

Vegetation of Narran Lake Nature Reserve, North Western Plains, New South Wales

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The vegetation of Narran Lake Nature Reserve (4527 ha) in the central north of New South Wales approximately 30 km west of Cumborah (29°43', 147°29') in the Walgett Shire on the North Western Plains and the Darling River Plains Bioregion is described. Seven 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. All communities are simple in structure being primarily woodlands, shrublands and herbfields. Communities are: 1) Mixed Low Woodlands, 2) Mulga Low Woodlands, 3) Triodia Hummock Grasslands, 4) Chenopod Low Open Shrublands, 5) Ephemeral Herbfields, 6) Riparian Open Forests, and 7) Lignum Shrubby Thickets. A total of 325 taxa were recorded including two species listed under the NSW Threatened Species Conservation Act (1995), *Lepidium monoplacoides* and *Goodenia macbarroni*. An additional 11 species are considered to be at their geographic limit or disjunct in their distribution; 11% are exotic in origin.

Introduction

Narran Lake Nature Reserve is approximately 30 km west of Cumborah (29°43'S, 147°29'E) and lies between Brewarrina, Walgett and Lightning Ridge in the Shire of Walgett on the North Western Plains of NSW (Fig. 1). The reserve was dedicated in 1988 and encompasses an area of 4527 ha. An adjoining property 'Lumeah' has been purchased more recently by the NSW National Parks & Wildlife Service. Other reserves in the general area with vegetative affinities to Narran Lake include Culgoa National Park, gazetted in 1996 (16 616 ha) and Macquarie Marshes Nature Reserve, gazetted in 1971 (18 143 ha).

The Narran River is a tributary of the Bokhara River (part of the Condamine River System) with its headwaters in southeastern Queensland. The Narran River leaves the Balonne near Dirranbandi in Queensland and continues 150 km to Narran Lake. Other rivers flowing from the Condamine River in the general vicinity include the Culgoa and the Balonne Rivers, both of which flow directly into the Darling. The reserve does not include Narran Lake itself. The Narran River delineates the south-western boundary of the reserve.

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This paper gives part of the results of a flora survey conducted on behalf of the Narrabri District of the NSW National Parks & Wildlife Service. The aims were to provide baseline data on the Reserve, to construct a map of vegetation communities to assist in reserve management and to provide information on the distribution of rare or geographically restricted or disjunct taxa. This information will be used to assist the development of appropriate management strategies (Hunter 1999).

Climate

The climate is semi-arid with an average annual rainfall of 358–425 mm. The monthly rainfall is variable with a larger summer (in the long term), but also a winter peak. Years with less than 250 mm often occur in pairs or threes causing drought conditions (Aldis 1987). Despite the severe droughts of the late 1890s, the period prior to 1910 was

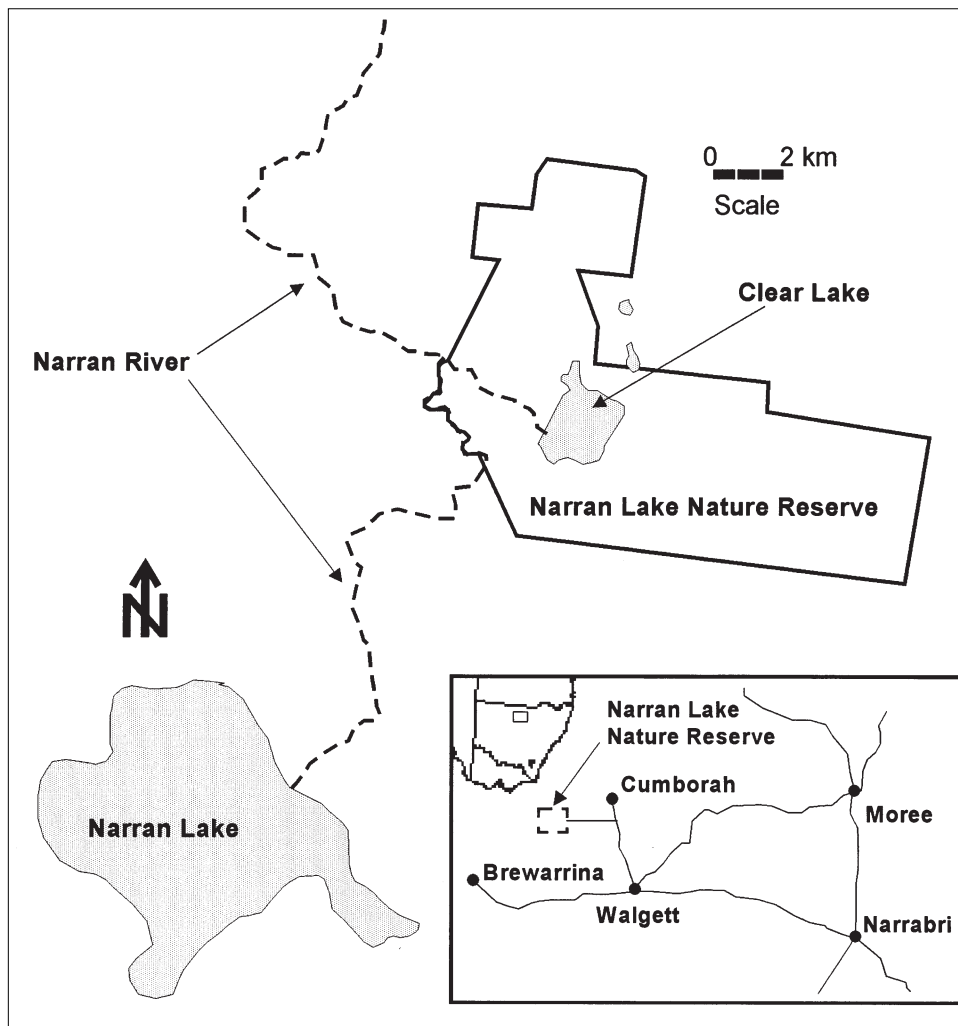


Fig. 1. Map of locality of the Narran Lake Nature Reserve.

wetter than from 1911 to 1947 (Gentilli 1971). Since that time the rainfall has been substantially higher and there has been an increase in summer rainfall (Pickard & Norris 1994). There is a long hot summer and a short cold winter. The diurnal temperature fluctuates greatly. The average maximum and minimum summer temperatures are 36°C and 21°C and winter maximum and minimum are 18°C and 6°C respectively.

Geology and geomorphology

The landforms are gently sloping, undulating plains that fall to the southwest. In terms of fertility, the cracking clay soils are the most important soil group in the area with red earths and sandy red earths being of low fertility (Neldner 1992). The reserve incorporates extensive wetlands, lunettes and sandy and minor rocky ridge country (NSW NP&WS 1996). The region encompassing the Narran is thought to be a plain formed by the coalescence of alluvial fans (Aldis 1987).

Nearly half of the reserve is seasonal wetlands contained within Clear Lake and Back Lake, both subject to flooding by the Narran River. The eastern parts of the reserve are primarily of sandy and rocky ridge country but also include extensive areas of semi-saline playa lakes and drainage depressions (NSW NP&WS 1996). Between the lakes and the ridge country are discontinuous aeolian lunettes and sandy levees.

Coverage of the geology is presented in NSW NP&WS (1996). Cretaceous sandstone and quartzite sediments of the Rolling Downs Group are exposed on the ridge country in the east of the reserve. The ridges are in some places capped by Cenozoic silcrete. Quaternary sediments on the Narran River floodplain overlie the Rolling Downs sediments. These include dark organic muds in the lakes and light grey clays in the nearby playa lakes. The surrounding lunettes are composed of orange sand while the younger dunes closer to the lakes are of yellow-white sands.

The Narran River has a small and shallow channel with a contiguous floodplain. The floodplain of the Narran River is Quaternary alluvium and extends for 120 km and averages about 65 km in width within New South Wales. It is contained by the higher ground around Lightning Ridge in the east and the Myuna and Cartlands Land System in the west (Dick 1993). A number of lakes occur along the main channel and the river terminates at Narran Lake. The river probably originally flowed onto the Barwon River in previous geological times but now only does so infrequently (Aldis 1987).

The Narran wetlands flood more frequently than most other wetlands in western New South Wales (NSW NP&WS 1996). Narran Lake fills approximately every two years (Aldis 1987). Clear Lake, within the reserve, fills first with waters later flowing onto Narran Lake (Aldis 1987). Clear Lake can drop quickly if flows are not sufficient (NSW NP&WS 1996). Once flooded, the smaller lakes usually hold water for four to nine months, while Narran Lake can hold water for two years. Flooding in the Narran Lakes is predominately (85%) a summer and autumn event.

History and landuse

Sir Thomas Mitchell and his party were the first recorded Europeans to pass through the Narran Lakes area (Mitchell 1848). Settlement of the district by Europeans began soon after Mitchell's visit. By the 1850s the frontages of the Darling River up to Wilcannia had been occupied with land to the east of the river only being used opportunistically after rain (NPWS 1996). The first squatters brought cattle, later replaced by sheep (Cunningham et al. 1981). The opal mining fields of Glengarry, Cumborah and Lightning Ridge opened up the area near Narran Lake. Currently the main usage in the region is sheep grazing with cattle numbers fluctuating due to market prices; Narran Lake itself is used for dry land cropping (Pickard & Norris 1994).

Previous investigations

During Mitchell's exploration of the Narran River in 1846 a number of new plant species were described (Mitchell 1848) including: *Anthistiria membranacea* Lindley (now *Iseilema membranaceum* (Lindley) Domin.), *Chenopodium auricomum* Lindley, *Haloragis glauca* Lindley, *Kochia lanosa* Lindley (now *Maireana lanosa* (Lindley) Paul G. Wilson), *Kochia villosa* Lindley (now *Maireana villosa* (Lindley) Paul G. Wilson), *Geijera parviflora* Lindley, *Loranthus aurantiacus* A.Cunn. ex Hook. (now included under *Amyema miquelii* (Lehm. ex Miq.) Teighem), *Loranthus linearifolius* Hook. (now *Lysiantha linearifolia* Teighem), and *Pittosporum salicinum* Lindley (now included with *Pittosporum. phylliraeoides* DC.). Later Cambage (1900a, 1900b) published annotated notes on the flora and communities around the Bourke, Cobar, Bogan River and Nyngan areas. Turner (1903, 1905) described the plant species of the Darling and northwestern New South Wales. Haviland (1911, 1913) discussed the flora and vegetation in the Cobar area. The first vegetation map of the western district of New South Wales was prepared by Noel Beadle in 1945 (Beadle 1948). Pickard and Norris (1994) have updated a large area of Beadle's map in their 1: 1 000 000 natural vegetation map of northwestern New South Wales.

Methods

Fifty 20 × 20 m quadrats were surveyed for vascular plants scored using the Braun-Blanquet (1982) cover abundance scale. Quadrats were placed using a stratified random method. As only a relatively low number of sites were used, physiography was used to stratify survey sites. The survey was conducted over five days in November of 1998.

Good quality material of species was retained as vouchers by the Narrabri District NSW NP&WS and duplicates of significant collections 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 and the analysis performed using

Kulczynski association measure which is recommended for ecological applications (Belbin 1995a, b) along with flexible UPGMA and the default PATN settings.

Delineation of community boundaries in Fig. 2 was based on the location of sites and their position within the multivariate analysis, air photograph interpretation and ground truthing. The vegetation map is based on 1: 50 000 topographic map produced by the Western Zone, NSW NP&WS. Structural names follow Specht et al. (1995) and are based on the most consistent uppermost stratum.

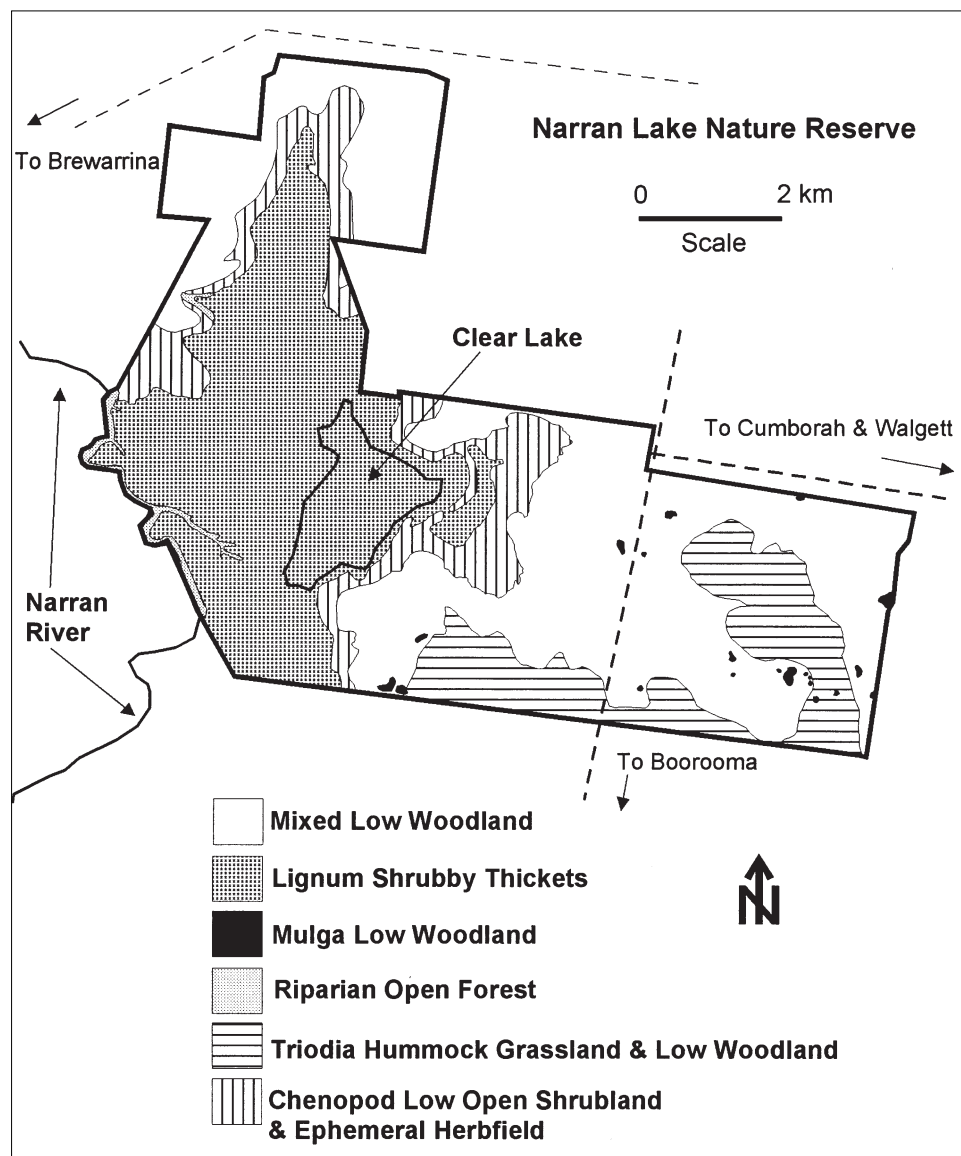


Fig. 2. Map of vegetation communities for Narran Lake Nature Reserve.

Results and Discussion

Seven communities (Table 1) were recognised at the dissimilarity measure of c. 0.8. A summary of the community relationships is given by the dendrogram (Fig. 3). The first major division on the dendrogram is the separation of the wetland areas. The next major division separates the fringing herb and shrublands, which may periodically be inundated, from the woodlands which are rarely inundated. In all 325 vascular plant taxa, from 62 families and 213 genera, were recorded from the collation of existing site data and subsequent sampling. Approximately 11% (37) of all taxa were introduced (Appendix).

Table 1: Selected attributes of the seven defined communities at Narran Lake Nature Reserve.

Note Chenopod Low Open Woodlands could not be mapped effectively at this scale and so the proportion of the reserve and number of hectares are estimates.

Community	Number of Sites	Richness per 400 m ² (average)	No. of Species	No. of Introduced Species	Proportion of Reserve	No. of Hectares
Mixed Low Woodlands	18	22–47 (38)	156	9	43.2%	3932
Mulga Low Woodlands	3	19–31 (24)	43	4	0.3%	31
Triodia Hummock Grasslands	6	13–30 (23)	60	3	11.9%	1079
Chenopod Low Open Shrubland	5	8–14 (12)	37	1	70.2%	730
Ephemeral Herbfields	4	9–13 (11)	31	3	11%	1000
Riparian Open Forests	4	8–22 (16)	43	4	1%	87
Lignum Shrubby Thickets	10	5–18 (12)	47	2	32.6	2971

Vegetation communities

The communities within Narran Lake Nature Reserve form structurally simple assemblages, low in height and foliage cover (usually < 30%). Although simple, these associations exhibit distinct layering. Figures in brackets represent maximum and minimum values.

Community 1: Mixed Low Woodlands: *Callitris glaucophylla* (White Cypress Pine) - *Geijera parviflora* (Wilga) - *Eucalyptus populnea* subsp. *bimbil* (Poplar Box)

Structure: Upper: (6–) 10–15 (–20) m; 10–20% cover. Middle: 3–6 (–8) m; 10–30 (–60)% cover. Herb: 0.1–0.2 m; (20–) 40–80%.

Trees: *Callitris glaucophylla*, *Geijera parviflora*, *Eucalyptus populnea* subsp. *bimbil*, *Atalaya hemiglaucula*, *Acacia pendula*, *Eucalyptus melanophloia*, *Hakea leucoptera*, *Acacia acuminata*, *Acacia excelsa*, *Acacia omalophylla*, *Alstonia constricta*.

Shrubs: *Chenopodium curvispicatum*, *Sida cunninghamii*, *Sclerolaena birchii*, *Sclerolaena convexula*, *Abutilon fraseri*, *Dodonaea viscosa*, *Eremophila mitchellii*, *Sida ammophila*, *Sida* sp. A, *Dissocarpus paradoxus*, *Teucrium racemosum*.

Climbers & trailers: *Einadia nutans*, *Glycine canescens*, *Evolvulus alsinoides*, *Convolvulus erubescens*, *Parsonsia eucalyptophylla*, *Boerhavia dominii*, *Jasminum linear*, *Boerhavia repleta*, *Kennedia procurrans*.

Ground cover: *Pimelea trichostachya*, *Calotis cuneifolia*, *Oxalis chnoodes*, *Ptilotus polystachyus*, *Calotis lappulacea*, *Eragrostis lacunaria*, *Rhodanthe moschata*, *Angianthus brachypappus*, *Nicotiana simulans*, *Austrostipa scabra*, *Calandrinia eremaea*, *Chenopodium melanocarpum*, *Plantago varia*, *Chamaesyce drummondii*, *Cheilanthes sieberi* subsp. *sieberi*.

Variability: *Atalaya hemiglauca*, *Grevillea striata* and *Ventilago viminalis* dominate areas of sandy red earths to the north-west of Narran Lake NR. *Eremophila mitchellii* and

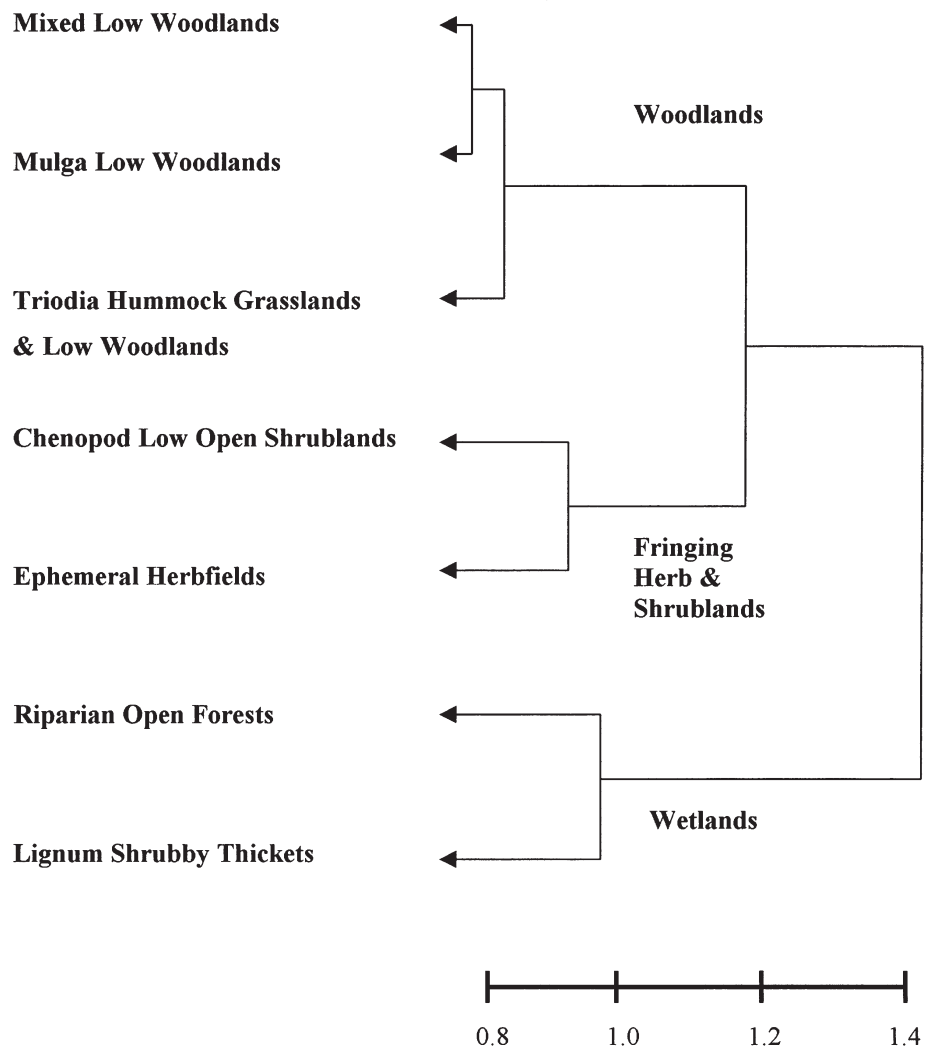


Fig. 3. Summary dendrogram of the full floristic dataset of sites using the Kulczynski association and flexible UPGMA fusion strategy and a value of -0.1. Communities have been defined at a dissimilarity level of c. 0.8.

Geijera parviflora are a frequent component of the understorey, a situation found throughout the range of *Eucalyptus populnea* (Neldner 1984). In areas cleared of *Eucalyptus populnea* the woody understorey taxa become prominent and form thickets. In a few places *Acacia cambagei* occurs within the matrix of the Mixed Woodlands. *Acacia excelsa* occurs as mono-specific stands in a few minor areas within *Eucalyptus populnea*. Such mosaics appear to be restricted to north of Bourke and east of Enngonia (Pickard & Norris 1994). In more disturbed sites and particularly over a large area of 'Lumeah', *Callitris glaucophylla* is dominant to the exclusion of most species (Pickard & Norris 1994). In a few minor depressions on the eastern side of Clear Lake, *Eucalyptus populnea* lined swamps are present. Despite the changes in overstorey taxa, all sites were still incorporated within the Mixed Stand Woodlands in analysis, thus suggesting the understorey (primarily ephemeral) species were remarkably similar. Species richness also did not change dramatically between sites within this community.

Conservation and management issues: Mixed Woodlands with *Callitris* extend widely across Australia though associated species differ across this range (Porteners 1993). In many areas of NSW *Callitris glaucophylla* dominant assemblages now occur only as remnants with heavily grazed understoreys. Much of the area in the south-east has been extensively cleared and rabbits have reduced the capacity of the trees to regenerate (Morcom & Westbrooke 1990, Fox 1991, Scott 1992, Porteners 1993). *Atalaya hemiglauca*, *Grevillea striata* and *Ventilago viminalis* dominate areas of sandy red earths to the north-west of Narran Lake NR. In western Queensland similar associations are widespread and occur on stony rises or limestone outcrops (Boylard 1984, Neldner 1984, Neldner 1991). The lack of *Eucalyptus populnea* and other eucalypt species from the western boundary of Narran Lake NR on the same soil type, and the dominance of tropical taxa such as *Atalaya hemiglauca*, *Ventilago viminalis*, *Grevillea striata* and *Hakea leucoptera* may be due to a long absence of fire, differences in soil moisture or the differential effects of drought. Disturbances such as fence construction and some clearing activities in neighbouring properties have stimulated the germination of *Eucalyptus populnea* in these localities. Local farmers state that the last fire in this area was almost 100 years ago. The *Atalaya* dominant sites represent an assemblage that is very restricted within New South Wales (and is only conserved in NSW in Nocholeche Nature Reserve — Specht et al. 1995).

Community 2: Mulga Low Woodlands: *Acacia aneura* (Mulga)

Structure: Upper: 8–12 m; 40–70% cover. Herb: 0.1–0.5 m; 80–100% cover.

Trees: *Acacia aneura*.

Shrubs: *Abutilon leucopetalum*, *Sida cunninghamii*, *Hibiscus sturtii*.

Climbers & trailers: *Convolvulus erubescens*.

Ground cover: *Calotis cuneifolia*, *Stuartina muelleri*, *Trachymene ochracea*, *Ptilotus polystachyus*, *Wahlenbergia stricta*, *Cheilanthes sieberi*, *Fimbristylis dichotoma*, *Goodenia hederacea*, *Pimelea trichostachya*, *Bracteantha bracteata*, *Brunoniella australis*, *Goodenia macbarroni*, *Tripogon loliiformis*, *Velleia arguta*, *Actinotus paddisonsii*, *Angianthus brachypappus*, *Bulbine semibarbata*, *Calandrinia eremaea*, *Daucus glochidiatus*, *Oxalis chnoides*.

Variability: Although *Acacia aneura* associations have a very wide range they do not form a single assemblage (Boyland 1984). The assemblage present within Narran Lake NR appears to be uniform and occurs in groves that are visually distinct from the surrounding Mixed Woodland matrix. Groving is rare on the eastern margin of the species distribution and is more common in arid areas further west (Boyland 1984, Pickard & Norris 1994).

Conservation and management issues: Large areas of Mulga Low Woodlands have been degraded, they are frequently used for drought fodder (Boyland 1984) and 'woody weeds' invade many. Of particular significance at Narran Lake is that the Mulga Low Woodlands is beyond the predicted eastern limit of its occurrence (Nix & Austin 1973). At present only 0.3% of the Narran Lake reserve is of this community. Mulga Woodlands do not occur in either of the nearby Culgoa NP or Macquarie Marshes NR.

Community 3: Triodia Hummock Grasslands & Low Woodlands: *Callitris glaucophylla* (White Cypress Pine) - *Eucalyptus melanophloia* (Silver-leaved Ironbark) - *Angophora melanoxylon* (Coolabah Apple) and *Triodia mitchellii* (Buck Spinifex)

Structure: Sometimes an Upper: 5–20 m; 10–20% cover. Grass: 1–2 m. 30–80% cover. Herb: 0.1 m; 10–40% (80) cover.

Trees: *Callitris glaucophylla*, *Eucalyptus melanophloia*, *Angophora melanoxylon*, *Acacia murrayana*, *Eucalyptus populnea* subsp. *bimbil*, *Geijera parviflora*.

Shrubs: *Dodonaea viscosa*, *Alstonia constricta*.

Climbers & trailers: *Glycine canescens*, *Glycine clandestina*, *Einadia nutans*, *Kennedia procurrens*.

Ground cover: *Triodia mitchellii*, *Actinotus paddisonsii*, *Wahlenbergia stricta*, *Calandrinia balonensis*, *Chrysocephalum apiculatum*, *Poranthera microphylla*, *Angianthus brachypappus*, *Calotis cuneifolia*, *Pimelea trichostachya*, *Calandrinia eremaea*, *Chenopodium melanocarpum*, *Nicotiana simulans*, *Arthropodium minus*, *Oxalis chnoodes*, *Ptilotus polystachyus*.

Variability: Large areas of almost pure *Triodia mitchellii* occur within the reserve. In some areas *Angophora melanoxylon* and *Eucalyptus melanophloia* may occur. Such an association is rare but is also known from small areas in south central Queensland and apparently only occurs in two localised areas north east of Brewarrina in NSW (Beadle 1981, Neldner 1984, Pickard & Norris 1994).

Conservation and management issues: The floristic composition of *Triodia* hummock grasslands is related to fire history and time since last burn. The abundance and diversity of forbs increase initially after fire and then decrease as hummocks mature (Neldner 1984, Neldner 1991). Woody species have been known to increase in *Triodia* communities after fire (Suijdendorp 1981, Maconochie 1982). Maher et al. (1995) state that *Triodia* becomes too thick for other native plant species to survive in any quantity if not regularly burnt. This however, is a proposal from a grazing perspective. Large and old *Triodia* are hollow in the middle and within these hollows a distinct suite of perennial and ephemeral herbs including restricted taxa such as *Actinotus paddisonsii*.

For large hollows to form the hummocks clumps must be of considerable age, as is the case at Narran Lake NR. As such, patchy long inter-fire periods may be beneficial to such communities.

Community 4: Chenopod Low Open Shrublands: *Sclerolaena decurrens* (Green Copperburr) - *Atriplex nummularia* (Old Man Saltbush) - *Halosarcia pergranulata* (Samphire)

Structure: Shrub: 0.1–0.5 m; 20–70% cover.

Trees: None apparent.

Shrubs: *Sclerolaena decurrens*, *Atriplex nummularia*, *Halosarcia pergranulata*, *Chenopodium desertorum*, *Sclerolaena parallelicuspis*, *Sclerolaena convexula*, *Osteocarpum dipterocarpum*, *Sida* sp. A, *Atriplex holocarpa*.

Climbers & trailers: None apparent.

Ground cover: *Eriochlamys* sp. A, *Bulbine semibarbata*, *Portulaca oleracea*, *Chloris truncata*, *Rhodanthe floribundum*, *Plantago varia*, *Wahlenbergia fluminalis*, *Trianthaema triquetra*, *Sporobolus actinocladus*, *Portulaca filifolia*, *Podolepis jaceoides*, *Ixiolaena brevicompta*, *Gypsophila tubulosa*, *Brachyscome ciliaris*, *Tripogon loliiformis*.

Variability: The composition of this community is highly variable, as is the ground cover. This variation is probably dependent on rainfall and whether the community is on gilgai.

Conservation and management issues: The Chenopod Low Open Shrublands appear to have very few correlates anywhere. It seems that as circumscribed here, these communities are restricted to the Narran River area and are thus not represented in any other reserves and are unique and of significance.

Community 5: Ephemeral Herbfields: *Eriochlamys* sp. A (Woolly Mantle) - *Tripogon loliiformis* (Five Minute Grass) - *Sclerolaena bicornis* (Goathead Burr)

Structure: Herb: 0.1–0.2 m; 30–80% cover.

Trees: None apparent.

Shrubs: *Sclerolaena bicornis*, *Sclerolaena parallelicuspis*, *Maireana appressa*, *Osteocarpum dipterocarpum*, *Neobassia proceriflora*, *Eremophila mitchellii*, *Atriplex holocarpa*, *Dodonaea viscosa*.

Climbers & trailers: *Tephrosia sphaerospora*, *Convolvulus erubescens*.

Ground cover: *Eriochlamys* sp. A, *Tripogon loliiformis*, *Actinobole uliginosum*, *Centaurium spicatum*, *Millotia greevesii*, *Lepidium monoplocoides*, *Wahlenbergia fluminalis*, *Chthonocephalus pseudovax*, *Podolepis jaceoides*, *Pimelea trichostachya*, *Fimbristylis dichotoma*, *Daucus glochidiatus*, *Crassula sieberiana*, *Calandrinia pumila*, *Brachyscome ciliaris*.

Variability: This community varies from sparse to dense herblands or sometimes-open tussock grasslands. The floristic composition and structure of the vegetation at a site is probably dependent on the flooding frequency and duration, season of flood,

soil characteristics and salinity (Aldis 1987, Neldner 1991). Chenopods are common after winter floods on scalded areas (Neldner 1991). Only a few species dominate at any given time.

Conservation and management issues: The Ephemeral Herbfields appear to have very few correlates anywhere. It seems that as circumscribed here, these communities are restricted to the Narran River area and are thus not represented in any other reserves and are unique and of significance. Somewhat similar herbfields are likely to be more widespread but have not been surveyed extensively as they are usually not acknowledged as having any conservation value.

Community 6: Riparian Open Forests: *Eucalyptus camaldulensis* (River Red Gum) - *Eucalyptus coolabah* (Coolibah) - *Eucalyptus largiflorens* (Black Box)

Structure: Upper: 8–20 m; 20–40% cover. Mid: 3–8 m; 10–30% cover. Herb: 1–2 m; 10–70% cover.

Trees: *Eucalyptus camaldulensis*, *Eucalyptus coolabah*, *Acacia brachystachya*, *Eucalyptus largiflorens*, *Acacia pendula*.

Shrubs: *Eremophila bignoniiflora*, *Muehlenbeckia florulenta*, *Sclerolaena divericata*, *Sclerolaena birchii*, *Sclerolaena parallelicuspis*, *Geijera parviflora*, *Chenopodium curvoispicatum*.

Climbers & trailers: *Einadia nutans*.

Ground cover: *Alternanthera denticulata*, *Crinum flaccidum*, *Stellaria angustifolia*, *Ixiolaena brevicompta*, *Euchiton sphaericus*, *Eleocharis plana*, *Marsilea costulifera*, *Haloragis glauca*, *Centipeda cunninghamii*, *Wahlenbergia fluminalis*, *Pratia concolor*, *Portulaca oleracea*, *Pluchea dentex*, *Plantago varia*, *Oxalis chnoodes*.

Variability: The ground layers are diverse and contain many ephemeral grasses and forbs that respond quickly to rainfall. Tall shrubs including *Acacia stenophylla* and *Eremophila bignoniiflora* are frequent. Where flooding is less frequent, away from riverbanks and along minor channels; *Eucalyptus coolabah* becomes prevalent as the overstorey species. *Eucalyptus largiflorens* also occurs away from the main channel on slightly higher ground, but is less prevalent along the Narran River than in areas further south.

Conservation and management issues: Although *Eucalyptus camaldulensis* dominated communities are known from many inland rivers they differ along their length in terms of associated species (Scott 1992). Across their range Riparian Open Forests have been modified extensively by grazing and logging (Helman & Estella 1983, Scott 1992). The extent of River Red Gum communities is misleading as, in most situations, they are usually only one to three crown diameters wide. Their high boundary length to area ratio makes them prone to weed infestations and disturbance (Sivertsen & Metcalfe 1995). Changes in flooding regimes due to river regulation has led to a decline in recruitment and the quality of the stands of Riparian Forests in many areas (Porteners 1993). Significant areas of this community are reserved in the nearby Culgoa NP and the Macquarie Marshes NR.

Community 7: Lignum Shrubby Thickets: *Muehlenbeckia florulenta* (Lignum) - *Phragmites australis* (Common Reed) - *Eucalyptus camaldulensis* (River Red Gum)

Structure: Variable. Upper: 6–15 m; 20–40% cover. Mid: 1–4 m; 30–90% cover. Herb: 0.05–0.3 m; (0) 10–80% cover.

Trees: *Eucalyptus camaldulensis*, *Acacia stenophylla*.

Shrubs: *Muehlenbeckia florulenta*, *Atriplex vesicaria*, *Sclerolaena convexula*, *Abutilon leucopetalum*.

Climbers & trailers: None apparent.

Ground cover: *Azolla filiculoides* var. *rubra*, *Eleocharis plana*, *Calotis scapigera*, *Stellaria angustifolia*, *Marsilea drummondii*, *Lemna disperma*, *Haloragis glauca*, *Cyperus gymnocaulos*, *Myriophyllum verrucosum*, *Phragmites australis*, *Goodenia glauca*, *Rorippa eustylis*, *Cyperus bifax*, *Cynodon dactylon*, *Alternanthera angustifolia*, *Limosella australis*.

Variability: On the margins or in-between major lignum occurrences other associations occur including *Eleocharis plana* and *Cyperus bifax* sedgelands and/or *Marsilea drummondii* herbfields. Such assemblages have been found at 'Kirramingly' near Gurley (Clarke et al. 1998). In less flood prone areas *Acacia stenophylla* occurs with a dense Lignum understorey. *Eucalyptus camaldulensis* will also occur with a dense Lignum understorey. The ground cover is dependent on flooding duration.

Conservation and management issues: Narran Lakes Nature Reserve includes some of the largest expanses of Lignum Shrubby Thickets in NSW (Aldis 1987, NSW NP&WS 1996). Lakebed cropping and subsequent clearing of Lignum have become common practice in many other areas of the state (Aldis 1987, Briggs 1994) and it is estimated that 40% of NSW Lignum areas have been cleared in the last 20 years, with much of the remainder being grazed and disturbed by feral pigs (Scott 1992, Porteners 1993, Porteners et al. 1997). Lignum communities are in both the Culgoa NP and the Macquarie Marshes NR. Within the Lignum Shrubby Thickets are small areas of *Phragmites australis*. *Phragmites* assemblages are inadequately represented in conservation reserves and many are grazed (NP&WS 1990). The nearby Macquarie Marshes NR contains the largest *Phragmites* area in south-eastern Australia.

General Discussion

Although very little can be grasped from the account of Mitchell (1848) some minor comparisons can be made. Of particular note, are the dense and tall grasslands that Mitchell thought were some of the best he had ever seen in the colony. In particular, *Panicum laevinode* was up to the saddles on the horses. This species was not found during this current survey. A number of the new species whose type specimens were collected along the Narran River by Mitchell were also not located during this survey. Some of this may be explained by the seasonal changes in ephemeral communities, in particular the change from herb dominated to grass dominated after flooding. However, it is likely that significant changes may have occurred over the last 150 years due to grazing and farming practices, which may include changes in fire regimes.

A large number of communities of western NSW are broadly synonymous with those described for Narran Lake NR, but only a few are directly comparable as most previous surveys describe communities with similar dominants but largely different co-dominants and understoreys. The most directly comparable works are those of Beadle (1948, 1981) and Pickard & Norris (1994), descriptive works based on qualitative community definition. Very few communities at Narran Lake NR are synonymous with those in Specht et al. (1995) though the lack of quantitative studies in north western New South Wales probably accounts for lack of direct comparison. There appears to be no 'Lignum' communities in Specht et al. even though they are apparently common throughout the state and have been identified in quantitative analyses many times.

The most directly comparable work is that of Dick (1993). Across the Wombeira Land System, which included the Narran River, Dick placed 65 sites (20 × 40 m and 20 × 20 m). 175 species were found during his survey, with an additional 230 being recorded from collating previous survey records over 19 years (1969–1988). Dick found an average of 20.4 species per site overall, with 25.4 in vegetation away from channelised country and 20 species per site within. Within similar land systems in Narran Lake NR a total of 120 species were found from 22 sites, incorporating 55% of the total number known and 71% of those recorded by Dick. However, the average species richness of sites at Narran Lake Nature Reserve was 12.6, decidedly less than the 20.4 recorded by Dick. This may be explained, but only partly, by the larger size of some of the quadrats used by Dick.

Dick (1993) also qualitatively delineated eleven communities within five structural classes. These 11 communities are circumscribed by two of the communities defined here for Narran Lake Nature Reserve (Community 6: Riparian Open Forests and Community 7: Lignum Shrubby Thickets). Extra sampling may have aided the delineation of more communities within these two though it is unlikely that as many classes of vegetation as described by Dick (1993) actually exist.

Despite such limitations, the general distribution and affinities of all communities described here for Narran Lake NR can be placed into regional and national perspectives as southern outliers of more widely distributed assemblages further north and over the Queensland border.

Conservation Issues

Benson (1989) lists the conservation status of most of the major plant communities in western New South Wales as poor or very poor. Only 2% of the western plains are conserved in national parks or nature reserves (Benson 1991), with only 3% reserved in the north-western sector (Pickard & Norris 1994). Recent analysis by the NP&WS has shown that only 0.83% of the Darling Riverine Plains Bioregion are currently conserved. Of all the vulnerable plants in New South Wales, 44% occur on the western slopes and plains (Benson 1989, Benson 1991). It has been estimated that up to 95% of the original native vegetation has been changed by cropping or pasture improvement in the Murray Darling Basin (Sivertsen & Metcalfe 1995).

Two species currently listed on the *NSW Threatened Species Conservation Act 1995* were found within the reserve and eleven others were thought regionally significant. The herb *Lepidium monoplocoides* (family Brassicaceae) found within Mixed Stand Woodlands is listed as endangered (TSC Act) and ROTAP (3ECi), and is known from semi-arid regions of New South Wales, Victoria and possibly South Australia. The herb *Goodenia macbarroni* (family Goodeniaceae) also found within Mixed Low Woodlands is listed as vulnerable (TSC Act) and ROTAP (3VC-) and found from the Darling Downs in Queensland to northeastern Victoria on the tablelands and slopes. Eleven other significant species are of conservation significance as they are disjunct or thought to be at or near their geographic limit. These species add to the overall importance of Narran Lake NR. These taxa are: *Anacampseros australiana*, *Glossostigma diandrum*, *Kennedia procurrens*, *Myriophyllum striatum*, *Nymphoides geminata*, *Pluchea dentex*, *Rorippa eustylis*, *Trachymene ochracea*, *Velleia arguta* and *Zaleya galericulata* subsp. *australis*.

Conclusion

Seven distinct vegetation communities have been identified within Narran Lake Nature Reserve, a number of which are noted for their restricted occurrence and poorly conserved nature. Drainage or time and duration of inundation are the major environmental correlates associated with the delineation of communities. A number of species are significant regionally and two are significant nationally. The park is of regional and national significance but is threatened by impacts of reduced water flows to the wetlands as a result of diversion for irrigation.

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Appendix: Flora of Narran Lake Nature Reserve.

Nomenclature follows that of Harden (1990–1993) except where recent changes have occurred. Taxa found within the survey sites are scored according to their occurrence in each of the 7 communities defined. Some taxa were found in previous surveys or opportunistically and therefore are not assigned to a specific community. 1 = Mixed Low Woodlands, 2 = Mulga Low Woodlands, 3 = Triodia Hummock Grasslands, 4 = Chenopod Low Open Shrublands, 5 = Ephemeral Herbfields, 6 = Riparian Open Forests, 7 = Lignum Shrubby Thickets.

FERNS AND ALLIES		<i>Cyperus difformis</i>	7
Azollaceae		* <i>Cyperus eragrostis</i>	6
<i>Azolla filiculoides</i> var. <i>rubra</i>		<i>Cyperus flaccidus</i>	1, 7
		<i>Cyperus gymnocaulos</i>	7
Isoetaceae		<i>Cyperus squarrosus</i>	
<i>Isoetes drummondii</i>		<i>Eleocharis pallens</i>	
		<i>Eleocharis plana</i>	6, 7
Marsileaceae		<i>Eleocharis pusilla</i>	6, 7
<i>Marsilea costulifera</i>	6, 7	<i>Fimbristylis dichotoma</i>	1, 2, 3, 5
<i>Marsilea drummondii</i>	7	<i>Fimbristylis velata</i>	
		<i>Isolepis victoriensis</i>	
Salviniaceae		<i>Schoenoplectus dissachanthus</i>	
* <i>Salvinia molesta</i>			
Sinopteridaceae		Hydrocharitaceae	
<i>Cheilanthes distans</i>	1	<i>Ottelia ovalifolia</i>	
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	1, 2, 3		
GYMNOSPERMS		Juncaceae	
Cupressaceae		<i>Juncus flavidus</i>	7
<i>Callitris glaucophylla</i>	1, 3		
		Lemnaceae	
MONOCOTYLEDONS		<i>Lemma disperma</i>	7
Alismataceae			
<i>Damasonium minus</i>		Phormiaceae	
		<i>Dianella longifolia</i> var. <i>porracea</i>	1, 6
Amaryllidaceae			
<i>Crinum flaccidum</i>	6	Poaceae	
		<i>Agrostis avenacea</i> var. <i>avenacea</i>	1, 2, 4, 6, 7
Anthericaceae		<i>Aira cupaniana</i>	1, 5, 6
<i>Anthropodium minus</i>	1, 3	<i>Amphibromus neesii</i>	
<i>Thysanotus tuberosus</i> subsp. <i>tuberosus</i>		<i>Amphipogon caricinus</i> var. <i>caricinus</i>	1
		<i>Aristida jerichoensis</i> subsp. <i>subspinulifera</i>	1
Asphodelaceae		<i>Astrebla elymoides</i>	
<i>Bulbine semibarbata</i>	1, 2, 3, 4, 6, 7	<i>Astrebla lappacea</i>	
		<i>Astrebla pectinata</i>	
Centrolepidaceae		<i>Astrebla squarrosa</i>	
<i>Centrolepis strigosa</i>		<i>Austrostipa scabra</i> subsp. <i>scabra</i>	1, 3
		* <i>Bromus cartharticus</i>	
Commelinaceae		* <i>Cenchrus ciliaris</i>	1
<i>Commelina cyanea</i>	1	<i>Chloris truncata</i>	1, 4
		<i>Cynodon dactylon</i>	7
Cyperaceae		<i>Dactyloctenium radulans</i>	
<i>Bulbostylis barbata</i>	1, 3	<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	
<i>Cyperus bifax</i>	7	<i>Digitaria ammophila</i>	1

<i>Diplachne fusca</i>			
<i>Enteropogon acicularis</i>	1		
<i>Eragrostis dielsii</i>	4		
<i>Eragrostis eriopoda</i>			
<i>Eragrostis lacunaria</i>	1		
<i>Eragrostis laniflora</i>	1, 3		
<i>Eragrostis parviflora</i>	5		
<i>Eragrostis setifolia</i>			
* <i>Festuca pratensis</i>	5		
<i>Homopholis proluta</i>			
* <i>Hordeum leporinum</i>			
<i>Monachather paradoxa</i>	1		
<i>Neurachne munroi</i>			
<i>Panicum decompositum</i>			
* <i>Panicum miliacem</i>			
<i>Paspalidium jubiflorum</i>	4, 7		
<i>Perotus rara</i>			
<i>Phragmites australis</i>	7		
<i>Sporobolus actinocladius</i>	4		
<i>Sporobolus caroli</i>	1		
<i>Themeda triandra</i>	1		
<i>Thyridolepis mitchelliana</i>	1, 2		
<i>Thyridolepis xerophila</i>	1		
<i>Tragus australianus</i>	1		
<i>Triodia mitchellii</i>	1, 3		
<i>Tripogon loliiformis</i>	1, 2, 3, 4, 5		
<i>Triraphis mollis</i>	2		
<i>Urochloa gilesii</i>			
DICOTYLEDONS			
Acanthaceae			
<i>Brunoniella australis</i>	1, 2		
<i>Rostellularia adscendens</i> subsp. <i>adscendens</i> var. <i>pogonantha</i>	1		
Aizoaceae			
<i>Mollugo cerviana</i>			
<i>Tetragonia tetragonoides</i>			
<i>Trianthaema triquetra</i>			
<i>Zaleya galericulata</i>			
Amaranthaceae			
<i>Alternanthera angustifolia</i>	7		
<i>Alternanthera denticulata</i>	1		
* <i>Alternanthera pungens</i>			
<i>Ptilotus obovatus</i> var. <i>obovatus</i>	1, 2		
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	1, 2, 3		
Anacardiaceae			
* <i>Schinus areira</i>			
Apiaceae			
<i>Actinotus paddisonsii</i>		1, 2, 3	
<i>Daucus glochidiatus</i> form C		1, 2, 4, 5	
<i>Trachymene ochracea</i>		1, 2	
Apocynaceae			
<i>Alstonia constricta</i>		1, 3	
<i>Parsonsia eucalyptophylla</i>		1	
<i>Parsonsia lanceolata</i>			
Asclepiadaceae			
<i>Marsdenia australis</i>			
Asteraceae			
<i>Actinobole uliginosum</i>		1, 5	
<i>Angianthus brachypappus</i>		1, 2, 3	
<i>Brachyscome basaltica</i> var. <i>gracilis</i>			
<i>Brachyscome ciliaris</i> var. <i>ciliaris</i>		4, 5, 6	
<i>Brachyscome goniocarpa</i>		3	
<i>Brachyscome gracilis</i>			
<i>Brachyscome heterodonta</i> var. <i>heterodonta</i>			
<i>Brachyscome</i> sp. A			
<i>Brachyscome</i> sp. B			
<i>Bracteantha bracteata</i>		2	
<i>Calocephalus sonderi</i>		1	
<i>Calotis cuneifolia</i>		1, 2, 3	
<i>Calotis lappulacea</i>		1, 2	
<i>Calotis scapigera</i>		6, 7	
* <i>Centaurea solstitialis</i>		1	
<i>Centipeda cunninghamii</i>		1, 4, 6, 7	
<i>Centipeda minima</i> var. <i>minima</i>		1, 4	
<i>Centipeda thespidioides</i>			
<i>Chrysocephalum apiculatum</i>		1, 3	
<i>Chrysocephalum semipapposum</i>			
<i>Chthonocephalus pseudovax</i>		1, 3, 5	
* <i>Conyza albida</i>		1, 7	
* <i>Conyza bonariensis</i>			
<i>Eclipta platyglossa</i>			
<i>Eriochlamys</i> sp. A		1, 3, 4, 5	
<i>Euchiton sphaericus</i>		1, 6	
<i>Glossogyne tannensis</i>		1	
* <i>Hedypnois rhagadioloides</i> subsp. <i>cretica</i>			
* <i>Hypochoeris glabra</i>		1, 2, 3, 5	
<i>Ixiolaena brevicompta</i>		4, 6, 7	
* <i>Lactuca serriola</i>		2, 7	
<i>Lemooria burkittii</i>			
<i>Millotia greevesii</i> subsp. <i>greevesii</i> var. <i>glandulosa</i>		1, 3, 5	
<i>Minuria integerrima</i>		6	
<i>Pluchea dentex</i>		4, 5, 6	

<i>Podolepis jaceoides</i>	1, 3, 4, 5, 6, 7	<i>Spergularia rubra</i>	7
<i>Podolepis longipedata</i>		<i>Stellaria angustifolia</i>	1, 4, 6, 7
<i>Psuedognaphalium luteoalbum</i>	1		
<i>Pycnosorus chrysanthes</i>		Chenopodiaceae	
<i>Rhodanthe floribunda</i>	1, 4	<i>Atriplex holocarpa</i>	4, 5
<i>Rhodanthe moschata</i>	1, 2, 3	<i>Atriplex nummularia</i>	4
<i>Senecio quadridentatus</i>	2, 3	<i>Atriplex vesicaria</i> subsp. <i>macrocystidia</i>	7
<i>Senecio runcinifolius</i>	1, 2, 7	<i>Chenopodium auricomum</i>	
* <i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	1	<i>Chenopodium curvispicatum</i>	1, 3, 6
* <i>Soliva anthemifolia</i>		<i>Chenopodium desertorum</i> subsp. <i>desertorum</i>	4
* <i>Sonchus oleraceus</i>	1	<i>Chenopodium melanocarpum</i>	1, 3
<i>Stuartina muelleri</i>	1, 2	<i>Dissocarpus paradoxus</i>	1
* <i>Verbesina encelioides</i> subsp. <i>encelioides</i>	1, 3	<i>Einadia nutans</i> subsp. <i>eremaea</i>	1, 3, 6
<i>Vittadinia cervicularis</i> var. <i>cervicularis</i>	3	<i>Einadia nutans</i> subsp. <i>linifolia</i>	6
<i>Vittadinia pustulata</i>	3	<i>Einadia nutans</i> subsp. <i>nutans</i>	6
<i>Vittadinia sulcata</i>	1, 2	<i>Enchylaena tomentosa</i>	
* <i>Xanthium italicum</i>		<i>Halosarcia pergranulata</i>	4
* <i>Xanthium occidentale</i>		<i>Maireana appressa</i>	1, 5
* <i>Xanthium spinosum</i>	1, 2	<i>Maireana coronata</i>	1
		<i>Malacocera albolanata</i>	
Boraginaceae		<i>Neobassia proceriflora</i>	5
<i>Cynoglossum australe</i> var. <i>australe</i>	1, 3	<i>Osteocarpum dipterocarpum</i>	4, 5
* <i>Heliotropium supinum</i>		<i>Salsola kali</i> var. <i>kali</i>	1
		<i>Sclerolaena bicornis</i> var. <i>bicornis</i>	1, 2, 5
Brassicaceae		<i>Sclerolaena birchii</i>	1, 3, 6
<i>Harmsiodoxa brevipes</i> var. <i>major</i>	1, 3	<i>Sclerolaena convexula</i>	1, 4, 7
* <i>Lepidium bonariense</i>	1	<i>Sclerolaena decurrens</i>	4
<i>Lepidium monoplocoides</i>	5	<i>Sclerolaena diacantha</i>	
<i>Lepidium pseudohyssopifolium</i>	7	<i>Sclerolaena divericata</i>	6
<i>Lepidium sagittulatum</i>	5	<i>Sclerolaena parallelicuspis</i>	3, 4, 5, 6
<i>Rorippa eustylis</i>	7		
		Clusiaceae	
Cactaceae		<i>Hypericum gramineum</i>	1, 4, 6, 7
* <i>Opuntia stricta</i>	1		
		Convolvulaceae	
Campanulaceae		<i>Convolvulus erubescens</i>	1, 2, 5
<i>Wahlenbergia fluminalis</i>	1, 4, 5, 6	* <i>Cuscuta campestris</i>	
<i>Wahlenbergia graniticola</i>	1	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>	1
<i>Wahlenbergia stricta</i> subsp. <i>alternata</i>	1, 2, 3	* <i>Ipomoea hederifolia</i>	
Capparaceae		Crassulaceae	
<i>Apophyllum anomalum</i>		<i>Crassula helmsii</i>	
<i>Capparis lasiantha</i>		<i>Crassula sieberiana</i>	1, 3, 4, 5
<i>Capparis mitchellii</i>			
		Cucurbitaceae	
Caryophyllaceae		* <i>Citrullus lanatus</i>	
<i>Gypsophila tubulosa</i>	1, 3, 4		
<i>Polycarpaea corymbosa</i> var. <i>minor</i>	1	Droseraceae	
* <i>Spergula arvensis</i>	1, 7	<i>Drosera peltata</i>	3
* <i>Spergularia diandra</i>			

Elantinaceae		<i>Haloragis glauca</i>	6, 7
<i>Elatine gratioloides</i>		<i>Myriophyllum striatum</i>	
		<i>Myriophyllum verrucosum</i>	7
Euphorbiaceae		Lamiaceae	
<i>Chamaesyce drummondii</i>	1, 2, 3	<i>Ajuga australis</i>	1
<i>Phyllanthus virgatus</i>	1	<i>Lycopus australis</i>	7
<i>Poranthera microphylla</i>	3	<i>Teucrium racemosum</i>	1
Fabaceae		Lobeliaceae	
<i>Acacia acuminata</i> subsp. <i>birkittii</i>	1	<i>Pratia concolor</i>	6
<i>Acacia aneura</i>	1, 2	<i>Pratia darlingensis</i>	
<i>Acacia brachystachya</i>	1, 6	Loranthaceae	
<i>Acacia cambagei</i>		<i>Amyema miquelii</i>	
<i>Acacia caroleae</i>		<i>Amyema pendula</i> subsp. <i>longifolium</i>	
<i>Acacia deanei</i> subsp. <i>deanei</i>	1	<i>Dendrophthoe glabrescens</i>	
<i>Acacia excelsa</i>	1	<i>Lysiana exocarpi</i>	
<i>Acacia ligulata</i>		Malvaceae	
<i>Acacia murrayana</i>	3	<i>Abutilon fraseri</i>	1
<i>Acacia omalophylla</i>	1	<i>Abutilon leucopetalum</i>	1, 2, 7
<i>Acacia oswaldii</i>	1	<i>Hibiscus sturtii</i> var. <i>sturtii</i>	1, 2
<i>Acacia pendula</i>	1, 6	<i>Sida ammophila</i>	1
<i>Acacia stenophylla</i>	7	<i>Sida cunninghamii</i>	1, 2
<i>Aeschynomone indica</i>	7	<i>Sida</i> sp. A	1, 4
* <i>Astragalus hamosus</i>		Meliaceae	
<i>Glycine canescens</i>	1, 3	<i>Owenia acidula</i>	1
<i>Glycine clandestina</i>	3	Menyanthaceae	
<i>Kennedia procurrans</i>	1, 3	<i>Nymphoides crenata</i>	7
<i>Muelleranthus denticulatus</i>	3	<i>Nymphoides geminata</i>	7
<i>Senna artemisioides</i> nothosubsp. <i>artemisioides</i>		Myoporaceae	
<i>Swainsona swainsonioides</i>	1	<i>Eremophila bignoniiflora</i>	1, 6
<i>Tephrosia sphaerospora</i>	1, 3, 5	<i>Eremophila longifolia</i>	1
* <i>Vicia sativa</i> subsp. <i>sativa</i>		<i>Eremophila maculata</i>	
Gentianaceae		<i>Eremophila mitchellii</i>	1, 5
<i>Centaurium spicatum</i>	1, 4, 5	<i>Myoporum montanum</i>	
Geraniaceae		Myrtaceae	
* <i>Erodium cygnorum</i> subsp. <i>glandulosum</i>	1, 2	<i>Angophora melanoxydon</i>	3
Goodeniaceae		<i>Eucalyptus camaldulensis</i>	6, 7
<i>Brunonia australis</i>	1, 2, 3	<i>Eucalyptus coolabah</i>	6
<i>Goodenia delicata</i>	6	<i>Eucalyptus largiflorens</i>	6
<i>Goodenia glauca</i>	7	<i>Eucalyptus melanophloia</i>	1, 3
<i>Goodenia gracilis</i>		<i>Eucalyptus populnea</i> subsp. <i>bimbil</i>	1, 3
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	1, 2	Nyctaginaceae	
<i>Goodenia macbarroni</i>	1, 2	<i>Boerhavia dominii</i>	1
<i>Velleia arguta</i>	1, 2	<i>Boerhavia repleta</i>	1
Haloragaceae			
<i>Haloragis aspera</i>	7		

Oleaceae		<i>Santalum lanceolatum</i>	1
<i>Jasminum lineare</i>	1		
Onagraceae		Sapindaceae	
<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	7	<i>Alectryon oleifolius</i>	
* <i>Oenothera mollissima</i>	1, 3, 4	<i>Atalaya hemiglauca</i>	1
		<i>Dodonaea viscosa</i> var. <i>angustissima</i>	1, 3, 5
Oxalidaceae		Scrophulariaceae	
<i>Oxalis chnoodes</i>	1, 2, 3, 6, 7	<i>Gratiola pedunculata</i>	
<i>Oxalis perennans</i>	1	<i>Glossostigma diandrum</i>	1
		<i>Limosella australis</i>	7
Pittosporaceae		Solanaceae	
<i>Pittosporum phylliraeoides</i>	1	* <i>Lycium ferocissimum</i>	
Plantaginaceae		<i>Nicotiana simulans</i>	1, 3
<i>Plantago varia</i>	1, 2, 4, 6	<i>Solanum cleistogamum</i>	1
Polygonaceae		<i>Solanum esuriale</i>	
<i>Muehlenbeckia florulenta</i>	1, 6, 7	<i>Solanum ferocissimum</i>	1, 3
<i>Persicaria prostrata</i>	7	<i>Solanum nigrum</i>	
<i>Rumex stenoglottis</i>		<i>Solanum stuartianum</i>	1
<i>Rumex tenax</i>		Sterculiaceae	
Portulacaceae		<i>Brachychiton populneus</i> subsp. <i>trilobus</i>	
<i>Anacampseros australiana</i>		<i>Melhania oblongifolia</i>	1
<i>Calandrinia balonensis</i>	1, 2, 3	Thymelaeaceae	
<i>Calandrinia eremaea</i>	1, 2, 3, 4	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	1
<i>Calandrinia ptychosperma</i>		<i>Pimelea trichostachya</i>	1, 2, 3, 5
<i>Calandrinia pumila</i>	5	Verbenaceae	
<i>Portulaca filifolia</i>	4	* <i>Phyla nodiflora</i>	6, 7
<i>Portulaca oleracea</i>	1, 4, 6, 7	* <i>Verbena officinalis</i>	6
Primulaceae		Violaceae	
* <i>Anagallis arvensis</i>		<i>Hybanthus monopetalus</i>	3
Proteaceae			
<i>Grevillea striata</i>	1		
<i>Hakea leucoptera</i>	1		
Rhamnaceae			
<i>Ventilago viminalis</i>	1		
Rubiaceae			
<i>Canthium oleifolium</i>	1		
<i>Synaptantha tillaeacea</i>	1		
Rutaceae			
<i>Eremocitrus glauca</i>			
<i>Flindersia maculosa</i>	1		
<i>Geijera parviflora</i>	1, 3, 6		
Santalaceae			
<i>Exocarpos cupressiformis</i>	1		