, map sheet. The reserve is surrounded by private land and is divided into two sections by freehold titles. Almost all of the land surrounding the reserve has been extensively cleared, so that the reserve forms an 'island' of comparatively uncleared country.

This paper gives part of the results of a flora survey, carried out for the New England Tablelands Region of the NSW National Parks and Wildlife Service, to be used to develop appropriate management strategies (Hunter 2000a).

## Climate

The climate of Arakoola is typical of the northern portion of the North Western Slopes with a distinct summer maximum rainfall. Winds are mainly from the south-west in summer.

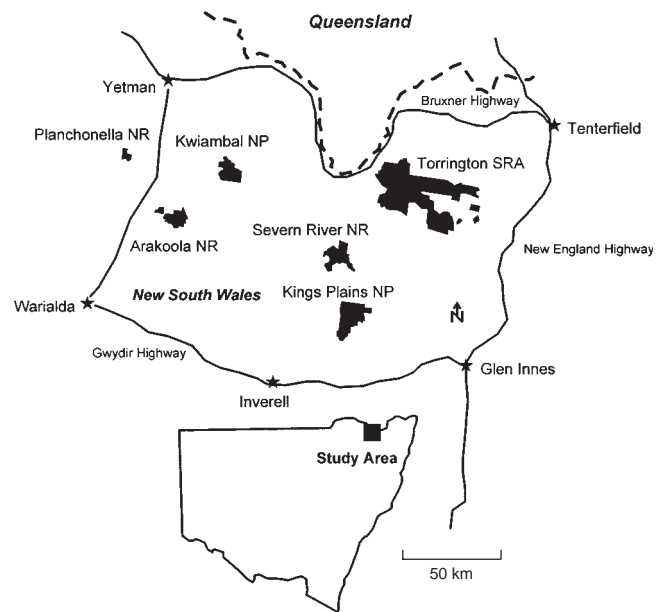


Fig. 1. Map of locality of Arakoola Nature Reserve

Dry thunderstorms are common throughout spring. On average one in every five years will be drought years (Division of Mapping 1986). The five years including 1991–1995 were drought declared. Usually summers are hot with an average temperature around 33°C and winters are cold with an average minimum temperature of around 2°C (Lea et al. 1977). The annual precipitation is around 650 mm a year. The humidity is low in summer and around 55% to 76% in winter.

### Landform

Arakoola Nature Reserve lies at the northern end of Mastermans Range on the western slopes of the Great Dividing Range. The reserve is of low relief but straddles the western fall of the range and thus has greater altitude and topography along the eastern boundary. Flatter terrain is associated with Ottleys Creek on the western boundary. The highest point, 570 m, occurs at the north eastern boundary, the lowest point is 370 m. Flat alluvial plains are associated with the meandering bed of Ottleys Creek and they may extend laterally for up to 1 km from the creek bed. Spring Creek a smaller tributary of Ottleys Creek forms part of the northern boundary of the reserve and extends into the heart of the reserve. Its upper reaches dissect the hillier terrain of Mastermans Range and form deeper gullies without any fluvial terraces.

### Geology

Arakoola Nature Reserve is within the Surat Basin of eastern Australia (Stroud 1990). Outcrops of Surat Basin sediments, along the western edge of the New England Orogen, consist of Pilliga Sandstone, late Jurassic in age. Tertiary basalt is another main rock type within the NR and this forms significant outcrops in the area. In addition, Tertiary sediments crop out within the Reserve and these appear to be associated closely with outcrops of the Tertiary basalt (Stroud 1990). Quaternary alluvial plain deposits are present along creeks.

### European history and landuse

Lands near Arakoola were first taken up after Governor Bourke's official gazettal of the Lands Act of 1836. By 1846, most properties were gazetted and running sheep and cattle. R.B. Otley came to the region in 1837 and took up the lands containing the reserve. His property was named *Mandoe* in 1841, being derived from the aboriginal word *mandoie* meaning 'big toe' or 'big foot' (Wiedemann 1981). As another property in the Inverell district had the same name the station was renamed *Coolatai*. The property carried 2500 cattle and covered 70 000 acres (c. 40000 ha). Later sheep were carried, but were replaced again by cattle in 1970 due to heavy losses by dingoes (Black 1988).

Most recently, the properties that now constitute Arakoola Nature Reserve were known as *Sylvan* and *Arakoola* and both were owned by B. Campbell who purchased the blocks in the 1950s. Before this, the main property was known as *White Rock*. The property has been extensively cleared on the alluvial flats and also on higher basalt country. The flats were used for cropping in recent years and the higher country including basalt areas was used for rough grazing and cropping of sorghum and wheat (B. Campbell pers. comm.).

### Methods

Sixty four quadrats, each 20 × 20 m, were surveyed for vascular plants scored using the Braun-Blanquet (1982) six point cover abundance scale. Quadrats were placed using a

stratified random method. Geology and Physiography (Crest & Upper Slope, Lower Slope & Flats, Open Depressions) were used to for strata delineation. Fifty sites were surveyed over five days in November and December 1999 and an additional 14 were conducted on one day in May 2003. Only the initial 50 sites were used in analyses.

Good quality material of species were retained as vouchers by the New England Tablelands Region of the NSW National Parks and Wildlife Service and duplicates of significant collections were submitted to the National Herbarium of NSW. Nomenclature follows that of Harden (1990–1993) except where recent changes have been made.

Analyses and data exploration were performed using options available in the PATN Analysis Package (Belbin 1995a, b). For final presentation of results all species and their relative abundance scores were used. Analysis was performed using Kulczynski association measure, which is recommended for ecological applications (Belbin 1995a, b) along with flexible Unweighted Pair Group arithmetic Averaging (UPGMA) and the default PATN settings.

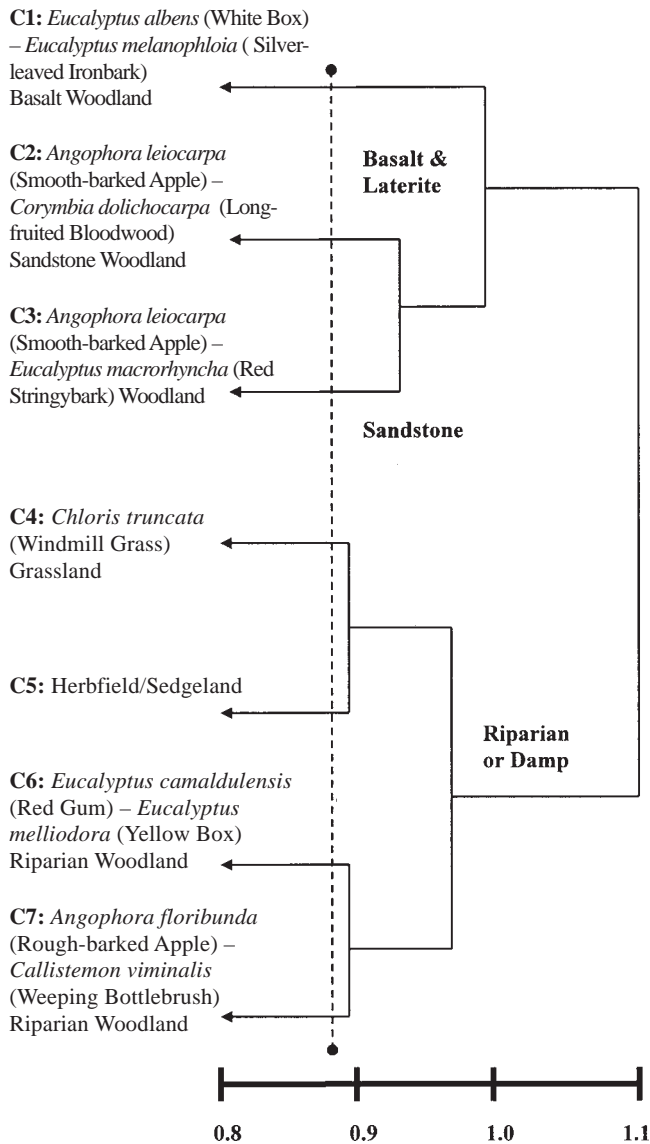
Delineation of community boundaries in Figure 3 was based on the location of sites and their position within the multivariate analysis, air photograph interpretation, substrate and ground truthing. The vegetation map is based on a 1:50 000 scale. Structural names follow Specht et al. (1995) and are based on the most consistent uppermost stratum.

### Results

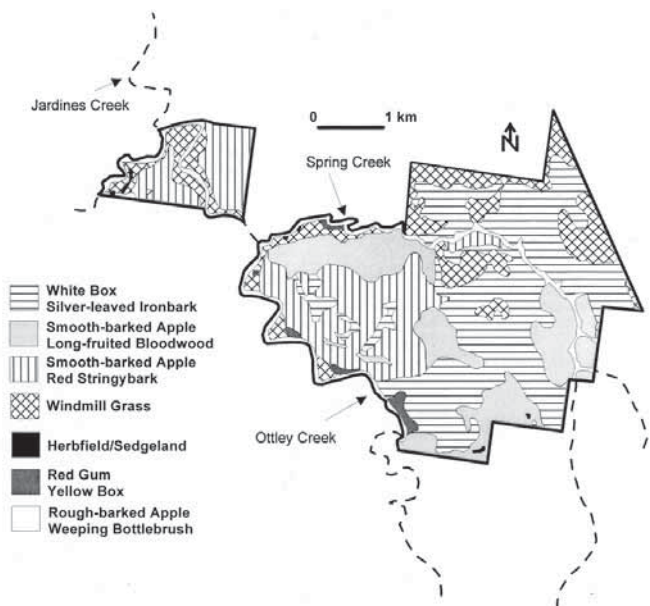
Seven communities are recognised at the dissimilarity measure of c. 0.9. A summary of the community relationships is given by the dendrogram (Fig. 2). The first major division of the dendrogram separates alluvial and riparian areas. In all 450, vascular plant taxa, from 86 families and 287 genera were recorded from collation of existing records and this current sampling. Approximately 21% (95) were of taxa introduced to NSW.

### Vegetation communities

The vegetation communities of Arakoola are broadly similar to many communities found on the North Western Slopes of New South Wales. Most of the vegetation communities are of woodland formation. The upper middle layer has a high cover of *Callitris endlicheri*. A distinct grassy component occurs in the areas influenced by basalt and a shrubby component in sandstone areas. Grasslands occur in valleys, heaths and shrublands occur in some cleared and disturbed localities, and small wetlands occur in oxbow sections of old creek channels. The communities are primarily determined by soil type and secondarily by landform. A summary of relevant statistics for each community are presented in Table 1. Extreme values are given in brackets within the following descriptions of communities. Within the following descriptions exotic species are not listed, their occurrence within each community is listed in Appendix 1. Species from each layer are listed in order of decreasing importance (cover × frequency).



**Fig. 2.** Summary dendrogram of the full floristic dataset of sites using Kulczynski association and flexible UPGMA fusion strategy.



**Fig. 3.** Map of vegetation communities for Arakoola Nature Reserve



**Fig. 4.** Community 1: *Eucalyptus albens* and *Callitris endlicheri* on basalt soil.

**Community 1: *Eucalyptus albens* (White Box) – *Eucalyptus melanophloia* (Silver-leaved Ironbark) Basalt Woodland**

**Distribution:** primarily restricted to basalt or ironstone associated with the contact zone between sandstone and basalt. Soils are variable from clay loams to sandy loams, but usually not very heavily textured or very light. Soil colour is from red, light brown to black and are well drained to moist and from shallow to deep but never skeletal.

**Structure:** upper layer 15–30 m tall; 15–30 (–50)% cover. Upper middle layer 5–20 m tall; 10–40% cover. Lower middle layer 1–5 m tall; 10–60% cover. Ground layer to 1 m tall; 40–90% cover (Fig. 4).

**Trees:** *Callitris endlicheri*, *Eucalyptus albens*, *Eucalyptus melanophloia*, *Eucalyptus crebra*, *Eucalyptus sideroxylon*, *Angophora leiocarpa*, *Eucalyptus dealbata*, *Corymbia dolichocarpa*, *Brachychiton populneus*.

**Shrubs:** *Olearia elliptica*, *Desmodium brachypodum*, *Notelaea microcarpa*, *Leucopogon muticus*, *Melichrus urceolatus*, *Pultenaea* sp. C, *Dodonaea viscosa*, *Cassinia uncata*, *Pimelea neo-anglica*, *Pimelea micrantha*, *Hibbertia obtusifolia*, *Acacia sparsiflora*, *Acacia penninervis*, *Acacia amblygona*.

**Climbers & trailers:** *Desmodium varians*, *Glycine clandestina*, *Glycine tabacina*, *Parsonia eucalyptophylla*, *Kennedia procurrens*, *Jasminum lineare*.

**Ground cover:** *Aristida ramosa*, *Brunonia australis*, *Cymbopogon refractus*, *Cyperus gracilis*, *Cheilanthes sieberi*, *Aristida vagans*, *Scleria mackaviensis*, *Wahlenbergia stricta*, *Vittadinia dissecta*, *Mentha satereioides*, *Dichondra repens*, *Swainsona greyana*, *Phyllanthus virgatus*, *Lomandra multiflora*, *Glossogyne tannensis*, *Eclipta platyglossa*, *Dichondra* sp. A, *Dichelachne micrantha*, *Senecio quadridentatus*, *Microlaena stipoides*, *Calotis lappulacea*, *Panicum simile*, *Austrostipa scabra*, *Ajuga australis*, *Stackhousia viminea*, *Senecio diaschides*, *Rostellularia adscendens*, *Oxalis rhinodes*, *Lomandra filiformis*, *Cheilanthes distans*, *Austrodanthonia richardsonii*, *Vittadinia sulcata*.

**Variability:** two very distinct and clear sub-assemblages that under finer scale mapping of 1:25 000 would probably have been recognised as separate entities. The first sub-assemblage is more extensive and is dominated by *Eucalyptus albens* and *Eucalyptus melanophloia*. It commonly has an understorey of *Olearia elliptica* and *Notelaea microcarpa*. At the highest points of the basalt hills *Olearia elliptica* forms very dense stands. In similar situations in the nearby Planchonella Hill Nature Reserve semi-evergreen vine thickets occur. The understorey is commonly very grassy but often this is of the

introduced grass *Hyparrhenia hirta*. The soils are always distinctly basaltic and are loamy and dark brown to black. The second sub-assembly is associated with the sandstone and basalt contact zones and as such the soils are somewhat intermediate, but generally heavier in texture than the adjacent sands. The soils are often Lateritic with imbedded ironstone and are red to light brown sandy loam. The dominants are *Eucalyptus crebra* and *Eucalyptus sideroxylon* with occasional associates not seen on true basalts such as *Angophora leiocarpa*. The understorey still contains substantial stands of *Olearia elliptica* but also may contain a number of other shrubby species such as *Acacia amblygona* and *Leucopogon muticus*.

**Conservation status:** Box woodlands are amongst the most poorly conserved ecosystems in Australia (Benson 1991, Prober 1996) and are highly vulnerable or endangered in agricultural lands. Benson (1991) highlighted Box woodlands on the western slopes as a priority for reservation. This type of Box association is reserved at Kwiambal NP where it occurs on metasediments and on metabasalts and at Planchonella Hill NR on basalt.



**Fig. 5.** Community 2: *Angophora leiocarpa* with dense understorey of *Pultenaea* sp. C on sandstone

**Community 2: *Angophora leiocarpa* (Smooth-barked Apple) – *Corymbia dolichocarpa* (Long-fruited Bloodwood) Sandstone Woodland**

**Distribution:** found throughout the sandstone areas but primarily in the central to western parts of the Reserve (Fig. 3). Soils are well drained and sandy or occasionally sandy loam in texture. The soil colour is white, creamy or rarely light brown and deep to skeletal.

**Structure:** upper 15–25 m tall; 20–30% cover. Upper middle layer usually absent to 8–15 m tall; 30–40% cover. Lower middle layer 1–3 m tall; 20–60% cover. Ground layer occasionally absent to 1 m tall; 10–20% cover (Fig. 5).

**Trees:** *Callitris endlicheri*, *Angophora leiocarpa*, *Corymbia dolichocarpa*, *Eucalyptus sideroxylon*, *Corymbia trachyphloia*, *Eucalyptus macrorhyncha*, *Eucalyptus dealbata*.

**Shrubs:** *Leucopogon muticus*, *Hovea lanceolata*, *Hibbertia acicularis*, *Brachyloma daphnoides*, *Pultenaea* sp. C, *Melichrus urceolatus*, *Calytrix tetragona*, *Grevillea triternata*, *Grevillea floribunda*, *Acacia sparsiflora*, *Acacia penninervis*, *Leucopogon attenuatus*, *Persoonia terminalis*, *Styphelia triflora*, *Persoonia sericea*, *Olearia ramosissima*, *Gompholobium virgatum*, *Dillwynia sieberi*, *Daviesia nova-anglica*, *Cryptandra amara*, *Allocasuarina inophloia*, *Xylomelum cunninghamianum*.

**Climbers & trailers:** *Cassytha glabella*.

**Ground cover:** *Triodia mitchellii*, *Fimbristylis neilsonii*, *Tricoryne elatior*, *Platysace ericoides*, *Goodenia macbarronii*, *Goodenia hederacea*, *Aristida ramosa*, *Isotoma axillaris*, *Goodenia bellidifolia*, *Dianella caerulea*, *Chrysocephalum apiculatum*, *Aristida acuta*, *Actinotus helianthi*.

**Variability:** *Angophora leiocarpa* may dominate in isolation with *Callitris endlicheri* scattered but subdominant with a generally sparse shrubby understorey. In other rockier localities, *Angophora leiocarpa* is subdominant to co-dominant with other species such as *Corymbia dolichocarpa* or *Eucalyptus sideroxylon*, with a dense shrubby understorey.

**Notes:** *Angophora leiocarpa* is usually only known from wide sandy valleys derived from sandstone primarily on the North Western Slopes and Plains of New South Wales north from Warialda and also much of south-central Queensland (Neldner 1984, Leach 1986, Hill 1991, Carr 1996). Beadle (1981) placed *Angophora leiocarpa* (as *A. costata*) in a Suballiance with *Eucalyptus crebra* and referred to it as being common in sandstone areas and noted that they have been termed ‘sandstone woodlands’ by other authors. *Corymbia dolichocarpa* usually occurs south of Charters Towers in Queensland and is infrequent in NSW with its southern limit at Narrabri. Both the dominant species in the case of this community are near the limits of their southern distribution and are more commonly associated with each other in Central to southern Queensland.

**Conservation status:** only small occurrences of *C. dolichocarpa* occur in New South Wales reserves, namely at Mt Kaputar NP, Torrington SRA and Kwiambal NP. *Angophora leiocarpa* is also conserved in Kwiambal NP west of the Divide. The two dominants of this community are at their southern limits and don’t occur together in any other reserve in New South Wales. Hence, this community should be considered highly significant and uniquely reserved in NSW at Arakoola.



**Fig. 6.** Community 3: *Angophora leiocarpa* and *Eucalyptus macrorhyncha* with *Xylomelum cunninghamianum*

### Community 3: *Angophora leiocarpa* (Smooth-barked Apple) – *Eucalyptus macrorhyncha* (Red Stringybark) Woodland

**Distribution:** on sandstone or sandstone/basalt intergrade zones in western parts of the Reserve (Fig. 3). Soils are highly variable but are always well drained. Texture is usually sandy but may be sandy loam or loamy clay depending on the amount of basalt influence or wash down. Soil colour is reddish, pink to brown on contact zones and yellow, pink light brown to white on pure sandy soils. The soil may be skeletal to deep.

**Structure:** highly variable: Upper layer (10–) 15–30 m tall; (10–) 20–30% cover. Upper middle layer usually absent on intergrading soils 8–15 m tall; 15–50% cover. Lower middle layer usually absent on sandy soils 1–3 m tall; 10–30% cover. Ground layer to 1 m tall; 15–90% cover (Fig. 6).

**Trees:** *Callitris endlicheri*, *Angophora leiocarpa*, *Eucalyptus macrorhyncha*, *Eucalyptus dealbata*, *Eucalyptus melanophloia*, *Brachychiton populneus*, *Xylomelum cunninghamianum*, *Eucalyptus chloroclada*, *Eucalyptus blakelyi*, *Eucalyptus sideroxylon*.

**Shrubs:** *Melichrus urceolatus*, *Hibbertia obtusifolia*, *Brachyloma daphnoides*, *Styphelia triflora*, *Jacksonia scoparia*, *Hovea lanceolata*, *Calytrix tetragona*, *Leucopogon muticus*, *Leucopogon attenuatus*, *Cassinia uncata*, *Bossiaea rhombifolia*, *Aotus mollis*.

**Climbers & trailers:** *Desmodium varians*, *Kennedia procurrens*, *Glycine* sp. A, *Glycine tomentella*.

**Ground cover:** *Calotis cuneifolia*, *Cheilanthes sieberi*, *Lomandra multiflora*, *Dichelachne micrantha*, *Aristida vagans*, *Wahlenbergia planiflora*, *Eragrostis elongata*, *Aristida acuta*, *Cymbopogon refractus*, *Tricoryne elatior*, *Poranthera microphylla*, *Podolepis arachnoidea*, *Chrysocephalum apiculatum*, *Cheilanthes distans*, *Aristida ramosa*, *Xanthorrhoea johnsonii*, *Wahlenbergia gracilentia*, *Schoenus apogon*, *Panicum simile*, *Lomandra filiformis*, *Imperata cylindrica*, *Glossogyne tannensis*, *Crotalaria michellii*, *Calotis lappulacea*, *Vittadinia dissecta*, *Triodia michellii*, *Evolvulus alsinoides*, *Dianella caerulea*, *Alloteropsis semialata*, *Ajuga australis*, *Actinotus helianthi*.

**Variability:** at least two distinct sub-assemblages are discernable and relate primarily to soil type. The first sub-assemblage occurs on sandstone and basalt intergrade soils on red to pink or brown to chocolate brown soils. The dominant trees include *Eucalyptus melanophloia* with *Eucalyptus dealbata* with occasional subdominants including *Eucalyptus sideroxylon*, *Eucalyptus populnea* or *Eucalyptus chloroclada*. The tree layer is often low between 10–20 m tall and any one of the understorey layers may be absent and in particular the tall shrub to low tree layer (10–15 m tall) is most often absent. Within this sub-assemblage, variation is notable between the red and lighter red soils and the light brown to chocolate brown soils. *Eucalyptus sideroxylon* and *Eucalyptus populnea* occurring on the red soils with a denser shrub layer but sparse herb layer and *Eucalyptus melanophloia* mostly on heavier brown soils with a sparser shrub layer and denser herb layer. The second major sub-assemblage is restricted to white to yellow or occasionally light pink to light brown sandstone soils. The tree layer is between 20–25 or up to 30 m tall and there is almost always a distinct tall shrub to lower tree layer around 6–15 m tall (primarily *Callitris endlicheri*). In contrast to the first sub-assemblage there is rarely a distinct shrub layer (1–3 m). The dominant tree is *Angophora leiocarpa* with occasional *Eucalyptus macrorhyncha*. Within the second sub-assemblage distinction is made for areas that have been cleared in the past that fringe the lower slopes and about with the tongues of basalt near major creeks. In these localities the understorey is much the same but there are fewer trees.

**Conservation status:** closely allied assemblages of *Eucalyptus populnea*, *Eucalyptus melanophloia*, *Callitris glaucophylla* are reserved in Brigalow Park NR (Specht et al. 1995) and Kwiambal NP (Hunter et al. 1999) in NSW. *Angophora leiocarpa* occurs only as far south as Warialda in large stands, although there are records from

Killarney State Forest near Narrabri. In Queensland, *Angophora leiocarpa* is more common, but *Eucalyptus macrorhyncha* is absent. This assemblage is therefore highly restricted, only occurring sporadically in the Inverell and Yallaroi shires. Arakoola is the only reserve in New South Wales with this unique assemblage.



Fig. 7. Community 4: *Chloris truncata* grasslands.

### Community 4: *Chloris truncata* (Windmill Grass) Grassland

**Distribution:** restricted to poorly drained areas with dark brown to brown cracking basaltic soils. Found primarily adjacent to major creeks (Fig. 3).

**Structure:** upper layer usually not present to 5 m tall; c. 5% cover. Middle layer usually not present but to 1–3 m tall; c. 10% cover. Ground layer 90–100% (Fig. 7).

**Trees:** *Eucalyptus dealbata*, *Eucalyptus camaldulensis*.

**Shrubs:** *Leptospermum brevipes*, *Jacksonia scoparia*.

**Climbers & trailers:** *Desmodium varians*, *Convolvulus erubescens*, *Cassytha labella*.

**Ground cover:** *Teucrium racemosum*, *Chloris truncata*, *Centaureum spicatum*, *Vittadinia muelleri*, *Sporobolus elongatus*, *Panicum simile*, *Mentha satuireioides*, *Austrodanthonia fulva*, *Wahlenbergia gracilentia*, *Sida trichopoda*, *Schoenus apogon*, *Oxalis chnoodes*, *Juncus aridicola*, *Geranium solanderi*, *Fimbristylis dichotoma*, *Euchiton gymnocephalus*, *Cyperus leiocaulon*, *Cyperus bifax*, *Cynodon dactylon*, *Chrysocephalum apiculatum*, *Calotis lappulacea*.

**Variability:** occurring as small patches of regenerating grassland associated with past cropping areas. Floristic variability is based on the degree to which native vegetation has been restored from past cropping practices. Some structural variation is noticeable where trees such as *Eucalyptus dealbata* or *Eucalyptus camaldulensis* may be present as scattered individuals giving a low open woodland appearance. Grasslands such as this can change considerably in floristics over seasons and between years depending on rainfall and flooding (Hunter & Earl 2002). An additional 14 sites were placed within this community during May 2003 over which time the floristics had changed considerably. During the subsequent sampling in May, an additional 15 species were found and many areas were dominated by dense stands of *Bothriochloa biloba* and *Dichanthium setosum*, along with *Panicum queenslandicum* and *Digitaria brownii*.

**Conservation status:** despite its complement of introduced taxa (Appendix 1) this community is still largely native. Such grasslands are not recorded as reserved within NSW.



**Fig. 8.** Community 5: *Eleocharis plana* sedgeland in ox-bow sections of Ottleys Creek.

### Community 5: Herbfield/Sedgeland

**Distribution:** restricted to waterlogged or damp, dark brown often cracking clay.

**Structure:** upper usually not present but to 15 m tall; c. 5–10% cover. Ground layer to 1 m tall; 40–100% cover (Fig. 8).

**Trees:** *Eucalyptus camaldulensis*.

**Shrubs:** None apparent.

**Climbers & trailers:** *Jasminum suavisimum*, *Cuscuta australis*, *Convolvulus erubescens*.

**Ground cover:** *Rorippa eustylis*, *Eleocharis plana*, *Centipeda cunninghamii*, *Persicaria lapathifolia*, *Polygonum plebeium*, *Ranunculus inundatus*, *Plantago varia*, *Juncus ochrocoleus*, *Euchiton gymnocephalus*, *Chamaesyce drummondii*, *Chamaesyce dallachyana*, *Centaurium spicatum*, *Carex inversa*, *Calotis cuneifolia*, *Brunonia australis*, *Bothriochloa decipiens*, *Austrostipa ramosissima*, *Alternanthera* sp. A.

**Variability:** floristic composition largely depends on duration and extent of water logging. This varies seasonally and temporally over years depending on rainfall and flooding.

**Conservation status:** assemblages such as this are often neglected in broad scale survey work as they cover such a small area and they thus have been rarely documented. They are often highly modified and even when in conservation reserves they are very limited in extent. Many species in this community are probably at their eastern limit within the Reserve and thus the community is significant.

### Community 6: *Eucalyptus camaldulensis* (Red Gum) – *Eucalyptus melliodora* (Yellow Box) Riparian Woodland

**Distribution:** restricted to deep, poorly drained chocolate brown to dark brown basalts soils adjacent to Ottleys Creek.

**Structure:** upper 15–25 m tall; 30–40% cover. Middle layer usually not present but can be 1–3 m tall; c. 10% cover. Ground layer to 1 m tall; 80–90% cover (Fig. 9).

**Trees:** *Eucalyptus camaldulensis*, *Eucalyptus melliodora*, *Brachychiton populneus*, *Angophora leiocarpa*.

**Shrubs:** *Lotus cruentus*, *Sida trichopoda*, *Sida corrugata*, *Rulingia dasyphylla*, *Notelaea microcarpa*, *Maireana microphylla*, *Lespedeza juncea*, *Hibbertia obtusifolia*.

**Climbers & trailers:** *Glycine tabacina*, *Desmodium varians*, *Boerhavia dominii*, *Glycine clandestina*, *Convolvulus erubescens*.



**Fig. 9.** Community 6: *Eucalyptus melliodora* woodlands.

**Ground cover:** *Sorghum leiocladum*, *Einadia nutans*, *Aristida jerichoensis*, *Vittadinia dissecta*, *Poa labillardieri*, *Cyperus gracilis*, *Calotis cuneifolia*, *Sporobolus elongatus*, *Rumex brownii*, *Lepidium pseudohyssopifolium*, *Carex inversa*, *Calotis lappulacea*, *Aristida vagans*, *Pratia concolor*, *Mentha diemenica*, *Imperata cylindrica*, *Digitaria longiflora*, *Dichondra* sp. A, *Dichelachne micrantha*, *Desmodium brachypodum*, *Cymbopogon refractus*, *Brunonia australis*, *Bothriochloa decipiens*.

**Variability:** the ground layer is diverse and varied and contain many ephemeral grasses and forbs that respond quickly to rainfall and/or flooding. Understorey species composition will change over seasons and over longer time periods due to variation in flooding and deposition of seeds, day length and soil temperature. The community is primarily linear in occurrence and as such has a high edge to area ratio.

**Conservation status:** widespread in NSW but has been extensively modified across its entire range. Bowlay (1992) and Le Brocque and Benson (1995) noted that this community type is highly disturbed throughout the Ashford map sheet. Benson (1991) considers plant associations of inland watercourses as poorly conserved, however a number of areas of this assemblage appear to be reserved across the state (Specht et al. 1995).



**Fig. 10.** Community 7: *Angophora floribunda*, *Casuarina cunninghamiana* and *Callistemon viminalis* along major creek lines.

**Community 7: *Angophora floribunda* (Rough-barked Apple) – *Callistemon viminalis* (Weeping Bottlebrush) Riparian Woodland**

**Distribution:** associated with Ottleys Creek and Spring Creek (Fig. 3). Found both on basalt and on sandstone with additional alluvial material. Soils are also variable from creamy white sandy soils to dark brown or black cracking clays.

**Structure:** upper (15–) 20–30 m tall; 10–30% cover. Low tree layer (5–) 8–15 m tall; 20–60% cover. Shrub layer usually absent 1–3 m tall; c. 30% cover if present. Ground layer to 1 m tall; 30–80% cover (Fig. 10).

**Trees:** *Angophora floribunda*, *Callitris endlicheri*, *Eucalyptus macrorhyncha*, *Corymbia dolichocarpa*, *Angophora leiocarpa*, *Eucalyptus prava*, *Eucalyptus blakelyi*, *Casuarina cunninghamiana*.

**Shrubs:** *Callistemon viminalis*, *Notelaea microcarpa*, *Leptospermum arachnoides*, *Pultenaea* sp. C, *Brachyloma daphnoides*, *Hibbertia obtusifolia*, *Sida cunninghamii*, *Hovea lanceolata*, *Pomaderris queenslandica*, *Melichrus unceolatus*, *Leptospermum brevipes*, *Dillwynia sieberi*, *Cassinia uncata*, *Bursaria spinosa*.

**Climbers & trailers:** *Rubus parviflorus*, *Commelina cyanea*, *Clematis microphylla*, *Desmodium varians*, *Hardenbergia violacea*.

**Ground cover:** *Imperata cylindrica*, *Cyperus gracilis*, *Urtica incisa*, *Lomandra longifolia*, *Rumex brownii*, *Stellaria flaccida*, *Wahlenbergia planiflora*, *Setaria paspalidioides*, *Hydrocotyle laxiflora*, *Geranium solanderi*, *Dichondra repens*, *Cyperus bifax*, *Cheilanthes sieberi*, *Carex incomitata*, *Austrostipa verticillata*, *Ajuga australis*, *Thonandia longifolia*, *Ranunculus lappaceus*, *Pteridium esculentum*, *Pratia concolor*, *Microlaena stipoides*, *Juncus continuus*, *Juncus aridicola*, *Echinopogon ovatus*, *Desmodium brachypodum*, *Cyperus victoriensis*, *Austrostipa ramosissima*, *Aristida vagans*, *Wahlenbergia stricta*, *Solanum pseudocapsicum*, *Scutellaria humilis*, *Rostellularia adscendens*, *Ranunculus inundatus*, *Oxalis chnoodes*, *Luzula flaccida*, *Lomandra conferta*, *Hypericum gramineum*, *Einadia nutans*, *Cynodon dactylon*, *Cymbopogon refractus*, *Chionochloa pallida*, *Cheilanthes distans*, *Centaurium spicatum*, *Austrodanthonia richardsonii*, *Austrodanthonia bipartita*, *Aristida ramosa*.

**Variability:** highly variable in structure and floristics. *Callistemon viminalis* becomes dominant closer to the creek line.

**Conservation status:** This community probably occurs throughout the lower altitude parts of the north western slopes and north into similar country in Queensland. It is almost always highly disturbed across its range. Only small sections occur within reserves and these are generally also highly disturbed due to past practices and thus of poor quality (Hunter 2002). These systems are of high priority, if in reasonable condition, for further inclusion into the reserve network. Benson (1991) noted that vegetation along inland water courses were very poorly reserved and highlighted them as a priority for conservation even though similar assemblages are reserved in a number of areas across the state (Specht et al. 1995).

## Discussion

The number of 450 vascular plant taxa found within the reserve is very similar to the richness found in similar sized reserves on the North Western Slopes, for example Kwiambal NP with 407 (Hunter et al. 1999), Single NP with 424 (Clarke et al. 2000), Kings Plains with 441 (Hunter 2000b), and Ironbark NR and *Bornhardtia* VCA with 477 (Hunter & Hunter 2003). Based on the variability between sites Hunter (2003) predicted that up to 514 taxa may be within Arakoola NR. Site richness on a 0.04 ha site was only 36 taxa on average, but this is similar to that found by Le Brocque and Benson (1995) for the Ashford 1:100000 map sheet (37/0.04 ha),

Hunter (2000c) in Severn River NR (38/0.04 ha), Hunter et al. (1999) in Kwiambal NP (40/0.04 ha) and Hunter and Hunter (2003) at Ironbark NR and the *Bornhardtia* Voluntary Conservation Agreement (35/0.04 ha).

Biogeographically Arakoola NR is placed on the edge of the Brigalow Belt South (BBS) and Nandewar (NAN) bioregions and includes the southern extent of a number of vegetation assemblages and species that are more common within southern central Queensland. It appears that despite overlap in species composition, and some similarity in Communities in a broad sense, much that is contained within Arakoola is rather unique or at least significantly under represented in other reserves in NSW. The affinities of the vegetation of the reserve are in part with Planchonella Hill and Kwiambal, but mainly only in the basaltic components. The sandstone communities of Arakoola NR are in a large part unique within the NSW reserve system and have their affinities with the larger sandstone areas of the Pilliga in New South Wales and south central Queensland. The distribution of these communities do extend, unreserved, to the south as far as Warialda and to the east on the western parts of the Ashford Map Sheet. The basaltic and more herbaceous communities within Arakoola have their greatest affinities with country of similar soils to the west of the reserve and possibly to the south as far as the Liverpool Plains and east as far as the Ashford Map Sheet.

## Conservation issues

Benson (1999) stated that 2.5% of the NSW Brigalow Belt South (BBS) Bioregion was held in conservation reserves and 60% had been cleared. In total only 2% of the Inverell Shire and only 0.01% of the Yallaroi Shire are in conservation reserves. All communities within Arakoola Nature Reserve were either unreserved or under represented in the current reserve network. Some communities, in terms of reservation in NSW are unique and represent assemblages that are more common in Queensland. Communities 6 and 7 are rather widespread but these are very highly disturbed throughout their range. Community 4 is probably widespread yet not recorded for a conservation reserve. As such, Arakoola is a highly significant bioregional reserve.

There are 23 taxa considered significant within Arakoola Nature Reserve. Seven of these taxa are listed nationally as Rare or Threatened species (RoTAP) (Briggs & Leigh 1996) and six are included within the *NSW Threatened Species Conservation Act 1995* (five are shared on both lists).

*Bothriochloa biloba* (3V, listed as Vulnerable under the *TSC Act*) and *Dichanthium setosum* (listed as Vulnerable under the *TSC Act*) are threatened grasses. Very few individuals were found in grassland areas on heavy soil along Ottleys Creek during the initial survey, yet many areas of Community 4 were dominated by these grasses during May 2003.

*Desmodium campylocaulon* (listed as Endangered under the *TSC Act*) is a robust twining herb to 1m tall. The species is

known from the Northern Territory and Queensland, and in NSW is generally found on the North Western Plains. This species was not discovered during this survey but was reported to be within the reserve after investigations by the Department of Land and Water Conservation. The species is reserved within Kirramingly Nature Reserve.

*Goodenia macbarronii* (3VC-, listed as Vulnerable under the TSC Act) is a perennial herb known from the Darling Downs in Queensland to north-eastern Victoria. The species is known to be reserved in Warrabah and Warrumbungle National Parks, Ironbark and Severn River Nature Reserves and the Torrington State Recreation Area. The species was sporadic but not uncommon within Arakoola NR.

*Olearia gravis* (3KC-) is a poorly known taxon that has a disjunct and sporadic distribution from Murgon to Sundown and Girraween National Park in Queensland, and Torrington State Recreation Area, Kings Plains, Gibraltar Range and Kwiambal National Parks in New South Wales. The species distribution is sporadic, but not uncommon on shallow sandstone soils within the Reserve.

*Persoonia terminalis* subsp. *recurva* and subsp. *terminalis* (2RCa and 2RC) are shrubs to 1 m tall. These taxa overlap in distribution within this region and east to Torrington. Both entities are restricted to sandstone areas within the Reserve.

*Pomaderris queenslandica* (listed as Endangered under the TSC Act) is a shrub to 3 m tall. The species is fairly common in Queensland but is threatened in New South Wales where it occurs in the Central and North Western Slopes and the North Coast. It is reserved within the Torrington State Recreation Area, Severn River Nature Reserve and Monablay National Park. Within the reserve less than 20 individuals were found in two locations.

*Thesium australe* (3VCi, listed as Vulnerable under the TSC Act) is a perennial herb which is currently known from a number of districts from south-east Queensland to the Bass Strait Islands. The species is known from at least 15 National Parks or Nature Reserves within New South Wales. Many hundreds of individuals were found within Arakoola NR on alluvial and basaltic soils in grassland.

Fourteen other taxa are considered to be of conservation significance, including those that are disjunct or thought to be at or near their geographic limit. These taxa are: *Allocasuarina gymnanthera*, *Angophora leiocarpa*, *Aristida acuta*, *Brachyloma daphnoides* subsp. *pubescens*, *Cheiranthra cyanea* var. *borealis*, *Corymbia dolichocarpa*, *Digitaria longiflora*, *Eucalyptus populnea* subsp. *bimbil*, *Evolvulus alsinoides* var. *villosicalyx*, *Haemodorum planifolium*, *Isotoma axillaris*, *Melaleuca erubescens* and *Rorippa eustylis*.

## Conclusion

Arakoola Nature Reserve is a highly significant bioregional reserve as it contains large areas of highly significant vegetation assemblages. The reserve includes communities

that are not currently represented in the NSW network of reserves and which are at their southern limit, as well as communities that are widespread but whose variation is very under-represented. 24 plant species are considered to be of significance. A number of species are at their distributional limits within the reserve and are thus highly significant in the regional context, six are highly significant from a state perspective (TSC Act Listed) and seven are of national significance (RoTAP).

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**Appendix: Flora of Arakoola Nature Reserve**

Taxa found within the survey sites are scored according to their occurrence in each of the seven communities defined. Some taxa were found in previous surveys or opportunistically and therefore are not assigned to a specific community.

Communities:

- 1 = *Eucalyptus albens* – *Eucalyptus melanophloia* Basalt Woodland
- 2 = *Angophora leiocarpa* – *Corymbia dolichocarpa* Sandstone Woodland
- 3 = *Angophora leiocarpa* – *Eucalyptus macrorhyncha* Woodland
- 4 = *Chloris truncata* Grassland
- 5 = Herbfield/Sedgeland
- 6 = *Eucalyptus camaldulensis* – *Eucalyptus melliodora* Riparian Woodland
- 7 = *Angophora floribunda* – *Callistemon viminalis* Riparian Woodland
- + = not assigned

Nomenclature follows Harden (1990–1993) except where recent changes have occurred. Introduced taxa are indicated by \*.

Taxon	1	2	3	4	5	6	7	+
<b>FERNS AND ALLIES</b>								
<b>Aspleniaceae</b>								
<i>Asplenium flabellifolium</i>								+
<b>Adiantaceae</b>								
<i>Cheilanthes distans</i>	1	2	3				7	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	1	2	3				7	
<b>Dennstaedtiaceae</b>								
<i>Pteridium esculentum</i>							7	
<b>GYMNOSPERMS</b>								
<b>Cupressaceae</b>								
<i>Callitris endlicheri</i>	1	2	3			6	7	
<i>Callitris glaucophylla</i>	1							
<b>Zamiaceae</b>								
<i>Macrozamia heteromera</i>			3					
<b>MONOCOTYLEDONS</b>								
<b>Anthericaceae</b>								
<i>Arthropodium milleflorum</i>	1		3				7	
<i>Laxmannia gracilis</i>	1		3				7	
<i>Thysanotus tuberosus</i>			3					
<i>Tricoryne elatior</i>		2	3			6		
<b>Asphodelaceae</b>								
<i>Bulbine semibarbata</i>								+
<b>Commelinaceae</b>								
<i>Commelina cyanea</i>					1		3	7
<i>Murdannia graminea</i>					1			
<b>Cyperaceae</b>								
<i>Bulbostylis barbata</i>							3	
<i>Carex inomitata</i>								6 7
<i>Carex inversa</i>						1		5 6
<i>Cyperus aggregatus</i>							3	
<i>Cyperus bifax</i>							3 4	7
<i>Cyperus fulvus</i>							3	6 7
<i>Cyperus gracilis</i>						1	3	6 7
<i>Cyperus leiocaulon</i>								4
<i>Cyperus rotundus</i>								4
<i>Cyperus victoriensis</i>						1		7
<i>Eleocharis plana</i>								5
<i>Fimbristylis dichotoma</i>						1	3 4	6
<i>Fimbristylis neilsonii</i>							2 3	
<i>Gahnia aspera</i>						1		
<i>Lepidosperma laterale</i>							2 3	7
<i>Schoenus apogon</i>						1	3 4	



<i>*Urochloa texana</i>				5		7				<i>*Conyza parva</i>	1	3	4	5	7			
<i>*Vulpia bromoides</i>					6					<i>Cymbonotus lawsonianus</i>	1	3			6			
<b>Xanthorrhoeaceae</b>										<i>Eclipta platyglossa</i>	1			5	6			
<i>Xanthorrhoea johnsonii</i>		2	3			7				<i>Euchiton gymnocephalus</i>	1	3	4	5				
<i>Xanthorrhoea glauca</i> subsp. <i>angustifolia</i>							+			<i>Euchiton sphaericus</i>	1							
<b>Xyridaceae</b>										<i>Glossogyne tannensis</i>	1	3	4		6			
<i>Xyris complanata</i>				4						<i>*Gnaphalium coarctatum</i>				4				
DICOTYLEDONS										<i>*Gnaphalium polycaulon</i>	1	3	4	5	7			
<b>Acanthaceae</b>										<i>*Hedypnois rhagadioloides</i> subsp. <i>cretica</i>				4	5	7		
<i>Brunoniella australis</i>					3					<i>*Hypochaeris glabra</i>	1			4	5		+	
<i>Rostellularia adscendens</i> subsp. <i>adscendens</i>	1		3			7				<i>*Hypochaeris radicata</i>	1	2	3	4		6	7	
<b>Aizoaceae</b>										<i>*Lactuca saligna</i>					5			
<i>Glinus lotoides</i>				5						<i>Lagenifera stipitata</i>							7	
<b>Amaranthaceae</b>										<i>Olearia elliptica</i>	1					6	7	
<i>Alternanthera</i> sp. <i>A</i>				5	6					<i>Olearia ramosissima</i>		2						
<i>*Gomphrena celosioides</i>				6		+				<i>Ozothamnus adnatus</i>		2						
<b>Apiaceae</b>										<i>Ozothamnus diosmifolius</i>		2						
<i>Actinotus helianthi</i>		2	3							<i>Ozothamnus obcordatus</i> subsp. <i>major</i>	2							
<i>*Ciclospermum leptophyllum</i>	1		3	4	5	7				<i>Podolepis arachnoidea</i>				3				
<i>*Daucus carota</i>										<i>Podolepis neglecta</i>				3				
<i>Daucus glochidiatus</i>	1		3							<i>Senecio diaschides</i>	1						7	
<i>Hydrocotyle laxiflora</i>					5	7				<i>Senecio quadridentatus</i>	1	3					7	
<i>Hydrocotyle peduncularis</i>						7				<i>*Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	1							
<i>Platysace ericoides</i>		2								<i>*Silybum marianum</i>					4			
<i>*Torilis nodosa</i>				5						<i>*Sonchus asper</i> subsp. <i>glaucescens</i>					5			
<b>Apocynaceae</b>										<i>*Sonchus oleraceus</i>	1	3	4	5	6	7		
<i>Parsonsia eucalyptophylla</i>	1									<i>*Tagetes minuta</i>							7	
<b>Araliaceae</b>										<i>*Taraxacum officinale</i>	1				5	6	7	+
<i>Astrotricha longifolia</i>			3							<i>Cyanthillium cinerea</i>	1	3			6			
<b>Asclepiadaceae</b>										<i>Vittadinia cuneata</i>					6			
<i>*Gomphocarpus fruticosus</i>	1		3		6	7				<i>Vittadinia cuneata</i> var. <i>morrisii</i>							7	
<b>Asteraceae</b>										<i>Vittadinia dissecta</i> var. <i>hirta</i>	1	3			6			
<i>*Arctotheca calendula</i>				5						<i>Vittadinia muelleri</i>				4				
<i>*Bidens pilosa</i>				5						<i>Vittadinia sulcata</i>	1			4				
<i>*Bidens subalternans</i>			3		6	7				<i>Vittadinia pterochaeta</i>				4				
<i>Brachyscome diversifolia</i> var. <i>dissecta</i>			3		6	+				<i>*Xanthium italicum</i>					5			
<i>Calotis cuneifolia</i>			3		5	6	7			<i>*Xanthium orientale</i>					5			
<i>Calotis dentex</i>				3		6	+			<i>*Xanthium spinosum</i>		3		5	6			
<i>Calotis lappulacea</i>	1		3	4		6	7	+		<b>Boraginaceae</b>								
<i>*Carduus pycnocephalus</i>							+			<i>*Buglossoides arvensis</i>		3						
<i>Cassinia laevis</i>						6				<b>Brassicaceae</b>								
<i>Cassinia uncata</i>	1		3			7				<i>Hirschfeldia incana</i>				4				
<i>*Centaurea calcitrapa</i>					5					<i>*Lepidium bonariense</i>							+	
<i>*Centaurea melitensis</i>			3	4	5					<i>Lepidium hyssopifolium</i>		3	4					
<i>*Centaurea solstitialis</i>						7				<i>Lepidium pseudohyssopifolium</i>					5	6		
<i>Centipeda cunninghamii</i>					5	6				<i>*Rapistrum rugosum</i>					5	7		
<i>*Chondrilla juncea</i>					5	7				<i>Rorippa eustylis</i>					5			
<i>Chrysocephalum apiculatum</i>	1	2	3	4		6				<i>*Rorippa nasturtium-aquaticum</i>							7	
<i>Chrysocephalum semipapposum</i>	1									<b>Cactaceae</b>								
<i>*Cirsium vulgare</i>	1				5	6	7			<i>*Opuntia stricta</i> var. <i>stricta</i>	1	2	3		6	7		
<i>*Conyza albida</i>	1		3	4	5	6	7			<b>Campanulaceae</b>								
<i>*Conyza bonariensis</i>					6	7				<i>Wahlenbergia gracilentia</i>	1	3	4		6			
										<i>Wahlenbergia planiflora</i> subsp. <i>longipila</i>	1	2	3		7		+	
										<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>	1	3			6	7		

**Caryophyllaceae***\*Cerastium fontanum* subsp. *vulgare**\*Cerastium glomeratum**\*Petrohragia nanteuillii* 1 3 4 5 7*\*Polycarpaea corymbosa* var. *minor**\*Polycarpon tetraphyllum* 3*Scleranthus biflorus**Stellaria flaccida* 7**Casuarinaceae***Allocasuarina gymnanthera* 1*Allocasuarina inophloia* 2*Casuarina cunninghamiana* 7**Chenopodiaceae***Chenopodium carinatum* 1 3*Chenopodium melanocarpum* 4*Einadia nutans* subsp. *nutans* 1 3 6 7*Einadia polygonoides* 3*Maireana aphylla* 4*Maireana microphylla* 6*Sclerolaena birchii* +**Clusiaceae***Hypericum gramineum* 1 3 4 7*Hypericum japonicum* +**Convolvulaceae***Convolvulus erubescens* 3 4 5 6*Cuscuta australis* 5*Dichondra repens* 1 4 6 7*Dichondra* sp. *A* 1 6 7*Evolvulus alsinoides* var. *villosicalyx* 3 +**Dilleniaceae***Hibbertia acicularis* 1 2 7*Hibbertia obtusifolia* 1 2 3 6 7**Epacridaceae***Brachyloma daphnoides* 1 2 3 7*subsp. pubescens**Leucopogon attenuatus* 2 3 7*Leucopogon muticus* 1 2 3*Lissanthe strigosa* +*Melichrus urceolatus* 1 2 3 7 +*Monotoca scoparia* +*Styphelia triflora* 1 2 3 7 +**Euphorbiaceae***Beyeria viscosa* +*Breynia cernua* +*Chamaesyce dallachyana* 5*Chamaesyce drummondii* 1 3 4 5 6*Phyllanthus virgatus* 1*Poranthera microphylla* 1 3 7*\*Ricinus communis* 7**Fabaceae***Acacia amblygona* 1*Acacia betchei* 3*Acacia buxifolia* subsp. *pubiflora* +*Acacia cheelii* +*Acacia conferta* +*Acacia deanei* subsp. *deanei* +*Acacia elongata* var. *elongata* 1*\*Acacia farnesiana* +*Acacia juncifolia* 1 2 3*Acacia leiocalyx* +*Acacia leptoclada* 2 3 7*Acacia pendula* +*Acacia penninervis* 1 2 3 7*Acacia pruinosa* +*Acacia sparsiflora* 1 2*Acacia ulicifolia* +*Acacia uncinata* 2*Acacia viscidula* +*Aotus mollis* 3*Aotus subglauca* var. *filiformis* 2 3*Bossiaea rhombifolia* 2 3*subsp. rhombifolia**Bossiaea scortechinii* 3 7*Crotalaria mitchellii* subsp. *laevis* 3*Daviesia nova-anglica* 2*Daviesia ulicifolia* subsp. *pilligaensis* 3*Desmodium brachypodum* 1 3 6 7*Desmodium varians* 1 3 4 6 7*Dillwynia sieberi* 1 2 7*Glycine clandestina* 1 3 6*Glycine* sp. *A* 3*Glycine tabacina* 1 3 6*Glycine tomentella* 3*Gompholobium virgatum* 2*var. aspalathoides**Hardenbergia violacea* 1 7*Hovea apiculata* 2 3 7*Hovea heterophylla* 7*Indigofera australis* 7*Indigofera adesmifolia* +*Jacksonia scoparia* 1 3 4*Kennedia procurrens* 1 3*Lespedeza juncea* subsp. *sericea* 1 6*Lotus australis* +*Lotus cruentus* 1 4 6 7*\*Medicago lupulina* 4 5 6 7*\*Medicago orbicularis* 4*\*Medicago polymorpha* 5 6 7*Pultenaea foliolosa* 3*Pultenaea setulosa* 4*Pultenaea* sp. *C* 1 2 3 7*Swainsona galegifolia* 4*Swainsona greyana* 1 3 7*Swainsona queenslandica* 6*\*Trifolium arvense* 5*\*Trifolium campestre* 4 7*\*Trifolium repens* 7*\*Vicia sativa* 5*\*Vicia tetrasperma* 1 5*Zornia dyctiocarpa* subsp. *dyctiocarpa* 3**Gentianaceae***Centaurium erythraea* 1 4 5*Centaurium spicatum* 1 3 4 5 7*\*Centaurium tenuiflorum* +

**Geraniaceae**

*Geranium solanderi* var. *solanderi* 1 4 6 7  
*Pelargonium inodorum* +

**Goodeniaceae**

*Brunonia australis* 1 5 6  
*Dampiera stricta* +  
*Goodenia bellidifolia* 2  
 subsp. *bellidifolia*  
*Goodenia hederacea* 2 3 6 7  
*Goodenia hederacea* 1  
 subsp. *hederacea*  
*Goodenia macbarronii* 2 3 7

**Haloragaceae**

*Gonocarpus micranthus* +  
 subsp. *ramosissimus*  
*Gonocarpus tetragynus* +  
*Haloragis aspera* 4 7  
*Haloragis heterophylla* 4

**Lamiaceae**

*Ajuga australis* 1 3 6 7  
 \**Marrubium vulgare* 1 5 6 7  
*Mentha diemenica* 6  
*Mentha satureioides* 1 3 4 5 6  
*Prostanthera cryptandroides* +  
 subsp. *euphrasioides*  
 \**Salvia verbenaca* 7  
*Scutellaria humilis* 7  
 \**Stachys arvensis* 5  
*Teucrium racemosum* 2 4  
*Teucrium* sp. *A* 7

**Lauraceae**

*Cassythia glabella* 2 3 4 7

**Lentibulariaceae**

*Utricularia dichotoma* 6

**Lobeliaceae**

*Isotoma axillaris* 2 3  
*Pratia concolor* 5 6 7  
*Pratia purpurascens* 1

**Loranthaceae**

*Amyema miquelii* 1 3  
*Dendrophthoe glabrescens* 1 3  
*Muellerina bidwillii* 1

**Malaceae**

\**Cotoneaster glaucophyllus* +

**Malvaceae**

\**Malvastrum americanum* 7  
 \**Modiola caroliniana* 5 7  
 \**Pavonia hastata* +  
*Sida corrugata* 6  
*Sida cunninghamii* 1 7  
 \**Sida rhombifolia* 1 5 7  
*Sida trichopoda* 4 6 7

**Martyniaceae**

\**Ibicella lutea* 5

**Moraceae**

*Ficus rubiginosa* +

**Myrtaceae**

*Angophora floribunda* 1 3 7  
*Angophora leiocarpa* 1 2 3 6 7  
*Babingtonia densifolia* 7  
*Callistemon viminalis* 7  
*Calytrix tetragona* 1 2 3 7 +  
*Corymbia dolichocarpa* 1 2 3 7  
*Corymbia trachyphloia* 2  
*Eucalyptus albens* 1 3  
*Eucalyptus andrewsii* +  
*Eucalyptus blakelyi* 3 7  
*Eucalyptus caleyi* subsp. *caleyi*  
*Eucalyptus camaldulensis* 5 6  
*Eucalyptus chloroclada* 3  
*Eucalyptus crebra* 1 7  
*Eucalyptus dealbata* 1 2 3 4 7  
*Eucalyptus macrorhyncha* 2 3 7  
*Eucalyptus melanophloia* 1 3  
*Eucalyptus melliodora* 6  
*Eucalyptus populnea* subsp. *bimbil* 3  
*Eucalyptus prava* 7  
*Eucalyptus sideroxylon* 1 2 3  
*Leptospermum arachnoides* 7  
*Leptospermum brevipes* 1 2 4 7  
*Leptospermum polygalifolium*  
 subsp. *transmontanum*  
*Melaleuca erubescens*

**Nyctaginaceae**

*Boerhavia dominii* 5 6

**Oleaceae**

*Jasminum lineare* 1 7  
*Jasminum suavisimum* 5  
*Notelaea microcarpa* 1 3 6 7

**Onagraceae**

*Epilobium billardierianum* 7  
 subsp. *billardierianum*  
 \**Oenothera rosea* 3 5 6 7

**Oxalidaceae**

*Oxalis chnoodes* 1 3 4 6 7  
*Oxalis perennans* 7

**Papaveraceae**

\**Argemone subfusiformis* 1 4 5  
 subsp. *subfusiformis*

**Pittosporaceae**

*Bursaria spinosa* 1 7  
*Cheiranthra cyanea* var. *borealis*  
*Pittosporum angustifolium* 1  
*Rhytidosporum diosmoides* 3

**Plantaginaceae**

*Plantago debilis* 1 7  
 \**Plantago lanceolata* 1 7  
*Plantago varia* 4 5 7

**Polygalaceae**

*Comesperma sphaerocarpum* 2  
*Polygala japonica* 7

