

Vegetation of Culgoa National Park, central northern New South Wales

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Abstract: The vegetation of Culgoa National Park (22 986 ha in area; 29°15' S, 147°15' E) in the central north of New South Wales, approximately 40 km west of Goodooga and adjoining the NSW/Queensland border, is described. Six vegetation communities are delineated based on UPGMA analysis of cover-abundance scores of all vascular plant taxa. These communities are mapped based on ground truthing and air photo interpretation. All communities are simple in structure being primarily woodlands, shrublands and grasslands. Communities described are: 1) *Eucalyptus coolabah* Woodlands, 2) *Muehlenbeckia florulenta* Shrubby Thickets, 3) *Eucalyptus coolabah* – *Acacia pendula* Woodlands & Grasslands, 4) *Eucalyptus largiflorens* – *Eucalyptus coolabah* Woodlands, 5) *Eucalyptus largiflorens* – *Alectryon oleifolius* Woodlands, 6) *Callitris glaucophylla* – *Eucalyptus populnea* Woodlands and Shrublands. A total of 240 vascular plant taxa were found of which 8% were exotic in origin. Conservation issues are discussed.

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Introduction

Culgoa National Park (29°15' S, 147°15' E) is located near Weilmoringle, in the central north of New South Wales, approximately 40 km west of Goodooga and 80 km north of Brewarrina. The Park occupies 22 986 ha between the Culgoa River and the NSW/Queensland Border and adjoins Culgoa Floodplain National Park in Queensland (Fig. 1). The Park was dedicated in 1996. Recent additions, including the properties of *Dieminga*, *Pinegrove* and *Old Toulby* may increase the current reserve size by as much as 60%, but were not part of this investigation.

The Culgoa, Binnie, Bokhara and Narran Rivers are four branches that split from the lower reaches of the Balonne River south of St George, in Queensland. The Culgoa River eventually enters the Barwon River upstream from Bourke.

This paper reports on floristic survey and vegetation mapping (Hunter & Earl 2002) conducted for Bourke District of the NSW National Parks and Wildlife Service to provide baseline data for the Park, to map vegetation communities, and to provide information on the distribution of rare or geographically restricted or disjunct taxa, and associated conservation issues.

Climate

The climate of Culgoa National Park is semi-arid with an average annual rainfall of 375 mm (Dick 1993). The monthly rainfall is variable with a larger summer peak (in the longterm), but also a winter peak. Years with less than 250 mm often occur in pairs or threes causing drought conditions (Aldis 1987). Despite the large droughts of the late 1890s, the period prior to 1910 was wetter than from 1911 to

1947 (Gentilli 1971). Since that time the rainfall has been substantially higher and there has been an increase in the amount of summer rainfall (Pickard & Norris 1994). There are long hot summers and short cold winters. The average maximum and minimum temperatures for summer are 36°C and 21°C, and for winter are 18°C and 6°C, with an average of 76 frost days per year (AUSLIG 1990).

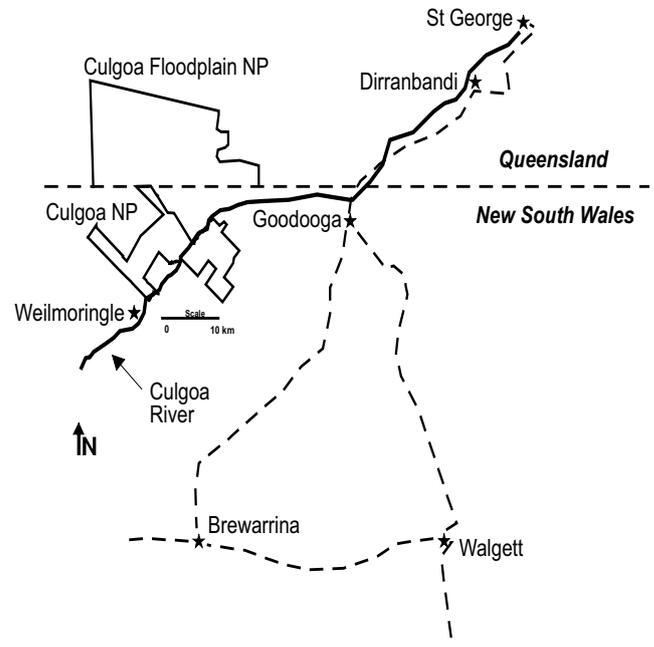


Fig. 1. Location of Culgoa National Park in central northern NSW.

Previous investigations

Early botanical work in north-western NSW includes Cambage (1900a; 1900b) around Bourke, Cobar, Bogan River and Nyngan; Turner (1903; 1905) Darling River area and Haviland (1911; 1913) for the Cobar area. Beadle (1948) produced the first vegetation map of the west, at 1: 1 024 000 scale in difficult conditions before the advent of aerial photographs (Beadle 1981; Beadle 1995). Pickard and Norris (1994) updated a large area of Beadle's map, based on reinterpretation of previous 1:250 000 map sheets, with greater ground truthing. Dick (1993) conducted an intensive floristic survey and produced a vegetation map of the Wombeira Land System which covers 32% of the Park. Though covering an extensive land system, this work used a variable plot size and the assemblages described were not based on statistical analyses, making cross comparisons with other areas difficult (Hunter et al. 2001). Other minor unpublished vegetation mapping products based on Land System types (Soil Conservation Service 1991) or on underlying soil type have been produced. The Departments of Infrastructure and Natural Resources, and Environment and Conservation have recently been mapping vegetation on 1: 100 000 map sheets that cover the Culgoa area; however these were not available for general release at the time of preparing this work.

Overall, most survey work, except for the most recent, have delineated plant communities on an a priori basis or circumscribed them based on field experience without numerical analysis. This has resulted in a number of unusual floristic units going unnoticed, and a number of other communities being defined on changes in structure or single overstorey taxa that, though of relevance to faunal assemblages and land management issues, often has little relevance to overall floristic resemblance.

Methods

In February 1999, 42 quadrats across Culgoa National Park, each 20 x 20 m in size were surveyed for vascular plants scored using the Braun-Blanquet (1982) cover abundance scale. Quadrats were placed using a stratified random method stratified by physiography. 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 UPGMA clustering and the default PATN settings.

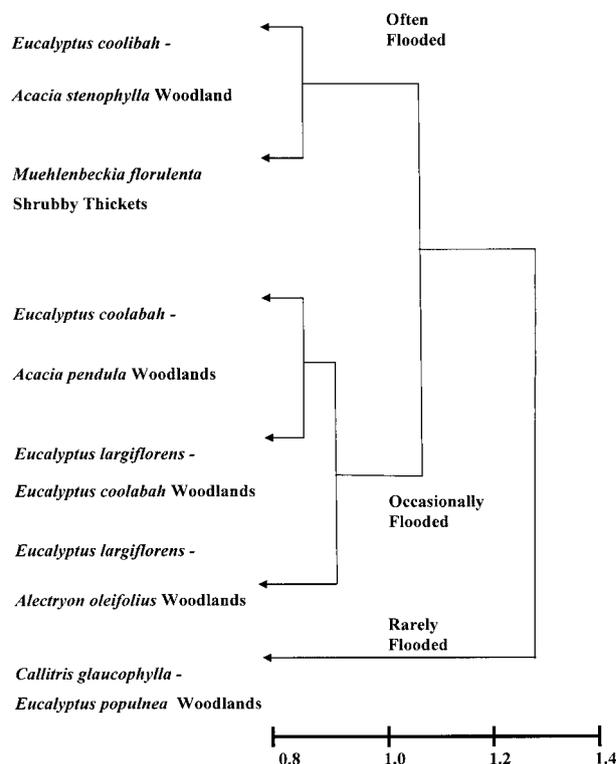


Table 1. Selected attributes of the six defined communities at Culgoa National Park. Note Lignum Open Shrublands could not be mapped effectively at this scale and so the proportion of the Park and the number of hectares are estimates.

Community	Number of sites	Richness per 400 m ²	Number of taxa	Number of introduced species	Proportion of Park	Area (ha)
C 1	13	11–39 (27)	98	2	30 %	6 754
C 2	2	24–26 (25)	40	3	2 %	460
C 3	12	23–42 (33)	121	4	44 %	10 125
C 4	5	21–33 (30)	71	3	12 %	2 698
C 5	4	16–38 (22)	57	2	8 %	1766
C 6	6	22–33 (26)	76	4	69 %	1 588

Fig. 2. Summary dendrogram of the full floristic dataset of sites using the Kulczynski association and UPGMA fusion strategy and a beta value of -0.1. Communities have been defined at a dissimilarity level of 0.8.

Mapping of vegetation community boundaries was based on the location of sites and their position within the multivariate analysis, air photo interpretation (1:50 000 scale air photos) and preliminary and subsequent ground truthing. Structural names follow Specht et al. (1995) and are based on the taxonomic identity of the most consistent species of the uppermost stratum. Good quality plant specimens were retained as vouchers by the Bourke District NSW NPWS (now Dept of Environment & Conservation) with duplicates of significant collections submitted to the National Herbarium of NSW, Sydney.

Results

Six communities were recognised at the dissimilarity measure of 0.8 (Table 1, Fig. 2). The major division implies a division between the often flooded and the more rarely flooded areas. In all 240 vascular plant taxa, from 58 families and 154 genera, were recorded from the collation of existing site data and subsequent sampling. 206 vascular plant taxa were recorded from the 42 quadrats of this survey. Approximately 8% (30) of all taxa were introduced in origin. The distribution of vegetation communities is shown in Fig. 3.

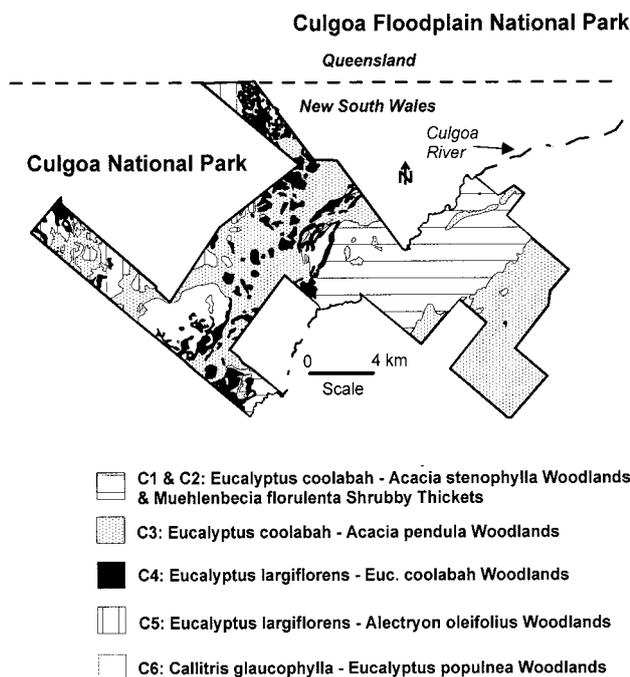


Fig. 3. Map of vegetation communities for Culgoa National Park. Community 2 & 3 are combined in this map as they were not readily discernable on the scale of aerial photographs used for map production.

Vegetation communities

The communities within Culgoa National Park form structurally simple assemblages, low in height and foliage cover. Although simple, these associations exhibit distinct layering. Figures in brackets within each community description represent maximum and minimum values. The most common native taxa are listed in decreasing order of importance (based on summed cover scores).

Community 1: *Eucalyptus coolabah* (Coolibah) — *Acacia stenophylla* (River Cooba) — *Muehlenbeckia florulenta* (Lignum) Woodlands

Distribution: restricted to channelled floodplain on grey cracking clays but found throughout the entire centre of the Park on either side of the Culgoa River.

Structure: upper layer: 7–15 (–20) m; 10–20 (–60)% cover. ± Taller shrub layer: 2–3 m; 0–40% cover. Shrub layer (Lignum): 1–2 m; 40–80% cover. Herb layer: <1 m; 5–40 (–60)% cover. (Fig. 4)

Trees: *Eucalyptus coolabah*, *Acacia stenophylla*, *Atalaya hemiglaucua*, *Alstonia constricta*, *Acacia coriacea*.

Shrubs: *Muehlenbeckia florulenta*, *Eremophila bignoniiflora*, *Einadia polygonoides*, *Sida trichopoda*, *Teucrium racemosum*, *Solanum esuriale*, *Sclerolaena muricata* var. *villosa*, *Sclerolaena calcarata*, *Atriplex muelleri*, *Myoporum platycarpum*, *Einadia nutans*, *Chenopodium auricomum*, *Sclerolaena tubata*, *Sclerolaena intricata*, *Sclerolaena bicornis*.

Ground cover: *Cyperus bifax*, *Paspalidium jubiflorum*, *Marsilea drummondii*, *Agrostis avenacea*, *Eragrostis setifolia*, *Plantago varia*, *Alternanthera nodiflora*, *Cyperus victoriensis*, *Sporobolus mitchellii*, *Ixiolaena brevicompta*, *Chamaesyce drummondii*, *Euchiton sphaericus*, *Panicum decompositum*, *Eragrostis lacunaria*, *Sporobolus caroli*.

Variability: this community can be further divided into those that are dominated by eucalypts often with *Acacia stenophylla* and *Eremophila bignoniiflora* and a dense *Muehlenbeckia florulenta* understorey. Other parts with a dense almost closed tree cover have a sparse *Muehlenbeckia florulenta*, *Eremophila bignoniiflora*, and *Acacia stenophylla* understorey with a dense grass/forb layer. The latter areas are due to large scale regeneration of *Eucalyptus coolabah* in the middle of this century (Dick 1993). *Eucalyptus camaldulensis* occurs sporadically within this community particularly close to river channels. The ground



Fig. 4. Community 1. *Eucalyptus coolabah* and *Acacia stenophylla* Woodlands. Showing dense growth of *Eucalyptus coolabah*.

layer is diverse and varied and contains many ephemeral grasses and forbs that respond quickly to rainfall. Tall shrubs including *Acacia stenophylla* and *Eremophila bignoniiflora* are frequent. Where flooding occurs to a lesser degree, just away from the riverbanks and along some more minor channels *Eucalyptus coolabah* becomes prevalent as the overstorey species. This community grades into Community 2.



Fig. 5. Community 2: *Muehlenbeckia florulenta* Shrubby Thicket with scattered *Eucalyptus coolabah* becoming denser in the background.

Community 2: *Muehlenbeckia florulenta* (Lignum) Shrubby Thickets

Distribution: found in slightly elevated areas and minor drainage lines with fine light grey soils within the central parts of the reserve, closely associated with the low lying floodplains of the Culgoa River.

Structure: Upper layer: c. 15 m; 0–20% cover. Shrub (Lignum) layer: 1–1.5 m; 5–20% cover. Herb layer: 0.1–0.5 m; 50–65% cover. (Fig. 5)

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

Shrubs: *Muehlenbeckia florulenta*, *Acacia coriacea*, *Sclerolaena muricata*, *Solanum stuartianum*, *Einadia nutans* subsp. *linifolia*, *Sclerolaena calcarata*, *Myoporum platycarpum*, *Myoporum montanum*.

Ground cover: *Eragrostis setifolia*, *Marsilea drummondii*, *Agrostis avenacea*, *Panicum decompositum*, *Eragrostis lacunaria*, *Chamaesyce drummondii*, *Pycnosorus thompsonianus*, *Pluchea dentex*, *Plantago varia*, *Panicum subxerophyllum*, *Malacocera albolanata*, *Haloragis glauca*, *Euchiton involucratus*, *Eryngium paludosum*, *Chloris truncata*, *Calotis scabiosifolia*, *Asperula cunninghamii*.

Variability: In less flood prone areas *Acacia stenophylla* occurs with a dense *Muehlenbeckia florulenta* understorey. The ground cover is normally dependent on the length of time since water was held. This community is closely associated with community 1 and many species are shared.

Community 3: *Eucalyptus coolabah* (Coolibah) — *Acacia pendula* (Weeping Myall) — *Acacia cambagei* (Gidgee) — *Eucalyptus largiflorens* (Black Box) Woodlands

Distribution: found on minor rises with sandy brown or red, red brown or light brown clay soils and grey cracking clay soils. Widespread away from the banks of the Culgoa River.

Structure: Upper layer: 5–10 m; 5–20%. Shrub (Lignum) layer: 1–1.5 m; 0–5%. Herb layer: 0.3–1 m; 50–80%. (Fig. 6)

Trees: *Eucalyptus coolabah*, *Acacia pendula*, *Acacia stenophylla*, *Acacia omalophylla*, *Acacia cambagei*, *Ventilago viminalis*, *Atalaya hemiglauca*, *Apophyllum anomalum*, *Alectryon oleifolius*, *Eucalyptus largiflorens*.

Shrubs: *Sida trichopoda*, *Muehlenbeckia florulenta*, *Sclerolaena bicornis*, *Atriplex muelleri*, *Sclerolaena calcarata*, *Chenopodium desertorum*, *Lotus cruentus*, *Cullen tenax*, *Maireana coronata*, *Salsola kali*, *Solanum esuriale*, *Einadia nutans* subsp. *eremaea*, *Sclerolaena tubata*, *Sclerolaena muricata*, *Chenopodium auricomum*.



Fig. 6. Community 3: *Eucalyptus coolabah* — *Acacia pendula* Woodland & Grassland. This area showing natural grassland with low open woodland in the background.

Ground cover: *Eragrostis setifolia*, *Chloris truncata*, *Astrebala lappacea*, *Euchiton sphaericus*, *Sporobolus caroli*, *Agrostis avenacea*, *Plantago varia*, *Marsilea drummondii*, *Eragrostis lacunaria*, *Ixiolaena brevicompta*, *Dichanthium sericeum*, *Bothriochloa decipiens*, *Portulaca oleracea*, *Sporobolus actinocladius*, *Panicum subxerophyllum*, *Daucus glochidiatus*, *Alternanthera nodiflora*.

Variability: this community can be loosely further divided into two sub-assemblages. The first has a low open woodland structure and occurs primarily on sandy red/brown and light brown clay soils. The second includes open grasslands primarily on grey cracking clays in less elevated areas. These two sub-communities form a mosaic and clear field delineation may not be possible. Community 3 is closely associated, and intergrades with, Community 4, particularly in slightly elevated areas. *Eucalyptus largiflorens* becomes more important away from the main floodplain on slightly higher ground.

Community 4: *Eucalyptus largiflorens* (Black Box) — *Eucalyptus coolabah* (Coolibah) Woodlands

Distribution: found on slightly elevated sites periodically inundated but less so than communities 1–3. Soils are primarily light brown/grey clays but also grey and red clays. More commonly on the northern side of the Culgoa River and particularly on the north western boundary.

Structure: Upper layer: 8–10 m; 10–40% cover. Shrub (Lignum) layer: c. 1 m; 0–20% cover. Herb layer: 0.1–0.2 m; 20–70% cover. (Fig. 7)

Trees: *Eucalyptus largiflorens*, *Eucalyptus coolabah*, *Acacia stenophylla*, *Flindersia maculosa*, *Acacia pendula*, *Acacia cambagei*, *Acacia harpophylla*.

Shrubs: *Muehlenbeckia florulenta*, *Pimelea trichostachya*, *Sida trichopoda*, *Einadia nutans* subsp. *linifolia*, *Teucrium racemosum*, *Sida cunninghamii*, *Salsola kali*, *Myoporum montanum*, *Atriplex muelleri*, *Hibiscus trionum*, *Einadia polygonoides*, *Solanum esuriale*, *Sclerolaena intricata*, *Maireana coronata*, *Sclerolaena calcarata*, *Sclerolaena bicornis*, *Dissocarpus biflorus*, *Chenopodium desertorum*.

Ground cover: *Eragrostis setifolia*, *Sporobolus caroli*, *Marsilea drummondii*, *Chloris truncata*, *Tripogon loliiformis*, *Pluchea dentex*, *Plantago varia*, *Enneapogon gracilis*, *Agrostis avenacea*, *Euchiton sphaericus*, *Centipeda cunninghamii*, *Sporobolus actinocladus*, *Portulaca oleracea*, *Haloragis glauca*, *Eragrostis parviflora*.

Variability: dominants vary from *Eucalyptus largiflorens* to *Eucalyptus coolabah* with a number of wattles co-dominant. The importance of chenopods in the understorey varies and grasses may be more dominant than chenopods in a number of areas. Such small changes in over- and understorey species are due to minor changes in topography and flooding history (Hunter & Earl 1999).



Fig. 7. Community 4: *Eucalyptus largiflorens* – *Eucalyptus coolabah* Woodland with small *Muehlenbeckia florulenta* shrubs and *Eragrostis setifolia* in the understorey.



Fig. 8. Community 5. *Eucalyptus largiflorens* – *Alectryon oleifolius* Woodlands with an understorey dominated by various *Sclerolaena* species.

Community 5: *Eucalyptus largiflorens* (Black Box) – *Alectryon oleifolius* (Western Rosewood) – *Acacia cambagei* (Gidgee) Woodlands

Distribution: found on slightly elevated areas with brown to reddish clay soils, some gilgai sites and light and friable grey clay soils. Common to the north of the Culgoa River particularly in the south western Park boundary.

Structure: Upper layer: 8–10 m; 10–30% cover. Middle (chenopod) layer: 0.4–0.7 m; 30–50% cover. Herb layer: 0.1–0.4 m; 5–50% cover. (Fig. 8)

Trees: *Eucalyptus largiflorens*, *Alectryon oleifolius*, *Acacia cambagei*, *Acacia stenophylla*, *Acacia pendula*.

Shrubs: *Sclerolaena calcarata*, *Sclerolaena bicornis*, *Chenopodium auricomum*, *Sclerolaena muricata* var. *villosa*, *Sclerolaena birchii*, *Myoporum platycarpum*, *Abutilon oxycarpum*, *Sclerolaena divaricata*, *Sclerolaena articulata*, *Hibiscus trionum*, *Einadia nutans* subsp. *eremaea*, *Dissocarpus biflorus*, *Chenopodium nitriaceum*, *Chenopodium desertorum*.

Ground cover: *Tripogon loliiformis*, *Sporobolus caroli*, *Eragrostis setifolia*, *Agrostis avenacea*, *Crassula sieberiana*, *Chloris truncata*, *Vittadinia eremaea*, *Portulaca oleracea*, *Euchiton sphaericus*, *Pycnosorus globosus*, *Plantago varia*, *Eragrostis lacunaria*, *Daucus glochidiatus*, *Cyperus bifax*.

Variability: chenopods are more prominent in disturbed sites where there is visible salt scalding. It is characterised by the increased importance of a chenopod understorey and absence of many of the co-dominant species shown in previous communities, such as *Eucalyptus coolabah* or the decreased importance of others such as *Acacia stenophylla*. Primarily this community is less frequently inundated than that of the previous two assemblages. Patches of *Acacia harpophylla* sporadically occur within this community.



Fig. 9. Community 6: *Callitris glaucophylla* – *Eucalyptus populnea* Woodlands which has been cleared in the foreground but is relatively intact in the background.

Community 6: *Callitris glaucophylla* (White Cypress Pine) – *Eucalyptus populnea* subsp. *bimbil* (Bimbil Box) Woodlands

Distribution: found on elevated dunes with sandy reddish to orange soils or more rarely yellow contrast soils with a sandy topsoil. This assemblage is restricted to the south central and southern boundary of the Park.

Structure: Upper layer: 10–12 m; 15–30% cover. Middle layer: 1–3 m; 10–50% cover. Herb layer: < 1 m; 40–80% cover. (Fig. 9)

Trees: *Callitris glaucophylla*, *Eucalyptus camaldulensis*, *Eucalyptus populnea* subsp. *bimbil*, *Eucalyptus coolabah*, *Alectryon oleifolius*.

Shrubs: *Pimelea penicillaris*, *Dodonaea viscosa*, *Phyllanthus carpentariae*, *Sida cunninghamii*, *Einadia nutans* subsp. *eremaea*, *Chenopodium curvispicatum*, *Senna artemisioides*, *Myoporum montanum*, *Einadia polygonoides*, *Acacia penninervis*, *Sclerolaena ventricosa*, *Sclerolaena muricata*, *Salsola kali*, *Atriplex muelleri*, *Acacia salicina*, *Euphorbia sarcostemmoides*.

Ground cover: *Aristida psammophila*, *Eragrostis setifolia*, *Triraphis mollis*, *Panicum effusum*, *Rhodanthe diffusa*, *Nicotiana simulans*, *Eriachne aristidea*, *Wahlenbergia stricta* subsp. *alterna*, *Perotis rara*, *Chamaesyce drummondii*, *Sporobolus caroli*, *Setaria surgens*, *Podolepis longipedata*, *Evolvulus alsinoides*, *Eragrostis lacunaria*, *Enneapogon polyphyllus*, *Dichondra* sp. A, *Crassula sieberiana*, *Panicum decompositum*, *Oxalis chmoodes*, *Alternanthera denticulata*.

Variability: this community is the most distinctive of all those defined for Culgoa National Park. It has a number of unique indicative species. The major difference in stands is due to past grazing history and the state of subsequent recovery. Some areas are characterised by the prominence of 'woody weeds'.

Discussion

Periodicity of flooding is the most distinctive apparent gradient affecting community distribution within Culgoa National Park. Major changes in floristics are correlated with areas that are regularly flooded and retain water for some time; those that are flooded regularly, but do not retain water for extended periods; those that are only infrequently flooded and do not retain water for any length of time; and the dune areas which do not flood. The first two major groupings are closely associated, and intergradation occurs between all, whereas the third is very distinctive with little intergradation occurring with the others (Fig. 2).

Dick (1993) is the most directly comparable published work to this survey. In 65 sites recorded across the Wombeira Land System, includes the Narran and Culgoa Rivers, Dick found 230 native and exotic species, 175 during the survey and 55 additional from collation of over 21 years of previous survey records (1969–1988). He found an average of 20.4 species per site overall, with 25.4 in vegetation away from, and 20 within, channelised country - sites however were of a variable size but not smaller than 20 x 20 m. In the current survey, within the same land system and region, 109 species were found (within 15 sites), incorporating 43% of the total number known and 62% of those recorded by Dick. However, the average richness of sites was 26 species per quadrat which is considerably higher than that the 20.4 per quadrat recorded by Dick, using larger quadrats. In similar communities within the Narran Lake Nature Reserve, Hunter et al. (2001) recorded 120 species within 22 sites, with an average species richness of 12.6 per site, decidedly less than that recorded by Dick, and during this survey. These results reinforce the comments made by Hunter (1999) that, although similar communities occur at Narran Lake, they show far greater beta diversity (differences between site

composition). In contrast those of the Culgoa region show a greater uniformity in associated species between sites. This correlation of higher beta diversity lowering alpha diversity was also shown in analysis of regional data by Hunter (2005).

Eleven communities within five structural classes were delineated qualitatively by Dick (1993), most of which are incorporated within the two communities *Eucalyptus coolabah* Woodlands and *Muehlenbeckia florulenta* Shrubby Thickets here. Although extra sampling may have increased the delineation of additional communities at Culgoa National Park, it is unlikely that the number of classes of vegetation described qualitatively by Dick could be derived from floristic analysis.

The communities at Culgoa National Park generally show greatest affinities with those in south-western Queensland (Neldner 1984) rather than those found further south in New South Wales.

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). About 44% of the vulnerable species in New South Wales, occur on the Western Slopes and Plains (Benson 1989, 1991). It has been estimated that up to 95% of the original native vegetation in the Murray Darling Basin has been changed by cropping or pasture improvement (Sivertsen & Metcalfe 1995).

The woodlands dominated by *Eucalyptus coolabah* on the Culgoa floodplain are the largest and least disturbed contiguous area of this vegetation remaining in New South Wales. Dick and Andrew (1993) report that clearing of extensive areas of Coolibah Woodland have already occurred, and that clear felling has generally left only small corridors, around 20 m wide along much of the Culgoa River. Elsewhere in New South Wales, riparian forests have been modified extensively by grazing and logging (Helman & Estella 1983; Scott 1992). The extent of *Eucalyptus camaldulensis* communities is misleading as they usually are of only one to three crown diameters wide in most situations, have a high boundary length to area ratio and are prone to weed infestations and disturbance (Sivertsen & Metcalfe 1995). Furthermore change in flooding regimes due to river regulation has led to a decline in recruitment and in the quality of the stands of Riparian Forests in many areas (Porteners 1993; Kingsford 2000).

Acacia harpophylla, Brigalow, forms distinct stands within community 5 *Eucalyptus largiflorens*-*Alectryon oleifolius* woodlands. Such stands are of significance due to impacts of the large scale clearing. *Acacia harpophylla* occurred widely in southeast Queensland with outliers in northern NSW

(Isbell 1962) and it is estimated that by 1951 about one third of the Brigalow lands had been cleared. In NSW some of the largest remaining stands of *Acacia harpophylla* country occur northwest of Bourke. *Acacia harpophylla* is usually restricted to 500 to 750 mm rainfall zones but may occur on alluvial clays when rainfall is lower (Neldner 1984). With an annual rainfall of around 375 mm in Culgoa National Park, Brigalow is restricted to low-lying clay soils there.

Callitris glaucophylla – *Eucalyptus populnea* woodlands similar to community 6 extend from Queensland to Victoria and South Australia, Western Australia and the Northern Territory (Beadle 1981) and are considered one of the most threatened communities in western New South Wales (Scott 1992). Associated species differ widely across its range (Porteners 1993). *Callitris glaucophylla* dominant assemblages in many areas of the state now occur only as remnants, with much of their understorey heavily grazed. Much of the area in the southeast of NSW has been extensively cleared and rabbits have reduced the regeneration capacity of the trees (Morcom & Westbrooke 1990; Fox 1991; Scott 1992; Porteners 1993). Under such conditions the soils are prone to salt scalding (Porteners 1993). The occurrence of this community within Culgoa National Park is of significance, as the mixed *Callitris* – *Eucalyptus populnea* assemblage is near its western range limit.

Culgoa National Park includes expanses of *Muehlenbeckia florulenta*. Lakebed cropping and subsequent clearing of *Muehlenbeckia florulenta* have become common practice in this and many other areas of the state (Aldis 1987; Briggs 1994) and graziers consider *Muehlenbeckia florulenta* a nuisance plant; experimental burns have been carried out to try to eradicate the species (Aldis 1987). It is estimated that 40% of *Muehlenbeckia florulenta* 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). The occurrence of such a large expanse of this community within Culgoa National Park is of significance.

Eucalyptus largiflorens – *Alectryon oleifolius* – *Acacia cambagei* Woodlands (Community 5) appears to have very few direct correlates in the published literature. As circumscribed here, this community is restricted to the Culgoa River area, is not represented in any other reserves, and is of conservation significance. It is likely that the understorey of this community will change dramatically from season to season in particular under different flooding regimes and thus may require re-surveying to test their integrity and/or the changes in dominance and fidelity of species.

Culgoa National Park in conjunction with Narran Lake and Macquarie Marshes Nature Reserves conserve a significant representation of the floodplain floristic associations of the NSW mid northwestern plains. Most of the species recorded on the Wombeira Land System by Dick (1993) are found within these reserves. A large part (32%) of Culgoa National Park is floodplain vegetation on cracking clay soils — there

are only minor occurrences of higher ground associations on red or orange soils. Woodland associations on higher ground may be worthy of addition to this reserve as they are under-represented within the region.

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Appendix: Flora of Culgoa National Park

Taxa found within survey sites are scored according to their occurrence in each of the six communities defined. Some taxa were found in previous surveys or opportunistically and therefore are not assigned to specific communities. * = exotic, O = opportunistic.

Communities

- 1 = *Eucalyptus coolabah* – *Acacia stenophylla* – *Muehlenbeckia florulenta* Woodlands
 2 = *Muehlenbeckia florulenta* Shrubby Thickets
 3 = *Eucalyptus coolabah* – *Acacia pendula* – *Acacia cambagei* – *Eucalyptus largiflorens* Woodlands & Grasslands
 4 = *Eucalyptus largiflorens* – *Eucalyptus coolabah* Woodlands
 5 = *Eucalyptus largiflorens* – *Alectryon oleifolius* – *Acacia cambagei* Woodlands
 6 = *Callitris glaucophylla* – *Eucalyptus populnea* subsp. *bimbil* Woodlands

Taxon

Alismataceae

Damasonium minus 0

Amaranthaceae

Alternanthera angustifolia 2
Alternanthera denticulata 1
Amaranthus macrocarpus 0
Alternanthera nodiflora 1, 3, 5, 6,
 **Gomphrena celosioides* 0
Ptilotus exaltatus var. *exaltatus* 3, 4
Ptilotus polystachyus var. *polystachyus* 3

Amarylidaceae

Crinum flaccidum 0

Anthericaceae

Corynotheca licrota 6,

Apiaceae

Daucus glochidiatus 3 5
Eryngium paludosum 1, 2, 3

Apocynaceae

Alstonia constricta 1
Parsonia eucalyptophylla 0

Asphodelaceae

Bulbine semibarbata 1, 2, 3, 4

Asteraceae

Brachyscome heterodonta var. *heterodonta* 2, 3, 4
Brachyscome melanocarpa 3
Brachyscome sp. *B* 3
Calotis latiuscula 1
Calotis scabiosifolia var. *scabiosifolia* 1, 2
Calotis scapigera 1, 3, 4
 **Carthamus lanatus* 0
 **Centaurea melitensis* 3 5
Centipeda cunninghamii 1, 3, 4, 5
Centipeda minima var. *lanuginosa* 4,
 **Conyza bonariensis* 6,
Eclipta polyglossa 1
Epaltes cunninghamii 1, 3
Euchiton involucreatus 2
Euchiton sphaericus 1, 3, 4, 5, 6
Gnaphalium diamantinense 2
 **Hedynois rhagadioloides* subsp. *cretica* 0
Leiocarpa brevicompta 1, 3, 6,
Leiocarpa semicalva var. *semicalva* 1, 3, 4
Millotia greevesii subsp. *greevesii* var. *glandulosa* 6,
Pluchea dentex 1, 2, 3, 4
Podolepis longipedata 6,
Pseudogaphalium luteoalbum 0
Pycnosorus globosus 5
Pycnosorus thompsonianus 2, 3
Rhodanthe diffusa subsp. *leucactina* 6,
Rhodanthe floribunda 3, 5, 6
Senecio quadridentatus 3
Senecio runcinifolius 1
 **Silybum marianum* 0

<i>*Sonchus asper</i>	6	<i>Dichondra</i> sp. A	6
<i>*Sonchus oleraceus</i>	2, 3, 5, 6	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	6
<i>*Verbesina encelioides</i> var. <i>encelioides</i>	6	Crassulaceae	
<i>Vittadinia condyloides</i>	0	<i>Crassula sieberiana</i>	3, 5, 6
<i>Vittadinia cuneata</i>	3, 4	Cucurbitaceae	
<i>Vittadinia eremaea</i>	5	<i>*Citrullus colocynthis</i>	6
<i>Vittadinia pterochaeta</i>	1, 3	Cupressaceae	
<i>Vittadinia pustulata</i>	1, 3	<i>Callitris glaucophylla</i>	6
<i>Vittadinia sulcata</i>	1, 4	Cyperaceae	
Boraginaceae		<i>Cyperus bifax</i>	1, 3, 5
<i>Cynoglossum australe</i>	6	<i>Cyperus concinnus</i>	1
Brassicaceae		<i>Cyperus victoriensis</i>	1, 3
<i>Lepidium sagittulatum</i>	4	<i>Eleocharis pallens</i>	1
Campanulaceae		<i>Eleocharis plana</i>	1
<i>Wahlenbergia luteola</i>	1, 3, 5, 6	<i>Fimbristylis dichotoma</i>	0
<i>Wahlenbergia stricta</i> subsp. <i>alternata</i>	1, 3, 6	Euphorbiaceae	
<i>Wahlenbergia stricta</i> subsp. <i>stricta</i>	1, 3	<i>Chamaesyce drummondii</i>	1, 2, 3, 4, 5, 6
Capparaceae		<i>Euphorbia sarcostemmoides</i>	0
<i>Apophyllum anomalum</i>	3	<i>Petalostigma pubescens</i>	0
<i>Capparis mitchellii</i>	0	<i>Phyllanthus carpentariae</i>	6
Caryophyllaceae		Fabaceae	
<i>Polyearpaea corymbosa</i> var. <i>minor</i>	3	<i>Acacia aneura</i>	0
<i>*Spergula arvensis</i>	4	<i>Acacia cambagei</i>	0
<i>Stellaria angustifolia</i>	1, 2, 4, 5	<i>Acacia coriacea</i>	1, 2, 3, 4
Chenopodiaceae		<i>Acacia harpophylla</i>	5
<i>Atriplex leptocarpa</i>	3, 4	<i>Acacia melvillei</i>	0
<i>Atriplex muelleri</i>	1, 3, 4, 5, 6	<i>Acacia omalophylla</i>	1, 3
<i>Chenopodium auricomum</i>	1, 3, 4, 5, 6	<i>Acacia oswaldii</i>	0
<i>Chenopodium cristatum</i>	0	<i>Acacia pendula</i>	3, 4, 5
<i>Chenopodium curvispicatum</i>	5, 6	<i>Acacia penninervis</i>	6
<i>Chenopodium desertorum</i> subsp. <i>desertorum</i>	1, 3, 4, 5	<i>Acacia salicina</i>	6
<i>Chenopodium nitriaceum</i>	1, 3, 4, 5	<i>Acacia stenophylla</i>	1, 2, 3, 4, 5
<i>Dissocarpus biflorus</i> var. <i>cephalocarpus</i>	3, 4, 5	<i>Acacia stowardii</i>	0
<i>Einadia hastata</i>	1	<i>*Astragalus hamosus</i>	6
<i>Einadia nutans</i> var. <i>eremaea</i>	1, 3, 5, 6	<i>Cullen tenax</i>	1, 2, 3
<i>Einadia nutans</i> var. <i>linifolia</i>	1, 2, 3, 4	<i>Glycine canescens</i>	6
<i>Einadia nutans</i> var. <i>nutans</i>	1	<i>Glycine latifolia</i>	6
<i>Einadia polygonoides</i>	1, 3, 4, 6	<i>Indigofera linnaei</i>	6
<i>Maireana aphylla</i>	3	<i>Lotus cruentus</i>	3, 4
<i>Maireana coronata</i>	1, 3, 4	<i>*Medicago polymorpha</i>	3
<i>Malacocera albolanata</i>	2	<i>*Neptunia gracilis</i>	3
<i>Malacocera tricornis</i>	3	<i>Senna artemisioides</i> nothosp. <i>artemisioides</i>	6
<i>Osteocarpum dipterocarpum</i>	4	<i>Swainsona affinis</i>	6
<i>Salsola kali</i> var. <i>kali</i>	1, 3, 4, 5, 6	Frankeniaceae	
<i>Sclerolaena articulata</i>	1, 3, 5	<i>Frankenia serpyllifolia</i>	0
<i>Sclerolaena bicornis</i> var. <i>bicornis</i>	1, 3, 4, 5, 6	Gentianaceae	
<i>Sclerolaena birchii</i>	1, 5	<i>Centaurium spicatum</i>	1, 2, 3
<i>Sclerolaena brachyptera</i>	5	<i>Centaurium tenuiflorum</i>	6
<i>Sclerolaena calcarata</i>	1, 2, 3, 4, 5	Goodeniaceae	
<i>Sclerolaena divericata</i>	1, 3, 5	<i>Goodenia glauca</i>	1, 3
<i>Sclerolaena eriancantha</i>	3, 5	Haloragaceae	
<i>Sclerolaena intricata</i>	1	<i>Haloragis aspera</i>	4
<i>Sclerolaena intricata</i>	1, 3, 4	<i>Haloragis glauca</i> var. <i>glauca</i>	2, 4
<i>Sclerolaena muricata</i> var. <i>muricata</i>	1, 3, 5	Hydrocharitaceae	
<i>Sclerolaena muricata</i> var. <i>villosa</i>	1, 2, 3, 4, 5, 6	<i>Ottelia ovalifolia</i>	0
<i>Sclerolaena stelligera</i>	3, 4, 5	Juncaceae	
<i>Sclerolaena tubata</i>	1, 3, 4	<i>Juncus subsecundus</i>	0
<i>Sclerolaena ventricosa</i>	4, 6	Lamiaceae	
Chloanthaceae		<i>Teucrium racemosum</i>	1, 3, 4
<i>Dicrastylis lewellinii</i>	0	Lomandraceae	
Commelinaceae		<i>Lomandra leucocephala</i> var. <i>leucocephala</i>	6
<i>Commelina cyanea</i>	0	<i>Lomandra patens</i>	1
Convolvulaceae		<i>*Amyema miquelii</i>	1
<i>Convolvulus graminetinus</i>	3, 4	<i>Amyema miraculosum</i> subsp. <i>boormanii</i>	1, 3
<i>Cuscuta campestris</i>	4		
<i>*Cuscuta suaveolens</i>	2, 5		

Lythraceae			
<i>Lythrum salicaria</i>	O	<i>Eragrostis lacunaria</i>	1, 2, 3, 5, 6
Malvaceae		<i>Eragrostis leptocarpa</i>	3
<i>Abutilon fraseri</i>	5, 6	<i>Eragrostis parviflora</i>	1, 3, 4
<i>Abutilon oxycarpum</i>	1, 5	<i>Eragrostis setifolia</i>	1, 2, 3, 4, 5, 6,
<i>Hibiscus trionum</i>	3, 4, 5	<i>Eragrostis speciosa</i>	2, 3
* <i>Malvastrum americanum</i>	1, 3, 4, 5	<i>Eriachne aristidea</i>	3, 6,
<i>Sida cunninghamii</i>	1, 3, 4, 6	<i>Panicum decompositum</i>	1, 2, 6
* <i>Sida rhombifolia</i>	6	<i>Panicum effusum</i>	3, 6,
<i>Sida</i> sp. A	O	<i>Panicum subxerophyllum</i>	1, 2, 3
<i>Sida</i> sp. B	O	<i>Paractaenium novae-hollandiae</i>	1, 6,
<i>Sida trichopoda</i>	1, 3, 4, 5, 6	<i>Paspalidium distans</i>	O
Marsileaceae		<i>Paspalidium jubiflorum</i>	1, 3, 4, 5, 6
<i>Marsilea drummondii</i>	1, 2, 3, 4	<i>Paspalidium rarum</i>	O
Meliaceae		<i>Perotis rara</i>	6
<i>Owenia acidula</i>	O	<i>Setaria surgens</i>	6
Menyanthaceae		<i>Sporobolus actinocladus</i>	1, 3, 4
<i>Nymphoides crenata</i>	O	<i>Sporobolus caroli</i>	1, 3, 4, 5, 6
<i>Nymphoides geminata</i>	O	<i>Sporobolus mitchellii</i>	1, 2, 3
Myoporaceae		<i>Themeda avenacea</i>	3
<i>Eremophila bignoniiflora</i>	1, 3, 5	<i>Tragus australianus</i>	1, 3, 5, 6
<i>Eremophila longifolia</i>	1	<i>Triodia mitchellii</i>	6,
<i>Myoporum montanum</i>	1, 2, 3, 4, 6	<i>Tripogon loliiformis</i>	3, 4, 5
<i>Myoporum platycarpum</i> subsp. <i>platycarpum</i>	1, 2, 4, 5	<i>Triraphis mollis</i>	3, 4, 6
Myrtaceae		<i>Urochloa foliosa</i>	O
<i>Eucalyptus camaldulensis</i>	6	Polygonaceae	
<i>Eucalyptus coolabah</i>	1, 2, 3, 4, 6	<i>Muehlenbeckia florulenta</i>	1, 2, 3, 4
<i>Eucalyptus largiflorens</i>	4, 5	<i>Polygonum plebeium</i>	O
<i>Eucalyptus populnea</i> subsp. <i>bimbil</i>	6	<i>Rumex tenax</i>	1 3
<i>Leptospermum brachyandrum</i>	1	Portulacaceae	
<i>Melaleuca trichostachya</i>	O	<i>Portulaca oleracea</i>	1, 2, 3, 4, 5
Nyctaginaceae		Rhamnaceae	
<i>Boerhavia coccinea</i>	1, 3, 4, 6	<i>Ventilago viminalis</i>	3
<i>Boerhavia dominii</i>	4	Rubiaceae	
Oleaceae		<i>Asperula cunninghamii</i>	1, 2, 3
<i>Jasminum lineare</i>	5, 6	<i>Psydrax oleifolium</i>	O
Onagraceae		Rutaceae	
* <i>Oenothera mollissima</i>	2	<i>Flindersia maculosa</i>	4
Oxalidaceae		<i>Geijera parviflora</i>	O
<i>Oxalis chnoodes</i>	1, 3, 6	Santalaceae	
Plantaginaceae		<i>Exocarpos aphyllus</i>	O
<i>Plantago drummondii</i>	3	<i>Santalum acuminatum</i>	O
<i>Plantago varia</i>	1, 2, 3, 4, 5	Sapindaceae	
Poaceae		<i>Alectryon oleifolius</i>	3, 5, 6
<i>Agrostis avenacea</i> var. <i>avenacea</i>	1, 2, 3, 4, 5, 6,	<i>Atalaya hemiglauca</i>	1, 3
* <i>Aira cupaniana</i>	3	<i>Dodonaea viscosa</i> var. <i>angustissima</i>	5, 6
<i>Amphibromus neesii</i>	O	Scrophulariaceae	
<i>Amphipogon caricinus</i> var. <i>caricinus</i>	O	<i>Stemodia glabella</i>	1
<i>Aristida longicollis</i>	3, 6	* <i>Verbascum virgatum</i>	6
<i>Aristida psammophila</i>	3, 6	Sinopteridaceae	
<i>Astrebla lappacea</i>	3	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	O
<i>Astrebla pectinata</i>	3	Solanaceae	
<i>Bothriochloa decipiens</i>	3	* <i>Lycium ferocissimum</i>	O
* <i>Cenchrus ciliaris</i>	O	<i>Nicotiana simulans</i>	6,
<i>Chloris truncata</i>	1, 2, 3, 4, 5	<i>Solanum esuriale</i>	1, 3, 4
<i>Cynodon dactylon</i>	1	<i>Solanum ferocissimum</i>	O
<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	3	* <i>Solanum nigrum</i>	5
<i>Digitaria brownii</i>	3, 6	<i>Solanum sturtianum</i>	1, 2, 4
<i>Digitaria divaricatissima</i>	3, 6	Thymelaeaceae	
<i>Digitaria hystrichoides</i>	3	<i>Pimelea penicillaris</i>	6
* <i>Echinochloa frumentacea</i>	O	<i>Pimelea trichostachya</i>	1, 3, 4
<i>Enneapogon gracilis</i>	3, 4	Verbenaceae	
<i>Enneapogon polyphyllus</i>	3, 6	* <i>Verbena hispida</i>	1, 3
<i>Eragrostis dielsii</i>	O	Violaceae	
		<i>Hybanthus monopetalus</i>	O