VEGETATION AND SOIL ASSESSMENT OF SELECTED WATERHOLES OF THE MAIN AND NORTHWEST CHANNELS OF COOPER CREEK, SOUTH AUSTRALIA, APRIL-MAY 2012

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Cover images:

L) Algal film on a Cooper Creek waterhole

R) Cooper Creek in flood, 2011

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1. PROJECT AIM

The overall project aim was the identification of biophysical processes influencing ecosystem health and associated biodiversity of selected waterholes along the length of Cooper Creek, South Australia. Assessment of the structure and floristics of vegetation associated with these waterholes aimed to contribute to this multidisciplinary elucidation. The collection and subsequent analyses of soil parameters served to provide insights into additional factors driving vegetation pattern and distribution of riverine plant communities. It must be emphasised at the outset that this study represents a 'snap-shot' in time of an arid zone ecosystem driven and organised by processes and patterns can only be appreciated and elucidated by long-term observation and monitoring.

2. METHODOLOGY

2.1 Site Locations

Vegetation and soils were assessed at each of the following fourteen locations;

1. Cullyamurra Waterhole
2. Minkie Waterhole
3. Scrubby Camp Waterhole
4. Tirrawarra Waterhole
5. Kudriemitchie Waterhole
6. Gidgealpa/Embarka Waterhole
7. Cuttapirie Corner Waterhole
8. Lake Apachirie Channel
9. Coongie Waterhole (Channel feeding directly into Lake Coongie)
10. Narie Waterhole
11. Parachirrinna Waterhole
12. Cooper channel west of Lake Appadare
13. Lake Hope shoreline
14. Killalpaninna (Channel feeding directly into Lake Killalpaninna)

2.2 Vegetation Sampling and Assessment

Vegetation was assessed at three sub-sites providing an overview of the variability of vegetation and soils at each of the 14 locations, providing data for 42 sites in total (Figure 1).

At each of the three sub-sites, vegetation was assessed over a 100 x 4 metre belt transect running parallel to the waterbody (Figure 2). All plant species occurring within the belt transect were recorded along with details on life form, life cycle and a semi-quantitative measure of relative cover/abundance accorded to each species. Position of each sub-site was GPS recorded. Uncertain identifications of plant species in the field was addressed by collecting voucher specimens, later lodged with the South Australian Herbarium for subsequent verification (Appendix 3).

For the central sub-site in each location (sub-site 2), a quantitative approach was adopted for structural assessment. Along the 100 metres, converted to a line transect, projected foliage cover measurements were recorded for all perennial species working from upper through to mid and finally lowest stratum (Figure 2). Additionally for the main tree species, the height, width and breadth of each individual encountered were documented. Photographs were recorded for these central sub-sites.

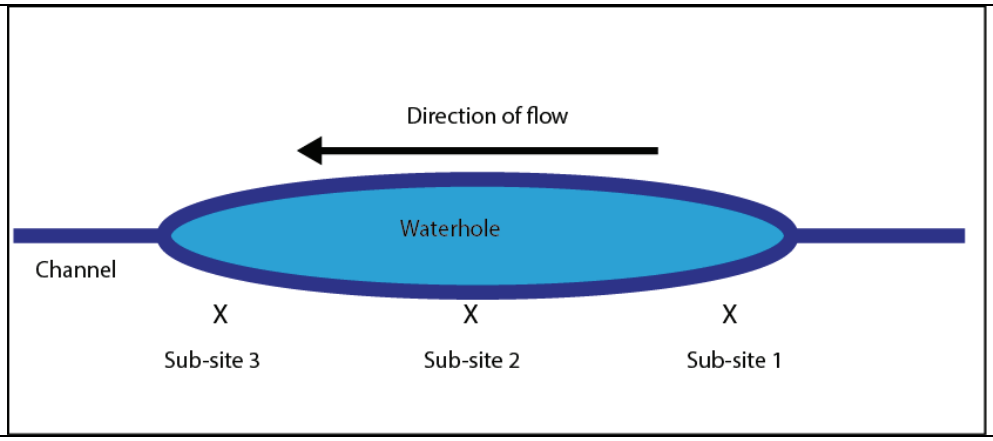

Figure 1: Placement of sub-sites at each location

2.3 Soil Sampling and Analysis

At the midpoint (50 metres) of the transect of the central sub-site the soil profile was sampled to a depth of 50 cm in 10 cm increments (5 samples) and bagged for subsequent laboratory analyses for pH and electrical conductivity (EC). In addition to profile sampling, 15 samples were taken, as depicted in Figure 2, to a depth of 5cm for subsequent laboratory assessment of total carbon and total nitrogen content.

All samples associated with the 50 cm profile were oven-dried at 40°C and ground to fine earth (<2 mm) for subsequent determination of pH and EC using the standardized laboratory procedures outlined in the Australian laboratory Handbook of Soil and Water Chemical Methods (Rayment and Higginson, 1992). All 5 cm samples were analysed for total carbon and total nitrogen content using high temperature combustion (LECO CN2000 analyser). All samples were tested prior to combustion for the presence of carbonate using 1M HCl, there were no positive results.

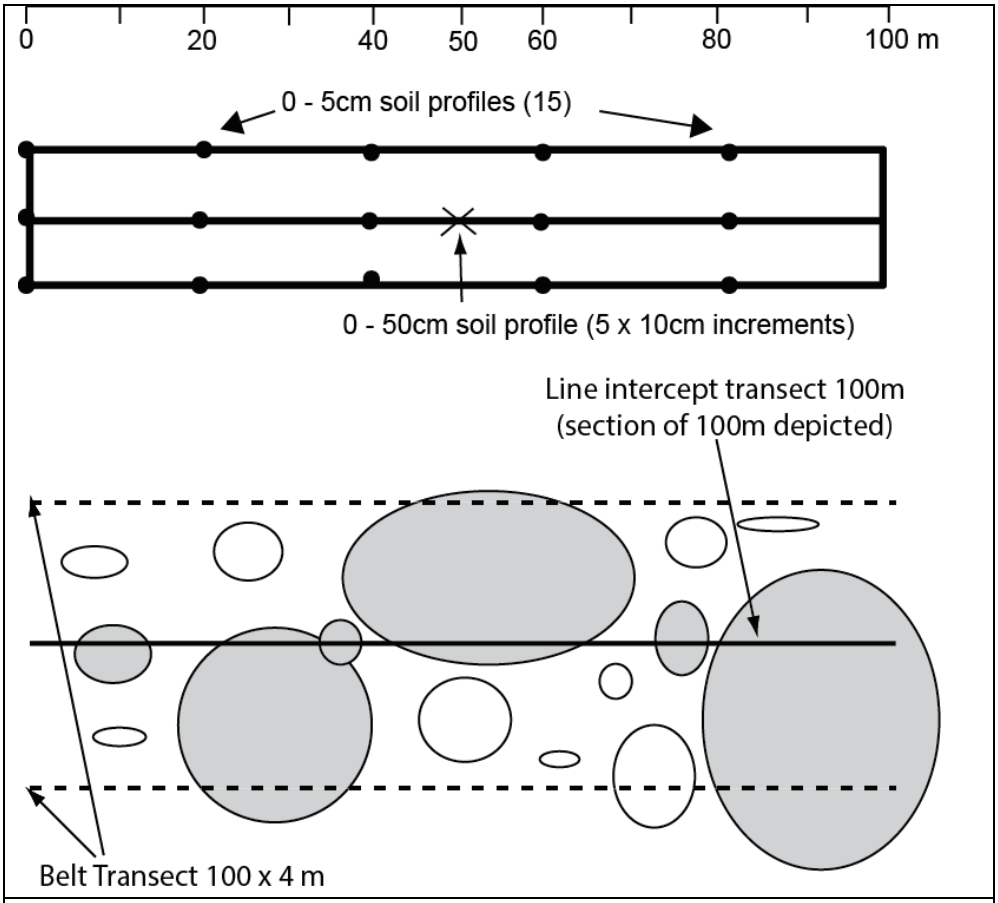

Figure 2: Soil and vegetation sampling

3. FINDINGS

3.1 Vegetation

Fieldwork was conducted from April 16 to May 2, 2012. Generally the vegetation of the Strzelecki Desert and associated Cooper Creek environs was in very good condition following three years of La Nina influenced hydrological pulses and significant extensive local rain events. For the 42 sites surveyed a total of 148 taxa was recorded, 146 of these to species level (Appendix 1). These taxa represented 106 genera and 42 families (Appendix 2). Table 1 lists the seven most commonly encountered families accounting for 63% of all species recorded at all sites.

Table 1: Most common floristic families

Family	Genera	Species
SOLANACEAE	3	6
AMARANTHACEAE	3	7
MALVACEAE	4	9
CHENOPODIACEAE	7	15
COMPOSITAE	12	17
LEGUMINOSAE	11	19
GRAMINEAE	16	20

The predominance of these families is consistent with other collections from this region over the last 28 years (Boyland, 1984, Mollenmans et al., 1984, Purdie, 1984, Gillen and Reid, 1988, Gillen and Drewien, 1993, Gillen, 2010). Interestingly, Gillen (2010) working across the same region during an extended period of drought, encountered 156 taxa representing 94 genera and 39 families Gillen surveyed extensively across a range of associated floodplain plant communities (11) in addition to the riverine communities of Cooper Creek. This project whilst restricted to predominantly the riverine vegetation of waterholes managed to encounter a greater number of genera and families reflecting the run of good seasons experienced in the region and the potential floristic richness and productivity of these riverine systems.

A total of 13 of the 148 species recorded (9%) over all sites were introduced or naturalized species (Table 2), following the *Census of South Australian Vascular plants, (Barker et al.,* 2005). Of most interest was the collection of *Conyza sumatrensis,* (Tall Fleabane) from the Innamincka Regional Reserve campsite at the Coongie Waterhole site. This species had not been recorded before during previously locally extensive and thorough surveys (Gillen and Reid, 1988, Gillen and Drewien, 1993, Gillen, 2010) suggesting a relatively recent introduction associated with tourism access. This invasive species has been more commonly associated

with the more mesic periphery of the arable portions of Australia (http://avh.ala.org.au/occurrences/search?taxa=Conyza+sumatrensis#mapView).

Table 2: Introduced or naturalized species

Species	Occurrence (42 sub-sites)
Brassica tournefortii *	3
Citrullus lanatus *	1
Conyza sumatrensis *	1
Cucumis melo *	18
Cynodon dactylon *	1
Heliotropium curassivicum *	2
Heliotropium supinum *	3
Ludwigia peploides ssp. montevidensis *	2
Malvastrum americanum *	4
Salsola kali *	11
Solanum nigrum *	27
Sonchus oleraceus *	17
Verbena officinalis *	32

In addition to the 13 species recorded within sites an extra three introduced or naturalized species were opportunistically recorded in the vicinity of a number of surveyed waterholes. These included the grasses, *Cenchrus ciliaris*, (Buffel Grass), *Chloris virgata* (Feathertop Rhodes Grass), and *Echinochloa crus-galli* (Barnyard Millet). *Cenchrus ciliaris* was observed in the vicinity of the Kudriemitchie Waterhole, predominantly around the exisiting outstation building. This species was also observed in the vicinity of Minkie Waterhole (J. Reid pers. Comm.). *Cenchrus ciliaris* is currently recognized as a most aggressively invasive species over significant areas of the arid zone and poses a significant threat to biodiversity values wherever encountered. *Chloris virgata* was observed and collected in the vicinity of Embarka Waterhole whilst *Echinochloa crus-galli* was observed and collected in a backwater associated with Tirrawarra Waterhole. Most interestingly the Purdie 1997 plant list (Appendix 5) of all species recorded from the Cooper – Coongie Region lists *Echinochloa crus-galli* as being last recorded in 1924, implying either a re-introduction or 'sleeper" status for this species.

3.2 General Vegetation Observations

The riverine vegetation associated with the Cooper channel and waterhole banks presents as an almost continuous closed canopy, covering dense vegetation beneath, a 'conduit of carbon' within the more sparsely vegetated expanse of associated floodplain habitats. The upper stratum at a number of the upstream waterholes comprises a mix of *Eucaluptus camaldulensis* (River red gum), *E. coolabah* (Coolibah) and *Bauhinia gilva* (Bauhinia). *Acacia salicina, A. stenophylla*

and *Muehlenbeckia florulenta* dominate the mid stratum and *Enchylaena tomentosa* and *Einadia nutans* the ground layer. Progression downstream from Cullyamurra Waterhole along both the North West and the Main Branches of Cooper Creek to waterholes of the lower reaches is accompanied by a distinctive shift in vegetation structure and plant species composition involving a gradual reduction in floristic richness and structural diversity.

A common sequence of perennial species loss from the more reliably watered upper reaches to the less reliable lower reaches is evident. *Eucalyptus camaldulensis, E. coolabah, Melaleuca trichostachya,* and *Bauhina gilva* all occur at Cullyamurra Waterhole. Progressing downstream, initially *Melaleuca trichostachya* drops out to be followed sequentially *by Eucalyptus camaldulensis* then *Bauhina gilva* until usually *Eucalyptus coolabah* remains the only perennial tree species present over various small trees/tall shrubs, typically *Acacia salicina* and *A. stenophylla* (however *Acacia stenophylla* typically drops out in the lower reaches).

Conceptual depictions of these structural arrangements for each of the waterholes/waterbodies assessed can be found in Appendix 4. Additionally for each of the 14 assessed waterholes/waterbodies Appendix 4 contains a complete list of all perennial and ephemeral species, a site photograph, GPS data for sub-site locations, a map of the three sub-sites, and a presentation of the quantitative cover of the significant perennial species.

The most significant environmental variable influencing the shifts described above is hydrology. Those sections and waterholes of the Cooper receiving and capable of holding more regular reliable flood pulses typically exhibit the greatest structural diversity and floristic richness (Figure 3). However as the reliability of flooding decreases downstream so soil variables such as salinity and alkalinity exert increasing influence inhibiting the presence of a range of more mesic and shade loving species. As a consequence the lower reaches and associated waterholes of the Cooper exhibit a greatly reduced structural and floristic diversity.

Figure 3 reveals the general trend of decreasing floristic richness from upper to lower reaches. The picture is complicated somewhat by the relative proximity of each waterhole/waterbody with the surrounding dune fields of the Strzelecki Desert. The closer the dunes to the waterhole/water/body the greater the opportunity for plant species typically found on dune sands to encroach upon the more typical flora of the riverine corridor. This situation is best exemplified by the site located on the Cooper Channel west of Lake Appadare (Figure 3). At this location the Cooper Creek channel is constrained immediately on either side by the dunes of the Strzelecki, hence the elevated number of dune field plant species recorded at the site. Conversely the dramatically lowered levels of species richness at Narie and Cuttapirie Corner waterholes in conjunction with the increased cover of introduced and unpalatable native species at these sites is a strong indication of past cattle grazing pressure.

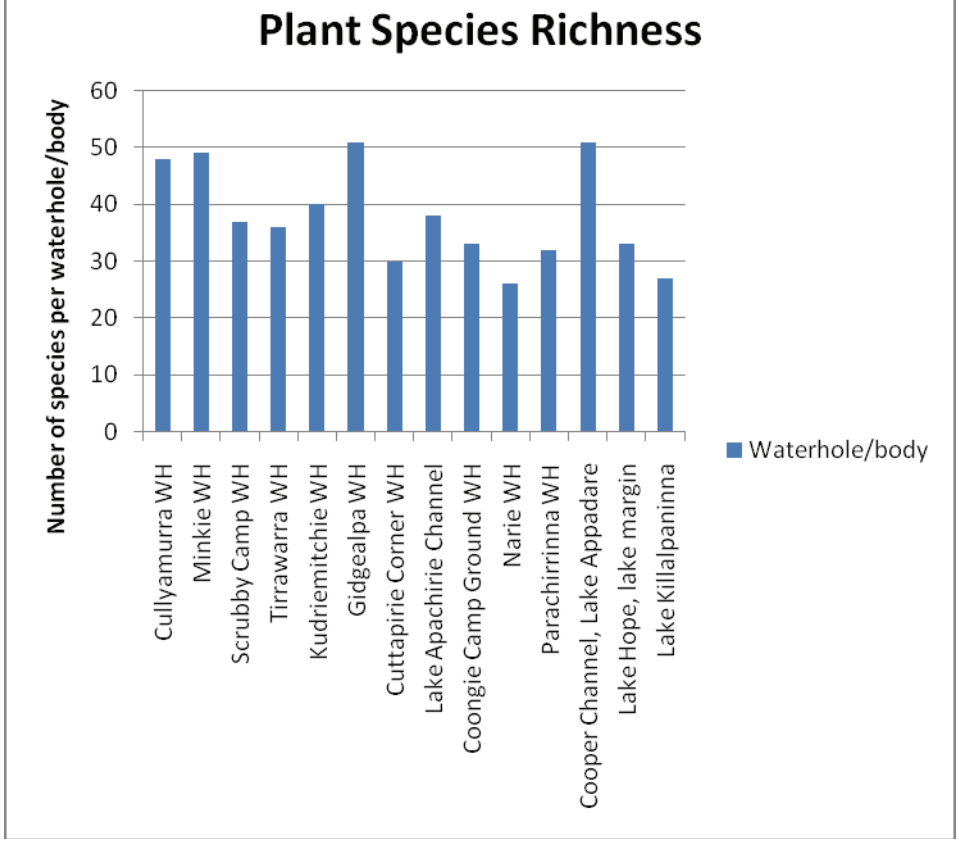

Figure 3: Species richness at all sites

The transition to decreasing structural complexity from upper to lower reaches which accompanies the decreasing trend in floristic richness is aptly depicted by comparing the shifts in cover for two of the most significant perennial tree species of the riverine ecosystem. Comparison of Figures 4 and 5 reveals the increasing role of *E. coolabah* as significant ecosystem component down the length of the Cooper as *E. camaldulensis* drops out in the upper reaches. Whilst Figure 4 reveals a gradual decrease in cover of *E. camaldulensis* along the North West Branch the cover determined at Coongie runs counter to this trend. This anomaly may indicate the contribution of waterhole permanence and/or connection to complementary groundwater sources to the persistence and cover of E. camaldulensis in this reach. Whilst the last occurrence of E. camaldulensis on the Main Branch for this study was recorded at Minkie Waterhole, previous studies (Reid and Gillen 1988, Gillen 2010) have recorded its last occurrence in a lower reach in the vicinity of Munjoorooanie Waterhole, north of Cuttapirie Corner. An investigation of waterhole bathymetry and/or groundwater interaction in relation to waterhole persistence and presence of E. camaldulensis at both Coongie and Munjoorooanie waterholes could be illuminating.

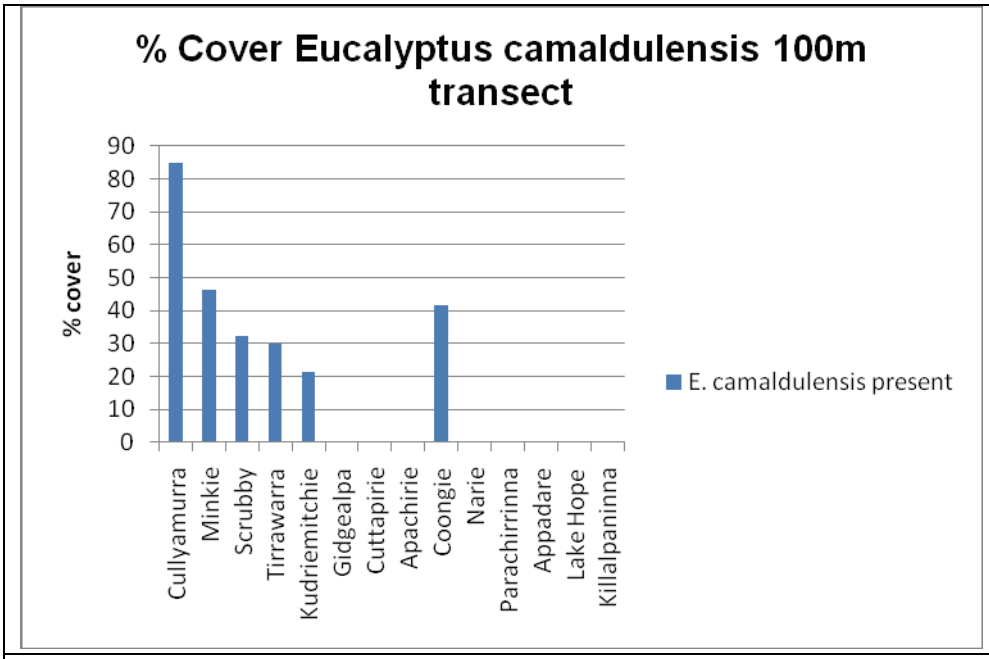

Figure 4: Eucalyptus camaldulensis cover – All 100m transect sites

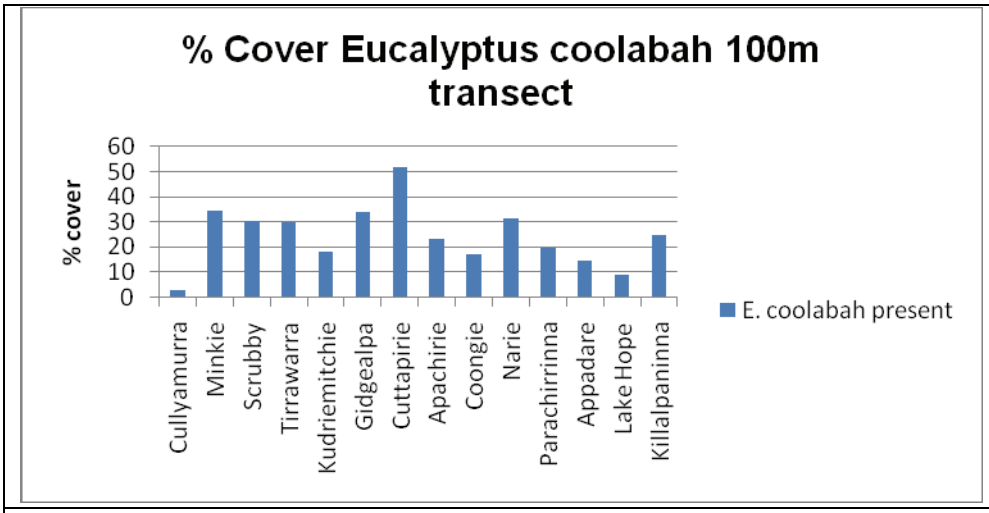

Figure 5: Eucalyptus coolabah cover – All 100m transect sites

3.3 Multivariate Analyses

Multivariate analysis of 64 plant species recorded at three or more of the 14 sites surveyed for vegetation (Table 4) showed the strong influence of longitudinal position, particularly declining discharge, along South Australian sections of Cooper Creek. Dendrogram analysis revealed two main clusters of sites, with the three most south-western sites around lakes Hope and Kilallpaninna combined with the minor channel between lakes Apachirie and 'DAER' in a distinct cluster from the other 10 upstream sites. This clear separation of two main clusters largely reflects the geographic position of surveyed sites. Lack of access to a long section of the river between Parachirrinna Waterhole and the Lake Hope region prevented investigation

of a gradual or steep transition in assemblage composition of riparian plant communities between freshwater upper reaches and the more saline lower reaches. Clustering within the upstream group of waterbodies distinguished between the six sites upstream of and including Kudriemitchie Waterhole on the North West Branch and Embarka Waterhole on the Main Branch (sub-group 1A), on the one hand, and the four sites downstream (sub-group 1B): the North West Branch near Coongie Lake, and Narie, Cuttapirrie Corner and Parachirrinna Waterholes on the Main Branch (Fig. 6).

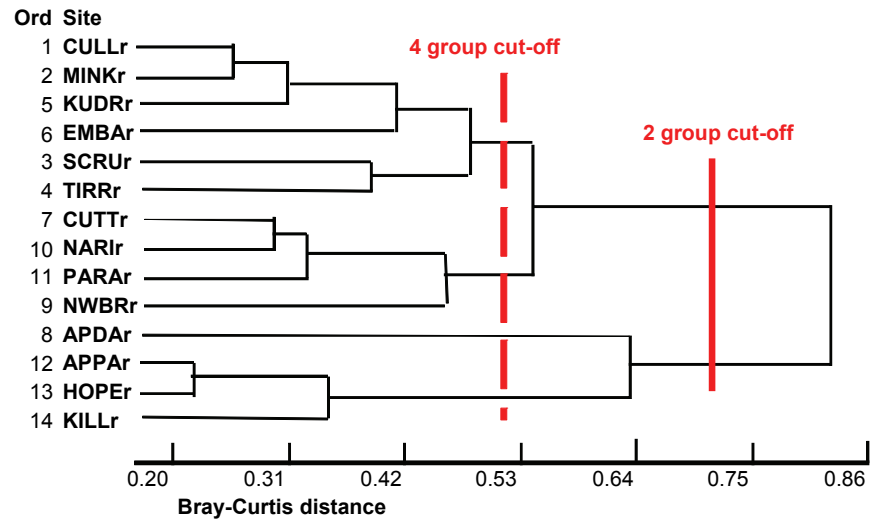

Figure 6: Dendrogram of 14 vegetation sites using Bray-Curtis distance of cover estimates of 64 plant species; 2 levels of cut-off distance shown, that separate two and four groups of sites, respectively

Table 3: Site Codes

Site Code	Waterbody Name
CULLr	Cullyamurra Waterhole
MINKr	Minkie Waterhole
SCRUr	Scrubby Camp Waterhole
TIRRr	Tirrawarra Waterhole
KUDRr	Kudriemitchie Waterhole
EMBAr	Embarka Waterhole
CUTTr	Cuttapirie Corner Waterhole
APDAr	Channel 'tween Lakes Apachirie and 'DAER'
NWBRr	Coongie Waterhole' NW Branch
NARIr	Narie Waterhole
PARAr	Parachirrinna Waterhole
APPAr	Channel downstream of Lake Appadare
HOPEr	Lake Hope
KILLr	Lake Killalpaninna

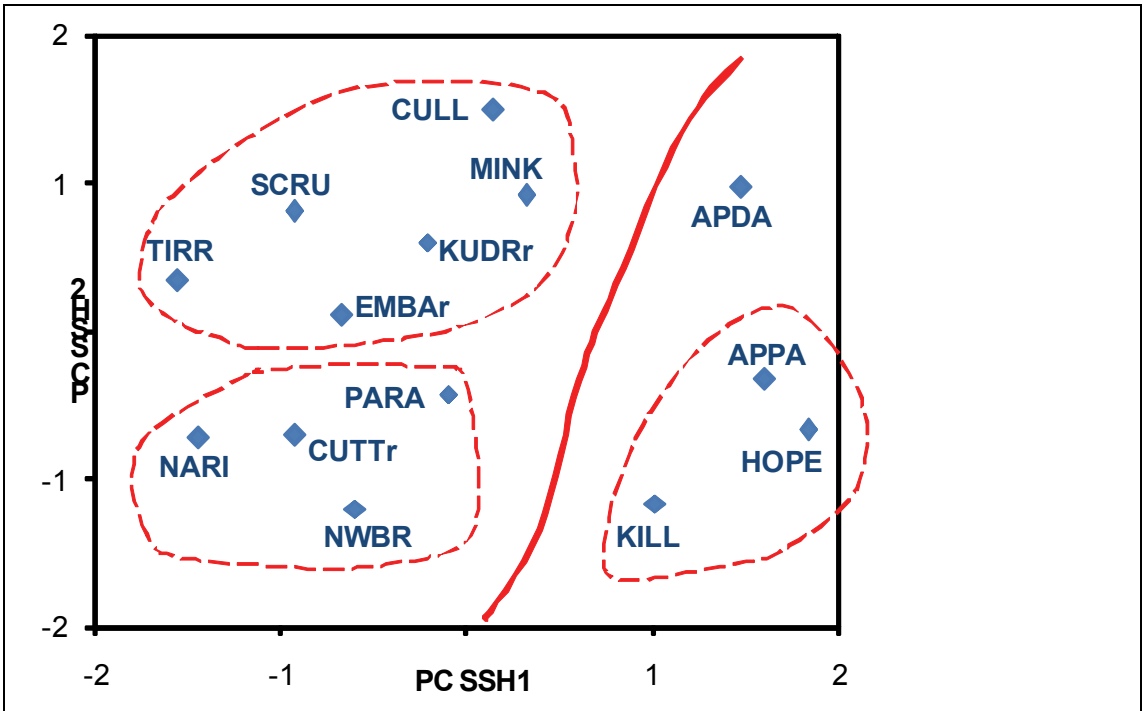

Figure 7a. NMDS ordination (2d ssh) of 14 vegetation sites using Bray-Curtis distance based on cover of 64 plant species, rotated to principal components; stress = 0.20.

The main division between sites from the dendrogram is shown by the solid red line, with the four groups (except the singleton) enclosed by dashed lines.

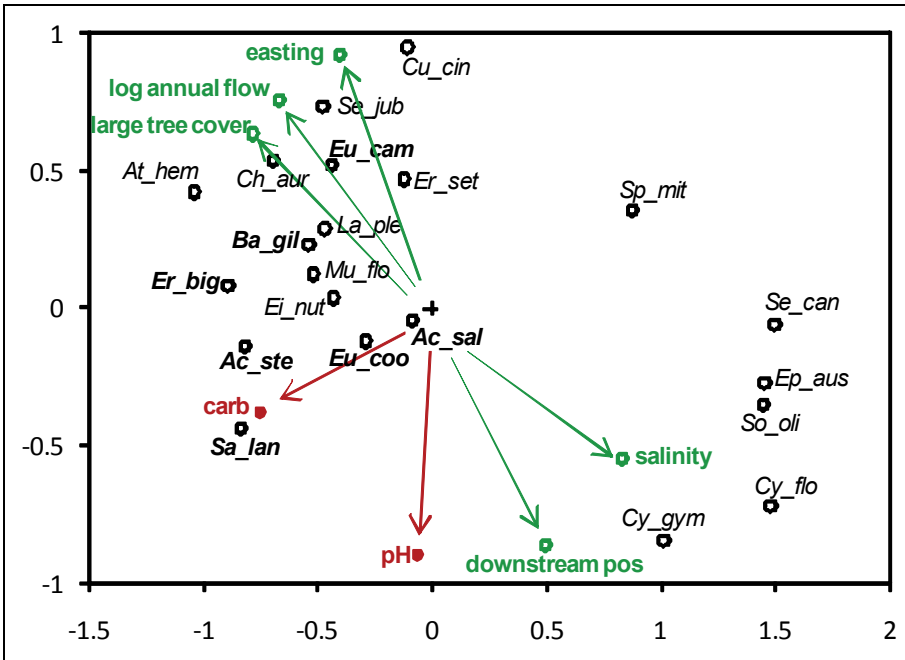

Figure 7b. Weighted mean position of 21 influential plant species (italics) superimposed on the ordination of sites in Fig. 7a.

With significant environmental vectors shown as arrows: soil variables in brown, and hydrology, location and one stand structure variable in green. Woody plants in bold font. See Table 5 for significance of

environmental correlates.

Code	Scientific	*R*
Ac_sal	*Acacia salicina*	0.47
Ac_ste	*Acacia stenophylla*	0.69
At_hem	*Atalaya hemiglauca*	0.58
Ba_gil	*Bauhinia gilva*	0.77
Ch_aur	*Chenopodium auricomum*	0.72
Cu_cin	*Cullen cinereum*	0.70
Cy_flo	*Cynanchum floribundum*	0.85
Cy_gym	*Cyperus gymnocaulos*	0.87
Ei_nut	*Einadia nutans*	0.83
Ep_aus	*Epaltes australis*	0.87
Er_set	*Eragrostis setifolia*	0.54
Er_big	*Eremophila bignoniiflora*	0.72
Eu_cam	*Eucalyptus camaldulensis*	0.64
Eu_coo	*Eucalyptus coolabah*	0.46
La_ple	*Lavatera plebeian*	0.82
Mu_flo	*Muehlenbeckia florulenta*	0.63
Sa_lan	*Santalum lanceolatum*	0.68
Se_can	*Sesbania cannabina*	0.70
Se_jub	*Setaria jubiflora*	0.85
So_oli	*Solanum oligacanthum*	0.89
Sp_mit	*Sporobolus mitchellii*	0.88

Table 4. Codes and names of 64 plant species used in floristic analyses, and frequency of occurrence across 14 sites.

Spp Code	Scientific Name	Frequency
Aca_sal	*Acacia salicina*	12
Aca_ste	*Acacia stenophylla*	7
Aes_ind	*Aeschynomene indica*	4
Alt_nod	*Alternanthera nodiflora*	7
Ama_gra	*Amaranthus grandiflorus*	11
Asp_gem	*Asperula gemella*	4
Ata_hem	*Atalaya hemiglauca*	4
Bau_gil	*Bauhinia gilva*	11
Boe_dom	*Boerhavia dominii*	9
Bra_pra	*Brachiaria praetervisa*	5
Bra_tou	*Brassica tournefortii*	3
Che_aur	*Chenopodium auricomum*	6
Cuc_mel	*Cucumis melo*	9
Cul_cin	*Cullen cinereum*	4
Cyn_flo	*Cynanchum floribundum*	3
Cyp_gym	*Cyperus gymnocaulos*	4
Dac_rad	*Dactyloctenium radulans*	7
Ein_nut	*Einadia nutans ssp. eremaea*	12
Enc_tom	*Enchylaena tomentosa var. glabra*	12
Enn_ave	*Enneapogon avenaceus*	3
Epa_aus	*Epaltes australis*	4
Epa_cun	*Epaltes cunninghamii*	3
Era_die	*Eragrostis dielsii var. dielsii*	9

Era_set	*Eragrostis setifolia*	7
Ere_big	*Eremophila bignoniiflora*	8
Euc_cam	*Eucalyptus camaldulensis var. obtusa*	6
Euc_coo	*Eucalyptus coolabah*	14
Eup_dru	*Euphorbia drummondii*	7
Eup_ste	*Euphorbia stevenii*	3
Gli_lot	*Glinus lotoides*	6
Hal_asp	*Haloragis aspera*	10
Lav_ple	*Lavatera plebeia*	10
Lys_sub	*Lysiana subfalcata*	4
Mal_ame	*Malvastrum americanum*	3
Mue_flo	*Muehlenbeckia florulenta*	11
Muk_mad	*Mukia maderaspatana*	3
Nic_vel	*Nicotiana velutina*	11
Phy_lac	*Phyllanthus lacunellus*	3
Por_int	*Portulaca intraterranea*	11
Pse_spi	*Pseudoraphis spinescens*	3
Pte_sph	*Pterocaulon sphacelatum*	5
Rut_hel	*Rutidosis helichrysoides var. helichrysoides*	6
Sal_kal	*Salsola kali*	7
San_lan	*Santalum lanceolatum*	7
Scl_bic	*Sclerolaena bicornis*	4
Scl_dia	*Sclerolaena diacantha*	3
Scl_int	*Sclerolaena intricata*	5
Scl_mur	*Sclerolaena muricata var muricata*	4
Sen_lan	*Senecio lanibracteus*	8
Ses_can	*Sesbania cannabina var. cannabina*	3
Set_jub	*Setaria jubiflora*	6
Sid_amm	*Sida ammophila*	5
Sol_esu	*Solanum esuriale*	6
Sol_nig	*Solanum nigrum*	11
Sol_oli	*Solanum oligacanthum*	4
Son_ole	*Sonchus oleraceus*	9
Spo_mit	*Sporobolus mitchellii*	7
Ste_flo	*Stemodia florulenta*	8
Tet_tet	*Tetragonia tetragonioides*	7
Teu_rac	*Teucrium racemosum*	9
Tri_eic	*Tribulus eichlerianus*	7
Tri_tri	*Trianthema triquetra*	8
Ver_off	*Verbena officinalis*	14
Zyg_amm	*Zygophyllum ammophilum*	8

Ordination of the sites (Figure 7a) confirmed the groupings apparent in the dendrogram (Figure 6), with the strongest gradient in assemblage composition – shifts in plant species occurrence and abundance between upstream and downstream waterbodies – being expressed on the first axis, PC SSH1. While the

local geographic range limit of the River Red Gum within the study region contributes to the clear distinction between upstream and downstream (and lower-discharge) sites, 25 other plant species had a stronger correlation with the arrangement of sites in ordination space (results from principal axis multiple correlation, *pcc*, in PATN), suggesting that other plants had a stronger influence on site groupings than red gum itself. For instance, the four herbaceous species – *Cynanchum floribundum*, *Cyperus gymnocaulos*, *Epaltes australis* and *Solanum oligacanthum* – were characteristic of the riparian environments on the Lower Cooper and had multiple correlation coefficients, *R*, greater than 0.85 ($P < 0.01$; see legend at foot of Fig. 7b), compared with $R = 0.64$ (marginally significant) for River Red Gum.

Table 5. NMDS ordination (2d ssh) of 14 vegetation sites using Bray-Curtis distance based on cover of 64 plant species, rotated to principal components; stress = 0.20.

The main division between sites from the dendrogram is shown by the solid red line, with the four groups (except the singleton) enclosed by dashed lines.

Var	Variable description	PC SSH1	PC SSH2	*R*	*P*
LgTrCov	Large Tree Cover (aerial projection)	-0.6145	0.7889	0.787	0.009
lnLTC	log of Large Tree Cover	-0.7750	0.6320	0.842	0.002
Rich15	species richness of 15 perennials	-0.9999	0.0078	0.905	0.001
Ec	Eletrical conductivity of soil (salinity)	-0.5186	-0.8550	0.539	>0.1
Ecv	cv of Ec	-0.8053	-0.5929	0.325	>0.1
pH	pH of soil	-0.0722	-0.9974	0.759	0.009
pHv	cv of pH	0.6003	-0.7998	0.592	0.095
Carb_sc	soil carbonate reaction score	-0.8887	-0.4585	0.705	0.016
WR_sc	soil water-repellant score	-0.7905	-0.6126	0.685	0.051
DSOrd	Order of sites downstream	0.5000	-0.8660	0.922	0.008
DSHyd	long-term estimate of annual flow volume*	-0.2287	0.9735	0.763	0.019
lnDSH	log of DSHyd*	-0.6602	0.7511	0.878	0.002
Cond	water conductivity (salinity)*	0.8355	-0.5496	0.878	0.002
UTME	AMG Easting	-0.3986	0.9172	0.879	0.014
UTMN	AMG Northing	-0.8574	0.5146	0.652	0.076

* a few missing values were estimated

The occurrence of River Red Gum was not completely restricted to sites within the Upper Cooper sub-group 1A, being absent from Embarka Waterhole; nor was the species absent from all other sites, as it is a dominant component of the riparian vegetation along the North West Branch downstream to Coongie Lake (site NWBR belonging to sub-group 1B). Only one species, the riparian understorey grass, *Setaria jubiflora*, was exclusively restricted to and recorded at all six sites in sub-group 1A ($R = 0.85$; Fig.7b). Five ecological associates of this species, revealed by clustering of the 64 species, were: the grass, *Brachiaria praetervisa*; herbs, *Cullen cinerea* and *Solanum esuriale*; bindii, *Sclerolaena muricata*; and the shrub, Queensland Bluebush, *Chenopodium auricomum*. These species were most

prevalent in the upper reaches of both branches of Cooper Creek in the study region. There were no species exclusively recorded at all sites in sub-group 1B, but the small riparian trees, River Cooba (or Belalie), *Acacia stenophylla*, and Plumbush, *Santalum lanceolatum*, occurred at the four sites in this cluster while being less prevalent in the other sub-groups. The closest ecological associates of these species were mainly other woody perennials, namely the Queensland Bean-Tree *Bauhinia gilva*, Broughton Willow *A. salicina*, Creek Wilga *Eremophila bignoniiflora*, and Lignum *Muehlenbeckia florulenta*, and also the herbaceous daisy, *Senecio lanibracteus*. These trends are reflected in the position of species in ordination space (Fig.7b), with members of this second group of species generally lying below the first group, i.e. more aligned with the cluster of sites in sub-group 1A (Fig. 7a).

The composition of riparian vegetation along Cooper Creek is determined by a range of environmental influences, most importantly the hydrological regime and soil properties, e.g. Gillen (2010). The influence of some of these variables was determined by *post-hoc* correlation analyses (routine *pcc* in PATN: see Fig. 7b and Table 5), and measures of hydrological regime and their proxies (downstream order of sites) exert strong control on the expression of riparian vegetation, e.g. downstream order of sites, the natural logarithm of annual discharge and water salinity were highly significant variables ($P < 0.01$). However, pH and carbonate content were two significant soil variables, operating independently to a degree (see the orthogonal spread of hydrological vs soil vectors in Fig. 7b), responsible for the separation of sites in ordination space. Soil pH tends to increase downstream, in line with decreasing biomass production and organic content in the soils, but its effect is partly independent of the strong hydrological drivers in the study region. Further analysis of soil variables and the addition of extra sites to the dataset would allow the relative contribution of hydrological and soil variables to be determined more precisely.

Multivariate analyses of 15 woody perennial species stand structure

Cluster analysis used the Bray-Curtis ecological distance between sites based on actual projected aerial cover estimates of the 15 species in Table 6:

Table 6: 15 perennial species codes

Ac_mur	*Acacia murrayana*
Ac_sal	*Acacia salicina*
Ac_ste	*Acacia stenophylla*
At_hem	*Atalaya hemiglauca*
Ba_gil	*Bauhinia gilva*
Ca_mit	*Capparis mitchellii*
Ch_aur	*Chenopodium auricomum*
Er_big	*Eremophila bignoniiflora*
Eu_cam	*Eucalyptus camaldulensis* var. *obtusa*
Eu_coo	*Eucalyptus coolabah*
Mu_flo	*Muehlenbeckia florulenta*

	Ow_aci	*Owenia acidula*	
	Pi_ang	*Pittosporum angustifolium*	
	Sa_lan	*Santalum lanceolatum*	
	Se_lan	*Senecio lanibracteus*,	

The two eucalypts and the bauhinia were defined as tall trees, most of the remainder as small trees and tall woody shrubs, and with the shrubs often associated with swamps (Lignum and Queensland Blue Bush) being of a different life-form, and with the life-form outlier, *Senecio lanibracteus*, a herbaceous species included because of its distinctive dominance at some sites. These species are identified in the following figures by the codes given above (Table 6). Cover of the three tall trees was combined as a descriptive measure for subsequent *post-hoc* analyses (and in the previous section), as this variable was likely to be strongly correlated with hydrological regime, and is considered to have value as a measure of riparian condition or health (Sheldon *et al.* 2005; Price *et al.* 2009), while also providing important habitat for instream fauna and for aquatic and terrestrial birds (Reid and Gillen 1988; Reid 1990).

The dendrogram (Figure 8) reveals three main groups of sites, corresponding to a River Red Gum defined assemblage (group 1), (largely) upstream sites lacking River Red Gum but having dense stands of Coolibah (group 2), and the two sites around Lake Hope with a scarcity of Coolibah cover. Because of the slightly denser cover of Coolibahs on the riparian fringe of the channel feeding Lake Hope where the quantitative stand structure assessment was made, this site (Lake Killalpaninna) clustered with the sites higher upstream (but outside the distribution limits of River Red Gum).

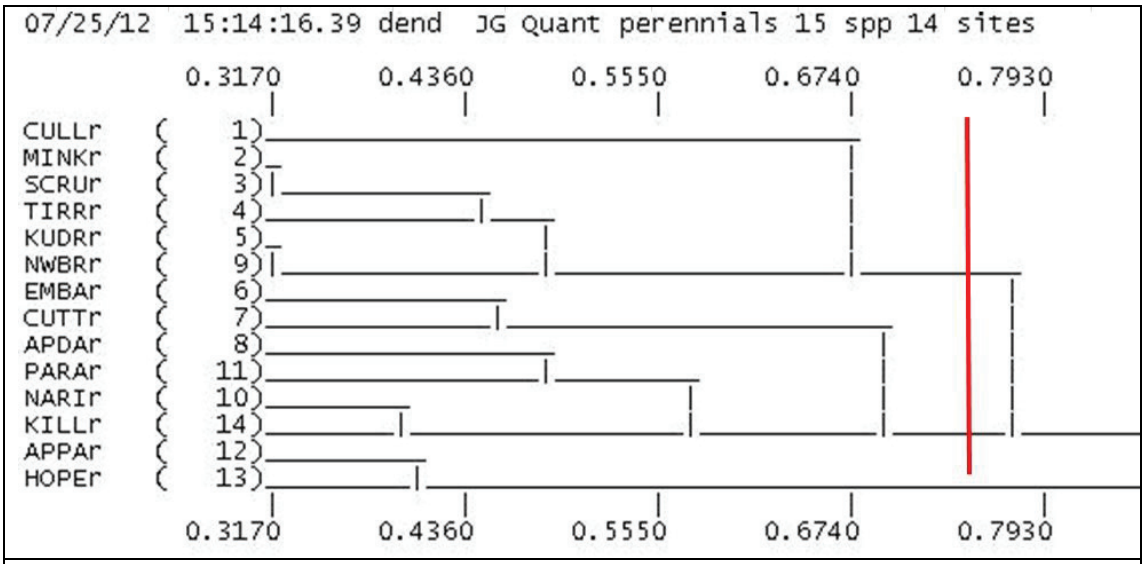

Figure 8: Dendrogram of 15 perennial species using Bray-Curtis distance

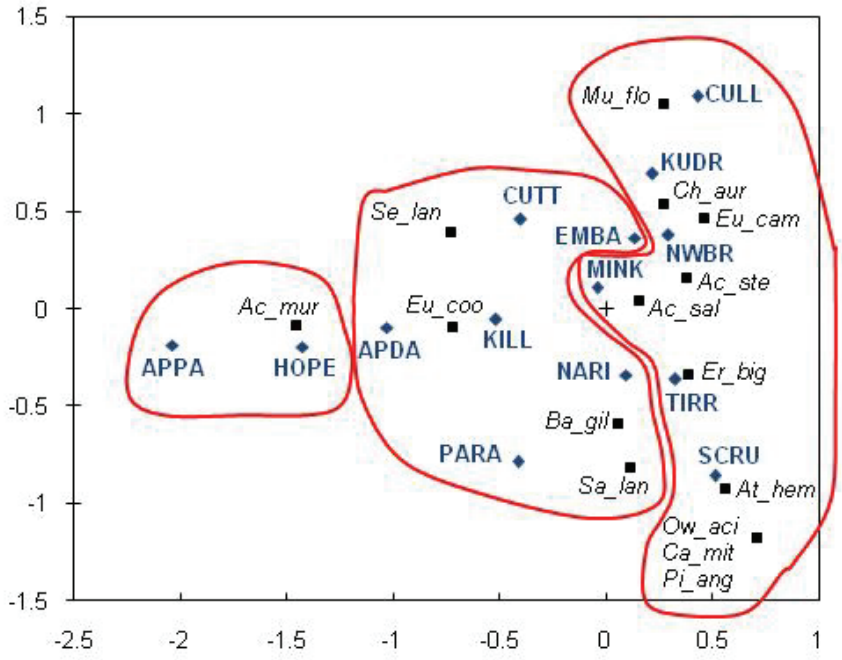

Figure 9a: Detrended correspondence analysis (DCA) of sites based on cover estimates of 15 plant species, showing sites, species and the three groups (red) recognised from cluster analysis.

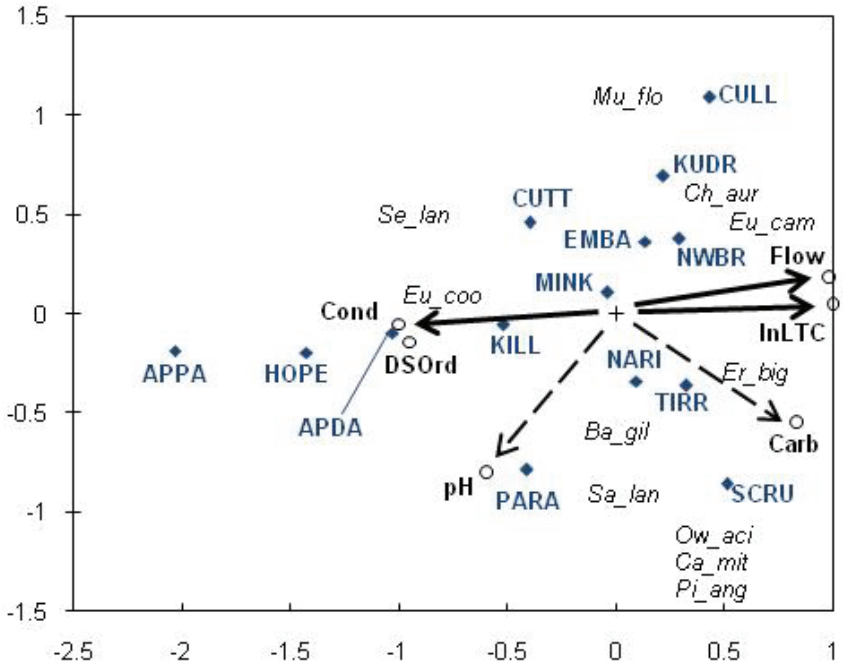

Figure 9b: Same DCA as Figure 9a with *post-hoc* fitted vectors, showing that hydrological regime (and log of Large Tree Cover) are aligned with the primary gradient among sites (*P* < 0.01); soil variables were marginally significant (0.05<*P*<0.1).

Ordination (DCA) revealed the major trend in the distribution of these 15 species to be under control of the hydrological regime (Figures 9a,b), and that cover of the three large trees (lnLTC) was closely aligned with the hydrological gradient as measured by long-term annual flow (discharge) and water conductivity (salinity), reflecting the declining discharge of Cooper Creek in South Australia with distance downstream. The implication of both sets of multivariate analysis is that understanding of site condition can only have meaning when placed in the context of the primary control of hydrology on vegetative expression.

As well as the primary importance of tall tree cover to the condition of riparian sites in arid ecosystems such as the South Australian Cooper Creek region, the smaller trees play an important role in provision of shelter and food resources for terrestrial fauna in addition to their part in ecosystem services, such as bank stability, nutrient and carbon cycling, and mediating the fluxes of organic and inorganic matter between aquatic and terrestrial systems (Sheldon *et al.* 2005). The significant small tree species of the Cooper region belong to diverse plant families – Creek Wilga (Myoporaceae), Sour Plum (Meliaceae), Plum Bush (Santalaceae), Native Orange (Pittosporaceae), Wild Orange (Capparaceae) and Whitewood (Sapindaceae) as well as the *Acacia* spp (Leguminosae) – and so provide different food sources and provisioning of those resources at different times of the year and flood cycle compared with the Eucalypts and Bauhinia. For instance, species of mistletoe that grow on the small trees are different to those that grow on the eucalypts, providing nectar and fruit at different times of the year (Reid and Gillen 1988) – *Diplatia grandibractea* on the eucalypts, and *Lysiana subfalcata* and *Amyema preissii* on diverse hosts such as the wattles and Plumbush. Robust development of a mid-storey small tree layer provides the structural habitat complexity that promotes a higher diversity of bird species in riparian assemblages. In this context it is significant that there was a tendency for a greater diversity of small trees to occur at sites midway along the longitudinal section surveyed, i.e. at sites between Scrubby Camp and Coongie Lake on the North West Branch and Embarka and Narie Waterholes on the Main Branch. Scrubby Camp Waterhole had a particularly fine stand of medium-sized trees, with Broughton Willow *A. salicina* dominant, and the Common Bronzewing, a species infrequently observed along the Cooper riparian frontages, was recorded there and at the structurally similar sites around Tirrawarra and Narie Waterholes; wattle seeds are a favoured food of the Common Bronzewing.

3.4 Soils

A recent study of the soils and perennial plants of the Cooper Floodplain in South Australia (Gillen 2010) produced a local classification of 8 soil groups which were clearly associated with distinct vegetation communities both longitudinally down the

Cooper and laterally across the floodplain. This soil vegetation relationship is depicted in Figure 10.

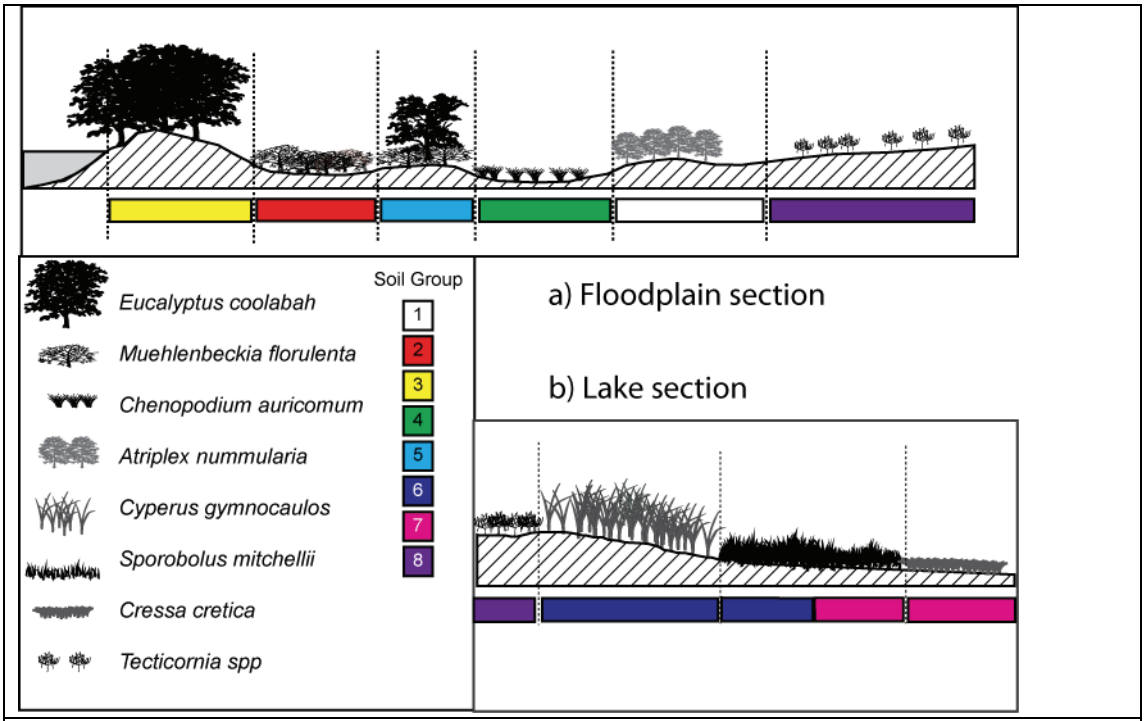

Figure 10: Association of soil groups with vegetation

The soils associated typically with river and channel banks (Group 3 in Figure 10) displayed distinct physical and chemical characteristics. Being predominantly alluvial these soils were found to be typically light textured, mainly silty loams or silty clay loams in the upper profile and exhibiting an increasing proportion of light clay at depth. Significantly the soils of this group possessed the highest levels of Total Organic Carbon (TOC, determined by MIR analysis) in the top 10cm compared to the other 7 soils groups of the floodplain (Group 3 Figure 11). The more mesic conditions and alluvial soil characteristics of the riparian fringe is conducive to the establishment of a structurally and floristically complex vegetation community providing a constant source of organic material.

Within soils carbon can be present in three basic forms, namely; elemental carbon (charcoal, graphite, soot etc); inorganic carbon (typically in carbonate form in arid regions) and organic carbon (principally formed from the breakdown of plant and animal products). The organic carbon associated with biomass breakdown comprises a mix of simple sugars, carbohydrates, complex proteins, waxes and organic acids (lowering surface soil pH). This complex mix plays an important role in enhancing and elevating the cation exchange capacity (CEC) of soils particularly those such as the riverine Cooper soils that contain component clay minerals (Group 3 Figure 12), resulting in an increased capacity to retain plant nutrients and hold

water all characteristics contributing to an enhanced fertility in an otherwise nutrient poor arid landscape.

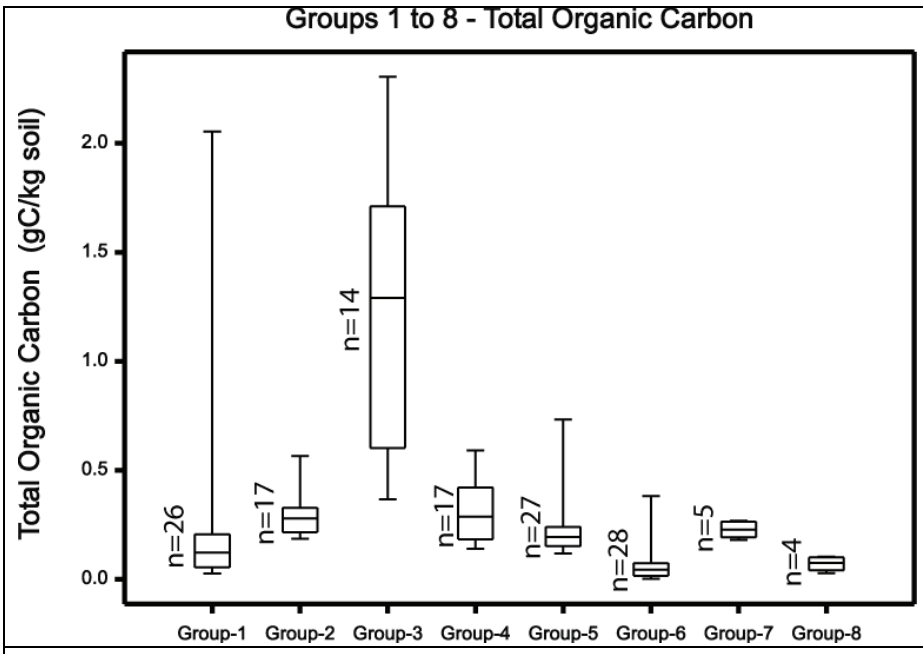

Figure 11: Total organic carbon 0-10 cm for all groups

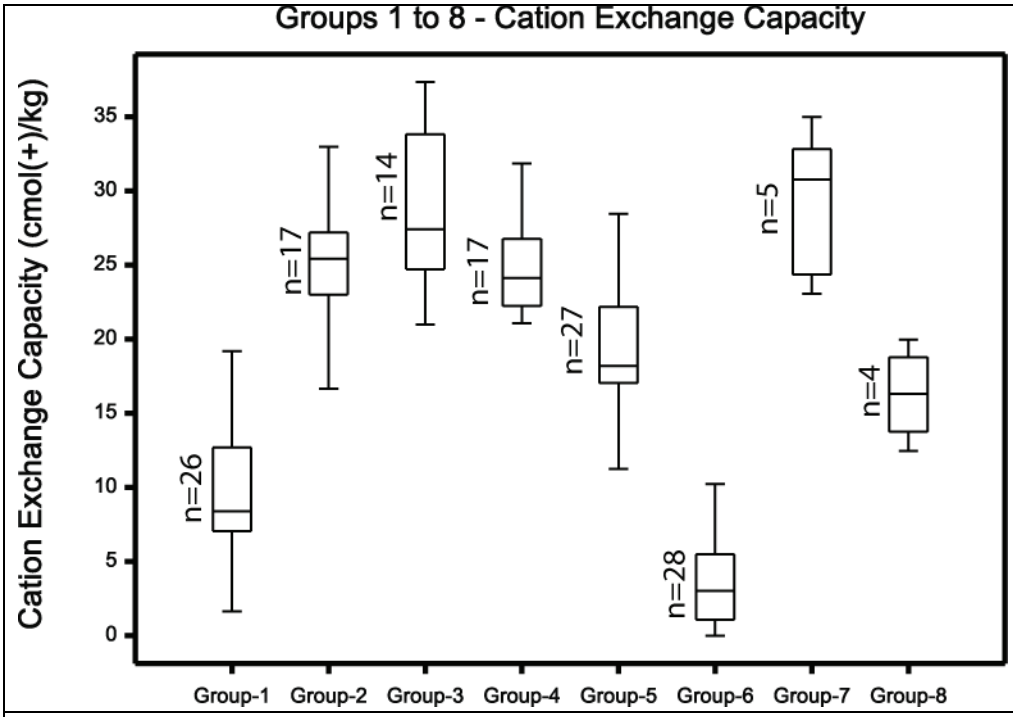

Figure 12: Cation exchange capacity 0-10cm for all groups

Based on the findings described above the investigation of soil carbon was incorporated into this current study, resulting in the collection of 15 samples of the top 5cm of soil at each of the 14 waterholes/water bodies surveyed (see Appendix 7

for all data). It was expected that the more structurally diverse and mesic environments of the upper reaches would display elevated levels of soil carbon compared to the drier, more structurally simple environments in the lower reaches. Interestingly as shown in Figure 13 the results of total carbon analysis revealed that those waterholes that had displayed past or recent signs of cattle impact possessed the most elevated values of soil carbon. It appears that the usual nutrient loading of the riverine fringe by the natural processes of litter production and breakdown as well as the deposition of native animal products (particularly associated with bird populations) and their breakdown and incorporation is accompanied by the import of nutrients by cattle. As all samples tested negatively to the presence of carbonate (inorganic carbon) the remaining total carbon comprised both elemental and organic forms. As mentioned earlier in this report, a number of burnt Coolibahs were noted at Narie Waterhole which may explain the very elevated carbon levels at that site representing the compounding impacts of fire and nutrient loading by cattle.

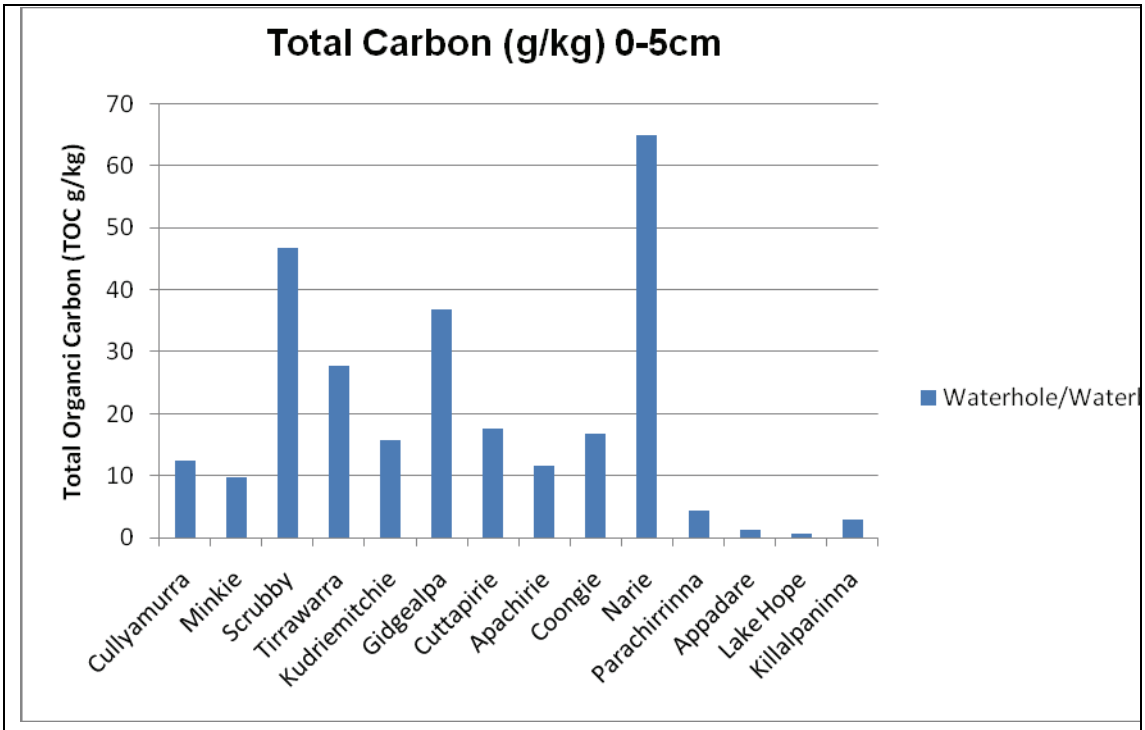

Figure 13: Total carbon results for all waterholes / waterbodies surveyed

Combining pH and EC soil data for all occurrences of a particularly significant perennial species such as *Eucalyptus camaldulensis* across all study sites provides a potential insight into the nature of relationships between soil variables and plant distribution. Figures 14 and 15 depict the average changes in soil EC and pH down the soil profile at all sites where *Eucalyptus camaldulensis* was present in comparison to the average values of pH and EC at those sites where it was absent.

The results indicate the preference of *E. camaldulensis* for soils of lower salinity and reduced alkalinity typically those soils associated with the upper reaches of the Cooper receiving more reliable flood pulses (see Appendix 6 for all pH and EC data across all sites).

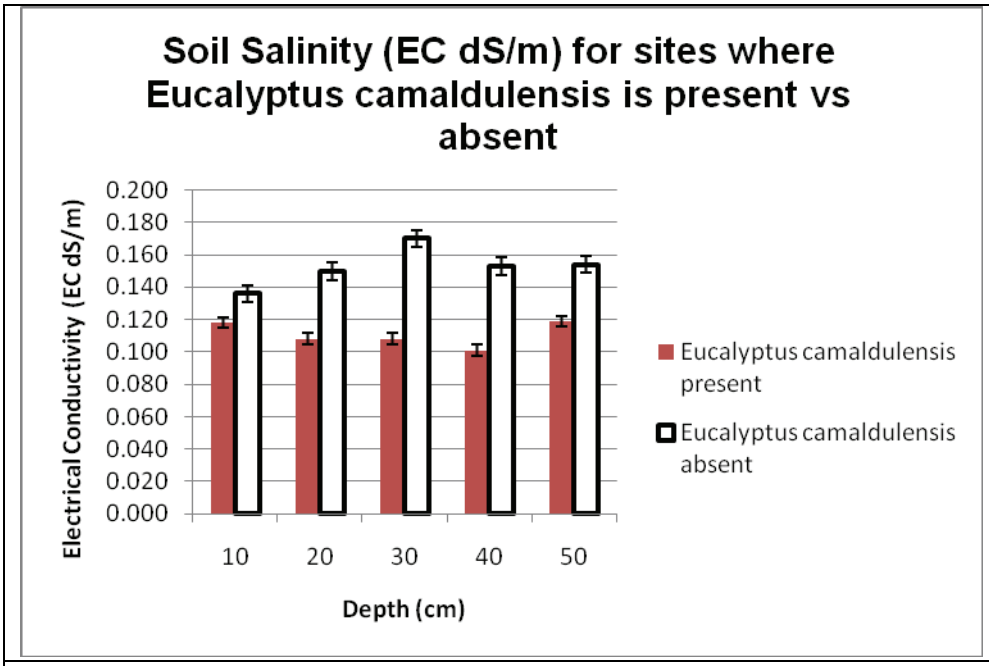

Figure 14. Soil salinity (EC dS/m) for sites where Eucalyptus camaldulensis is present vs absent

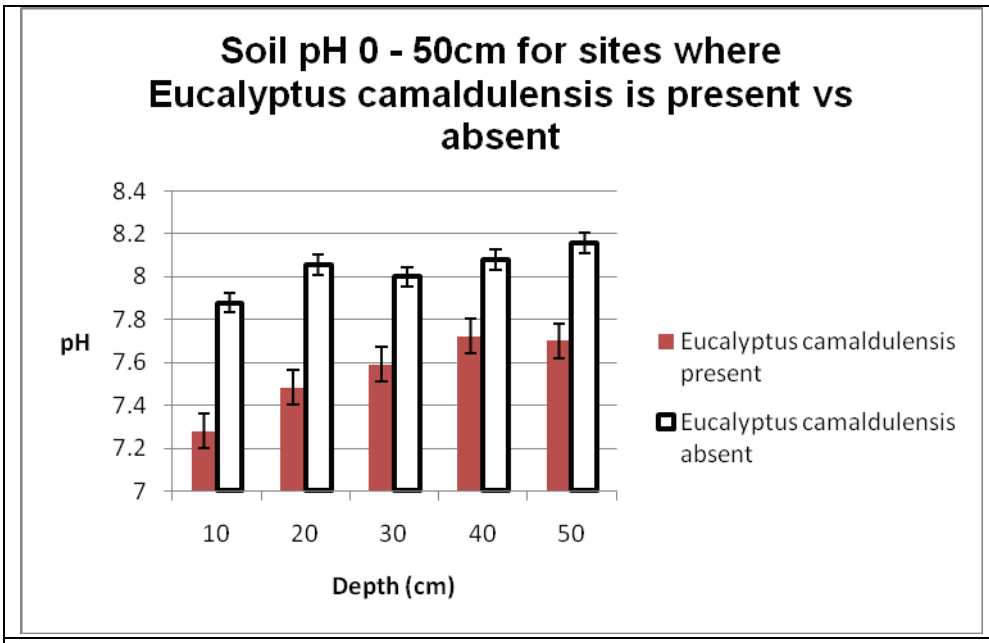

Figure 15. Soil pH 0 – 50cm for sites where Eucalyptus camaldulensis is present vs absent

This sensitivity of *E. camaldulensis* to saline conditions is more clearly demonstrated when compared with other major perennial riverine species such as *E. coolabah* and

Bauhinia gilva. Figures 16 and 17 reveal this relationship and show the capacity for both *E. coolabah* and *Bauhinia gilva* to cope with increasingly more saline conditions not tolerated by *E. camaldulensis* (Figure 16). Ultimately *E. coolabah* shows a greater tolerance for more alkaline conditions and remains the sole dominant perennial tree in the lower reaches (Figure 17).

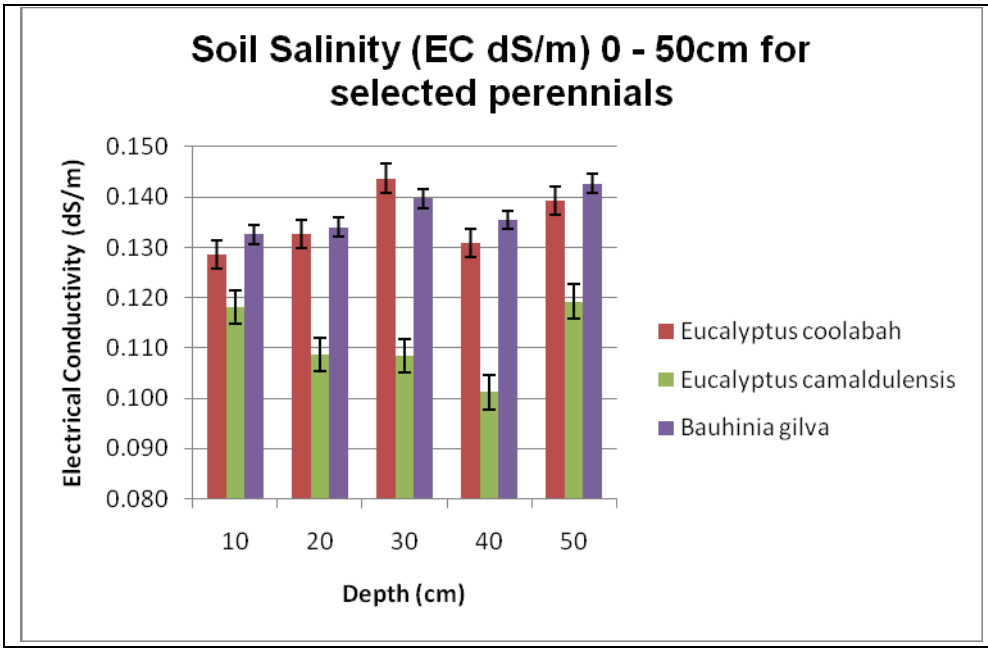

Figure 16. Soil salinity (EC ds/m) 0-50cm for selected perennials

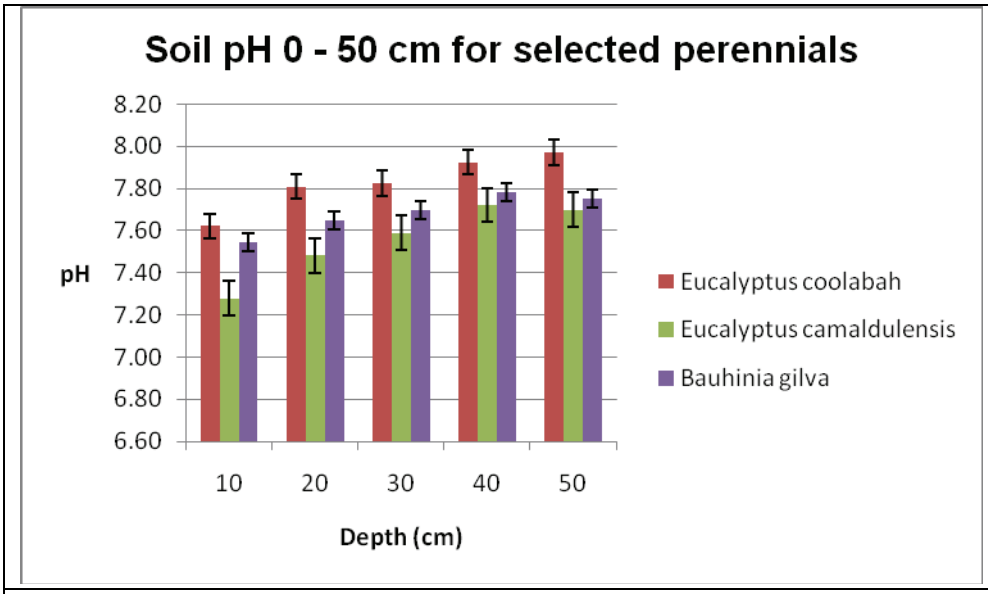

Figure 1. Soil pH 0-50cm for selected perennials

Whilst there are general trends for increasing soil salinity and alkalinity from upper to lower reaches in both the North West and Main Branches of the cooper in South Australia there are interesting anomalies. The lowered salinity and alkalinity of the sites at Lake Hope and on the Cooper Channel west of Lake Appadare (Appa and Hope in Figures 18 and 18) can be explained by the fact that their soils are atypical of the riverine silty clay loams of the other waterholes/water bodies sampled. At both sites the very sparse Coolibah fringes assessed were effectively positioned on the encroaching sands of surrounding dune fields. These are predominantly sandy soils with reduced cation exchange capacity and enhanced percolation potential hence readily flushed of salts and reduced in alkalinity. The other anomalies particularly the reasons behind the drop in soil alkalinity and salinity at Kudriemitchie are not as readily resolved and could deserve further investigation.

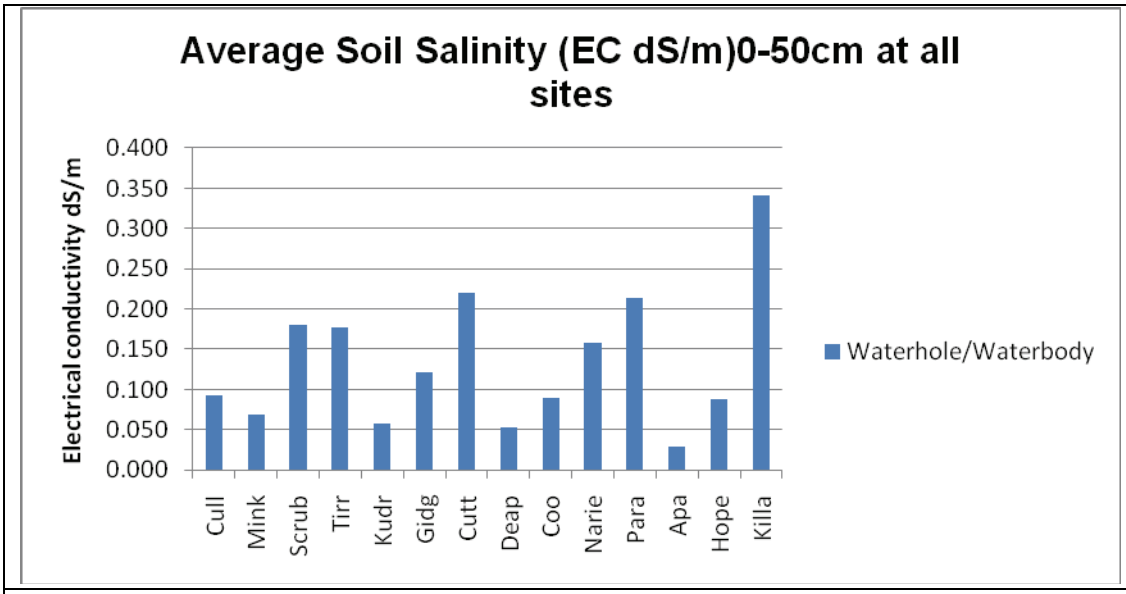

Figure 18. Average soil salinity (EC dS/m) 0-50cm at all sites

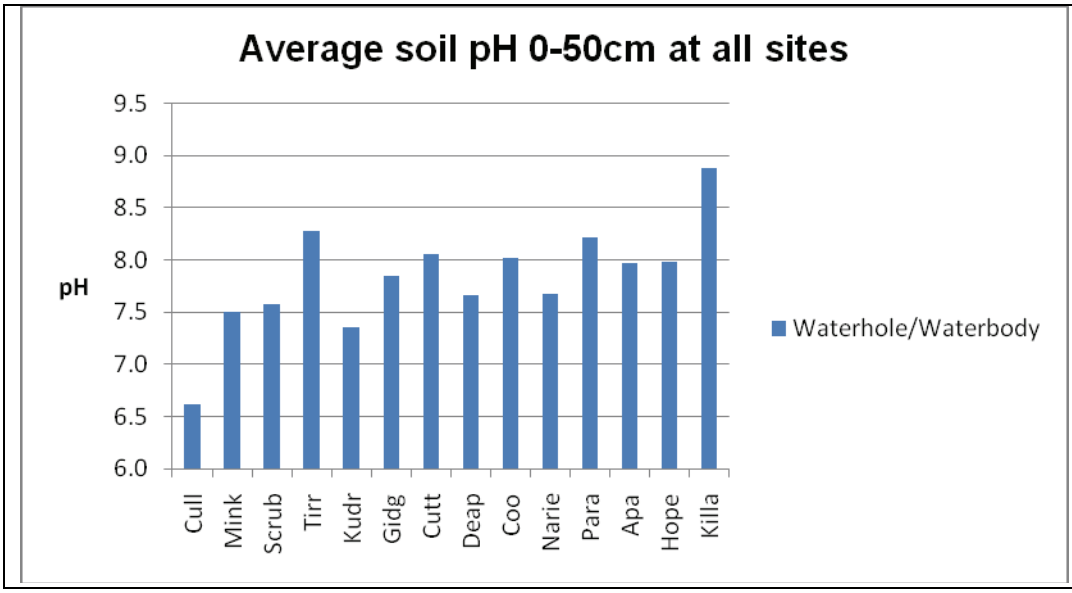

Figure 19. Average soil pH 0-50cm at all sites

4 THREATS AND IMPACTS

4.1 Hydrological Threats

The sites of focus for this study, namely selected waterholes of Cooper Creek in South Australia, are but a component of the highly significant unregulated endorheic drainage system of the Lake Eyre Basin. Any discussion of threats and associated impacts to the biodiversity values or overall biophysical system processes of the riparian vegetation of Cooper creek waterholes must be set in this context.

The Cooper Creek system along with the other major Lake Eyre Basin dryland river systems and their associated floodplains represent increasingly globally rare examples of naturally functioning unregulated systems which left in their currently naturally functioning state represent extremely valuable reference systems. Ongoing observation, monitoring and research of the hydrological and ecological patterns and processes of these natural systems will provide valuable insight into future rehabilitation and restoration of degraded dysfunctional dryland river systems elsewhere.

The hydrology of the Cooper Creek river system exhibits one of the most hydrologically variable flow regimes in the world (Puckridge et al., 1998) and its associated ecosystems are highly attuned and responsive to this natural variability. Whilst significant local rainfall events are important spasmodic ecological drivers it is predominantly the major flood events derived from upper catchment summer monsoonal influence that drive the ecosystem processes of the Cooper Creek and associated floodplain.

"*These flood events are a crucial driving force, a natural disturbance factor, in the structure and functioning of the wetland and floodplain systems of the Cooper and their associated perennial vegetation communities. These episodic events, distant in genesis, are vital for the support and functioning of floodplain biota, given that rainfall in this region is highly variable spatially, temporally, in duration and intensity even in comparison with other global arid regions (Stafford Smith and Morton 1990). As a consequence of its location in a region of extreme rainfall variability and its transmission through the most arid region of Australia the Cooper epitomizes the characteristics of a dryland river system*" (Gillen 2010).

Thus the most significant potential threat to the ecosystems of Cooper Creek in South Australia is any disruption to the naturally functioning hydrology of the greater region through major water extractions associated with agricultural or mining

activities. Whilst the waterholes surveyed in this study play ecologically highly significant refugial roles their ongoing existence is inextricably linked with the maintenance of the natural hydrological regime derived from the monsoonally driven flows of the upper catchment in Queensland. The Cooper in South Australia must be viewed as part of an integrated total catchment and managed in this context.

A potential managerial danger in focusing on waterholes and their refugial status is to inadvertently view waterholes as static, disjunct components rather than components of a vital, dynamic interconnected dryland river and floodplain system. Focusing on waterholes reinforces focus on longitudinal hydrological connectivity, potentially downplaying the highly significant role of lateral connectivity of the river with its floodplain. *Eucalyptus coolabah* is an iconic perennial species of the Cooper Creek channel and associated floodplain. The distribution and persistence of the species within the study region is dependent to a large extent upon;

- Longitudinal hydrological connectivity along the extent of the Cooper and associated channels;
- Lateral hydrological connectivity of the associated floodplain with the longitudinal flow of the river;
- Vertical connectivity of floodwaters recharging local groundwater systems; and
- Temporal connectivity; the persistence of *E. coolabah* through time, both along the river and across the floodplain providing the source of seed for distribution across the landscape associated with major flood events.

4.2 Recruitment Threats

The last point above, namely the importance of temporal connectivity, assumes great significance in the consideration of establishment and persistence of the range of long lived perennial species typically encountered in these arid ecosystems.

The recruitment, establishment and persistence of these species through time may be heavily dependent upon a particular constellation of climatic and hydrological conditions that occur episodically if not rarely over long time frames. The recent sequence of La Nina events lasting several years resulting in major local rains and extensive flooding events across the cooper Creek region has provided a valuable 'window of recruitment opportunity' for many perennial riverine and floodplain species. Not only has there been significant germination across a range of species but the subsequent sequence of wet years has provided a valuable period of establishment and potential persistence of new cohorts. Paradoxically this post establishment period is also a period of greatest threat to new cohorts as these vegetative productive seasons are subsequently impacted and exploited by cattle grazing and pressures from feral animals in particular rabbits, pigs and goats.

At almost all sites surveyed for this study there was positive evidence of recent recruitment of the range of perennial shrubs and trees of the riparian fringe. Seedlings and saplings of both *Eucalyptus camaldulensis (*River Red Gum*)*, *E. coolabah* (Coolibah) and *Bauhinia gilva* (Queensland Bean Tree) were observed at most sites that these species occurred. There was also evidence of recruitment of other valuable understory species including *Pittosporum angustifolium, Atalaya hemiglauca, Eremophila bignoniiflora, Acacia salicina, Acacia stenophylla* and significantly, *Owenia acidula (*a riverine/floodplain species which along with *Capparis mitchellii and Grevillea striata* are not common in the region.

However at those waterholes where there was evidence of active or relatively recent cattle pressure there was a distinct lack of recruitment. This was particularly the case at Tirrawarra, Narie, Cuttaprire Corner, and Parachirrinna waterholes.

4.3 Soil Impacts

At Tirrawarra Waterhole (site photo Appendix 4), following the recent presence of cattle the soil surface was pulversied, little surficial plant litter was evident and *Muehlenbeckia florulenta* (Lignum) cover typically extensive along the channel bank was sparse. Within the vicinity, in a backwater off the main waterhole *Echinochloa crus-galli* (Barnyard Millet) was observed.

At both Cuttapirie Corner and Parachirrinna waterholes the past impact of cattle grazing pressure along the channel was suggested by the significant cover of unpalatable species such as the natives*Sclerolaena intricata* and *S. bicornis* and in the case of Cuttapirie Corner, the densest cover of introduced *Solanum nigrum* encountered at all waterholes. Beyond the Cuttapirie waterhole were extensive areas of bare ground, devoid of vegetation dissected by occasional drainage lines actively eroding in their upper margins.

At Narie Waterhole extensive lengths of the channel bank were devoid of Lignum cover and the understory beneath very large old Coolibah specimens was dense with the introduced *Verbine officinalis* and native *Senecio lanibracteus* to the exclusion of a range of other native species typically encountered in these environments. This dense *Verbine officinalis, Senecio lanibracteus* association extended well beyond the riverine bank across the floodout. The past impact of fire was recorded by the presence of number of charcoaled Coolibah trunks.

All of these waterholes exhibited a reduced floristic richness in comparison to other surveyed waterholes.

The elevated total carbon levels established for the surface soils of most of the waterholes displaying evidence of cattle impact, strongly suggests the import and loading of nutrients via cattle dung. The associated pulverization of these alluvial soils by cattle hooves and the incorporation of these imported nutrients in this more mesic shaded environment provide ideal conditions for the invasion and

establishment of introduced plant species. The above observations of localized impact by cattle are by no means novel, as the following statement indicates;

"*The linear nature of the watercourse results in heavy grazing pressure paralleling the creek banks. The passage of stock to and fro results in the trampling of vegetation surrounding the waterholes; soil disturbance of the steep banks, along with browsing of shrubs and trees and a loss of vegetation cover. A decline in condition is evidenced by a reduction in perennial shrubs (possible old man saltbush) and an increase in the proportion of unpalatable species in the understory e.g. lignum*"(LAB 1986).

A range of threats and impacts upon regional vegetation has been identified and expounded upon in a number of relevant reports and studies pertaining to the study area. This literature can be categorized in an hierarchical framework as suggested in Figure 20.

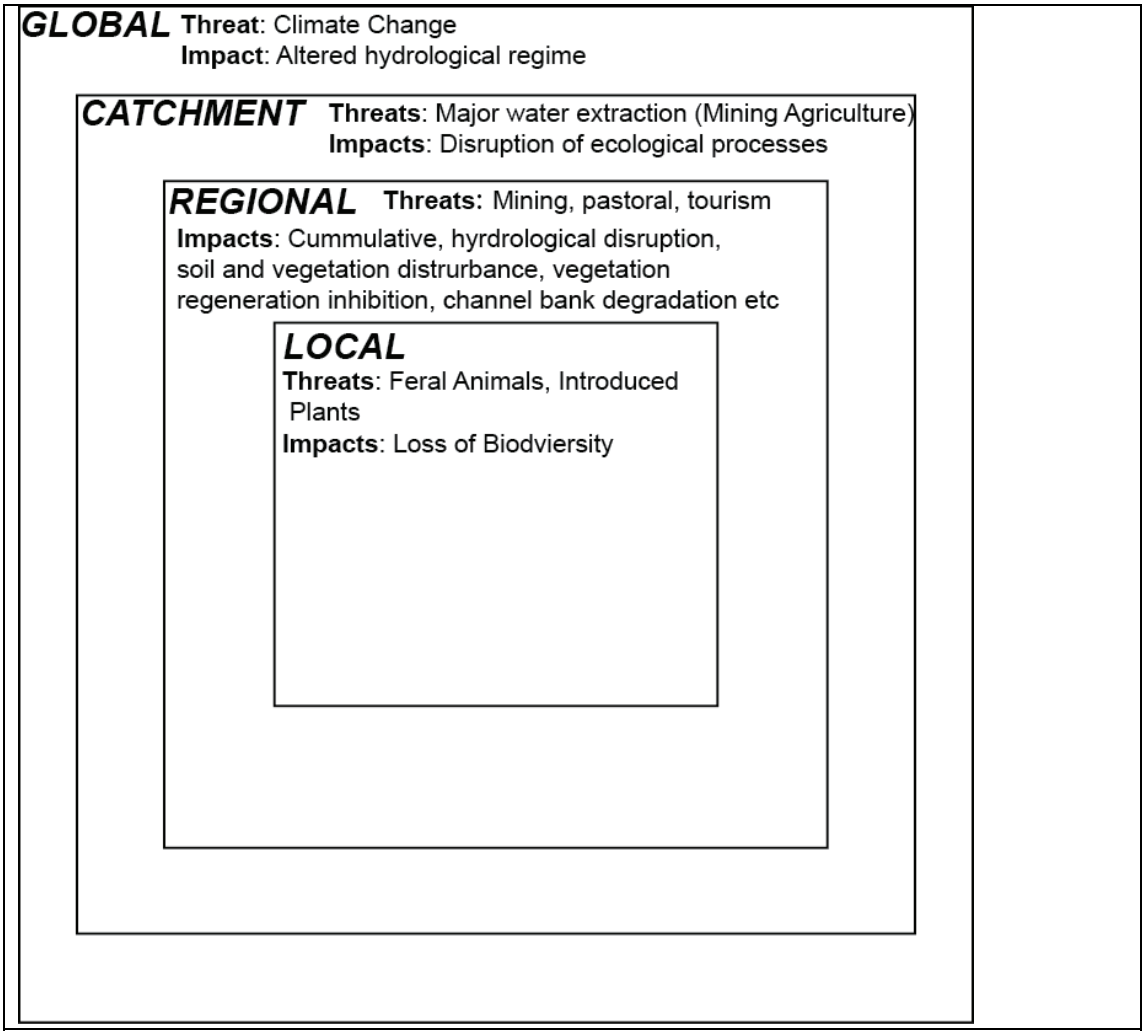

Figure 20: Hierarchical approach to the identification of threats and impacts to Cooper Creek Vegetation

An extensive literature review of all relevant literature of this nature should be conducted in the context of this study. An indication of the potential range of relevant national and international references is provided in Table 7.

Table 7. Relevant references

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4.4 Immediate Threats

4.4.1 Invasive Plant Species

The most obvious current and immediate threat to the riverine vegetation of the Cooper is the presence of Buffel Grass, *Cenchrus ciliaris* in the region. This species was observed twice during this study namely at Minkie and Kudriemitchhie waterholes. This highly invasive species has the potential to form monospecific stands over time, displacing native species with an obvious concomitant impact upon

local biodiversity. Additionally this hardy tussock species when in dense stands is extremely fire tolerant, burning with an intense heat, re-sprouting readily from the base outcompeting other local species. Currently within the study area the highly localized occurrences of Buffel grass must be eradicated immediately (and sites subsequently monitored) before these infestations spread. The other highly localized occurrence of Tall Fleabane, *Conyza sumatrensis,* observed during this study only at the Coongie Lakes Campsite should be dealt with accordingly.

4.4.2 Feral Animals

During the study the most obvious presence of both rabbits and pigs was within the Coongie Lake National Park. Rabbit activity was intense within the Coongie Camping zone and pig wallows and soil disturbance associated with foraging were observed at the Lake Apachirie Channel site.

The onus is on the Director of National Parks and Wildlife, South Australia to address these issues under section 37 of the National Parks and Wildlife Act 1972.

4.4.3 Cumulative Impacts

The synergistic, cumulative and interconnected nature of impacts associated with oil and gas exploration and extraction, pastoralism and tourism in the study region remains an issue, previously raised (Gillen and Drewien 1993) but subsequently not studied in any great detail. It was observed in the study by Gillen and Drewien (ibid) that the network of exploration tracks and service roads was subsequently utilized by the pastoral industry to gain rapid and easy access to more remote, previously less accessible areas of the Cooper Creek system. This facilitates the exploitation of these riverine and floodplain areas with obvious associated impacts previously referred to above. Additionally tourism access is thus provided to unsupervised (SANPWS) areas with associated impacts such as localized reduction in fallen timber, leaf litter, introduced plant species, soil compaction and potential loss of cultural artifacts.

The above issues were clearly encountered during this study. The development of a recent service road from Walkers crossing on the Main Cooper Branch to the Charo Oil field has resulted in the obstruction of recent floodwaters to parts of the outer floodplain. The track has facilitated the ready access and extension of pastoral activity to this region as attested by the presence of new cattle yards in the area. Additionally this new well surfaced road has provided an alternative route for tourists seeking to travel to the Birdsville track rather the previously used Christmas Creek track.

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6. APPENDICES 1-8

6.1 Appendix 1 – All species over all sites

All species encountered over all surveyed sites

Genus and Species	Family
Abutilon leucopetalum	MALVACEAE
Abutilon fraseri ssp. diplotrichum	MALVACEAE
Abutilon fraseri ssp fraseri	MALVACEAE
Abutilon otocarpum	MALVACEAE
Acacia ligulata	LEGUMINOSAE
Acacia murrayana	LEGUMINOSAE
Acacia salicina	LEGUMINOSAE
Acacia stenophylla	LEGUMINOSAE
Acacia victoriae	LEGUMINOSAE
Aeschynomene indica	LEGUMINOSAE
Alternanthera nodiflora	AMARANTHACEAE
Alternanthera sp.	AMARANTHACEAE
Amaranthus grandiflorus	AMARANTHACEAE
Amaranthus interruptus	AMARANTHACEAE
Amaranthus grandiflorus	AMARANTHACEAE
Amaranthus mitchellii	AMARANTHACEAE
Ammannia multiflora	LYTHRACEAE
Arabidella eremigena	CRUCIFERAE
Aristida holathera var holathera	GRAMINEAE
Asperula gemella	RUBIACEAE
Atalaya hemiglauca	SAPINDACEAE
Atriplex holocarpa	CHENOPODIACEAE
Atriplex limbata	CHENOPODIACEAE
Atriplex muelleri	CHENOPODIACEAE
Atriplex nummularia	CHENOPODIACEAE
Atriplex velutinella	CHENOPODIACEAE
Austrobryonia micrantha	CUCURBITACEAE
Bauhinia gilva	LEGUMINOSAE
Bergia trimera	ELATINACEAE
Boerhavia coccinea	NYCTAGINACEAE
Boerhavia dominii	NYCTAGINACEAE
Brachiaria praetervisa	GRAMINEAE
Brachyscome ciliarisssp lanuginosa	COMPOSITAE
Brachyscome rara	COMPOSITAE

Brassica tournefortii *	CRUCIFERAE
Calotis porphyroglossa	COMPOSITAE
Capparis mitchellii	CAPPARACEAE
Centipeda cunninghamii	COMPOSITAE
Centipeda minima	COMPOSITAE
Chenopodium auricomum	CHENOPODIACEAE
Citrullus lanatus *	CUCURBITACEAE
Conyza sumatrensis *	COMPOSITAE
Crinum flaccidum	AMARYLLIDACEAE
Crotalaria cunninghamii	LEGUMINOSAE
Crotalaria eremaea ssp. eremaea	LEGUMINOSAE
Crotalaria smithiana	LEGUMINOSAE
Cucumis melo *	CUCURBITACEAE
Cullen australasicum	LEGUMINOSAE
Cullen cinereum	LEGUMINOSAE
Cullen discolor	LEGUMINOSAE
Cynanchum floribundum	ASCLEPIADACEAE
Cynodon dactylon *	GRAMINEAE
Cyperus gymnocaulos	CYPERACEAE
Cyperus pygmaeus	CYPERACEAE
Dactyloctenium radulans	GRAMINEAE
Datura leichardtii	SOLANACEAE
Einadia nutans ssp. eremaea	CHENOPODIACEAE
Einadia nutans ssp. nutans	CHENOPODIACEAE
Enchylaena tomentosa var. glabra	CHENOPODIACEAE
Enneapogon avenaceus	GRAMINEAE
Epaltes australis	COMPOSITAE
Epaltes cunninghamii	COMPOSITAE
Eragrostis basedowii	GRAMINEAE
Eragrostis dielsii var. dielsii	GRAMINEAE
Eragrostis leptocarpa	GRAMINEAE
Eragrostis setifolia	GRAMINEAE
Eremophila bignoniiflora	MYOPORACEAE
Eriachne aristidea	GRAMINEAE
Erodium cygnorum	GERANIACEAE
Eucalyptus camaldulensis var. obtusa	MYRTACEAE
Eucalyptus coolabah	MYRTACEAE
Eulalia aurea	GRAMINEAE
Euphorbia drummondii	EUPHORIACEAE
Euphorbia stevenii	EUPHORIACEAE
Frankenia cupularis	FRANKENIACEAE
Glinus lotoides	AIZOACEAE

Gnaphalium diamantinense	COMPOSITAE
Goodenia glauca	GOODENIACEAE
Haloragis aspera	HALORAGACEAE
Helichrysum luteoalbum	COMPOSITAE
Heliotropium curassivicum *	BORAGINACEAE
Heliotropium supinum *	BORAGINACEAE
Indigofera psammophila	LEGUMINOSAE
Ipomoea polymorpha	CONVOLVULACEAE
Lavatera plebeia	MALVACEAE
Ludwigia peploides ssp. montevidensis *	ONAGRACEAE
Lysiana subfalcata	LORANTHACEAE
Malvastrum americanum *	MALVACEAE
Marsilea drummondii	MARSILEACEAE
Mentha australis	LABIATAE
Minuria denticulata	COMPOSITAE
Minuria integerrima	COMPOSITAE
Muehlenbeckia florulenta	POLYGONACEAE
Mukia maderaspatana	CUCURBITACEAE
Nicotiana velutina	SOLANACEAE
Owenia acidula	MELIACEAE
Panicum laevinode	GRAMINEAE
Paractaenum novae-hollandiae ssp. reversum	GRAMINEAE
Persicaria attenuata ssp. attenuata	POLYGONACEAE
Phyllanthus lacunellus	EUPHORBIACEAE
Pittosporum angustifolium	PITTOSPORACEAE
Polygonum plebium	POLYGONACEAE
Portulaca intraterranea	PORTULACACEAE
Pseudoraphis spinescens	GRAMINEAE
Pterocaulon sphacelatum	COMPOSITAE
Ptilotus atriplicifolius	AMARANTHACEAE
Rumex crystallinus	POLYGONACEAE
Rutidosis helichrysoides var helichrysoides	COMPOSITAE
Salsola kali *	CHENOPODIACEAE
Santalum lanceolatum	SANTALACEAE
Sauropus trachyspermus	EUPHORBIACEAE
Scaevola collaris	GOODENIACEAE
Sclerolaena bicornis	CHENOPODIACEAE
Sclerolaena diacantha	CHENOPODIACEAE
Sclerolaena intricata	CHENOPODIACEAE
Sclerolaena muricata var muricata	CHENOPODIACEAE
Senecio gregorii	COMPOSITAE
Senecio lanibracteus	COMPOSITAE

Senna artemisioides ssp sturtii	LEGUMINOSAE
Sesbania cannabina var. cannabina	LEGUMINOSAE
Setaria dielsii	GRAMINEAE
Setaria jubiflora	GRAMINEAE
Sida ammophila	MALVACEAE
Sida fibulifera	MALVACEAE
Sida sp	MALVACEAE
Solanum chenopodinum	SOLANACEAE
Solanum esuriale	SOLANACEAE
Solanum nigrum *	SOLANACEAE
Solanum oligacanthum	SOLANACEAE
Sonchus oleraceus *	COMPOSITAE
Sporobolus mitchellii	GRAMINEAE
Stemodia florulenta	SCROPHULARIACEAE
Swainsona laxa	LEGUMINOSAE
Tecticornia indica ssp. leiostachya	CHENOPODIACEAE
Tephrosia sphaerospora	LEGUMINOSAE
Tetragonia tetragonioides	AIZOACEAE
Teucrium racemosum	LABIATAE
Trachymene glaucifolia	APIACEAE
Tragus australianus	GRAMINEAE
Trianthema triquetra	AIZOACEAE
Tribulus eichlerianus	ZYGOPHYLLACEAE
Trichodesma zeylanicum	BORAGINACEAE
Trigonella suavissima	LEGUMINOSAE
Triraphis mollis	GRAMINEAE
Verbena officinalis *	VERBENACEAE
Wahlenbergia communis	CAMPANULACEAE
Zygochloa paradoxa	GRAMINEAE
Zygophyllum ammophilum	ZYGOPHYLLACEAE
* Introduced or Naturalised Species	

6.2 Appendix 2 – Familes, genera and species

Families genera and species for all surveyed sites

Family	Genus	Species
AMARYLLIDACEAE	1	1
APIACEAE	1	1
ASCLEPIADACEAE	1	1
CAMPANULACEAE	1	1
CAPPARACEAE	1	1
CONVOLVULACEAE	1	1
ELATINACEAE	1	1
FRANKENIACEAE	1	1
GERANIACEAE	1	1
HALORAGACEAE	1	1
LORANTHACEAE	1	1
LYTHRACEAE	1	1
MARSILEACEAE	1	1
MELIACEAE	1	1
MYOPORACEAE	1	1
ONAGRACEAE	1	1
PITTOSPORACEAE	1	1
PORTULACACEAE	1	1
RUBIACEAE	1	1
SANTALACEAE	1	1
SAPINDACEAE	1	1
SCROPHULARIACEAE	1	1
VERBENACEAE	1	1
CRUCIFERAE	2	2
CYPERACEAE	1	2
GOODENIACEAE	2	2
LABIATAE	2	2
MYRTACEAE	1	2
NYCTAGINACEAE	1	2
ZYGOPHYLLACEAE	2	2
AIZOACEAE	3	3
BORAGINACEAE	2	3
CUCURBITACEAE	4	4
EUPHORBIACEAE	3	4
POLYGONACEAE	4	4
SOLANACEAE	3	6

AMARANTHACEAE	3	7	
MALVACEAE	4	9	
CHENOPODIACEAE	7	15	
COMPOSITAE	12	17	
LEGUMINOSAE	11	19	
GRAMINEAE	16	20	
42	106	148	

6.3 Appendix 3 – Plant voucher specimens

Plant Voucher Specimens Identified by SA Herbarium

No.	Very Rough Field ID !!	Herbarium ID	Notes
1	*Paspalidium-like Tall*	*Setaria jubiflora*	
2	*Verbena officinalis*	*Verbena officinalis*	
3	*Sonchus oleraceus*	*Sonchus oleraceus*	* introduced
4	*Water couch ?*	GRAMINEAE	
5	*Haloragis aspera*	*Haloragis aspera*	
6	*Twiner*	*Asperula gemella*	
7	*Pseudognaphalium luteoalbum*	*Gnaphalium diamantinense*	relatively few SA records
8	*Polygonum*	*Persicaria attenuata* ssp. *attenuata*	4 SA records, all Innaminka area
9	*No specimen*		
10	*Goodenia sp*	*Goodenia glauca*	
11	*Euphorbia drummondii*	*Euphorbia drummondii*	
12	*Euphorbia sp*	*Euphorbia stevenii*	
13	*No specimen*		
14	*Lavatera plebeia*	No specimen	
15	*Solanum sp*	*Solanum esuriale*	
16	*Alternanthera nodiflora*	*Alternanthera nodiflora*	
17	*Boerhavia sp*	*Boerhavia dominii*	
18	*Amaranthus sp*	*Amaranthus ? interruptus*	
19	*Paspalidium-like small broad leaf*	*Brachiaria praetervisa*	
20	*Sclerolaena sp*	*Sclerolaena muricata* var *muricata*	
21	*Eragrostis sp*	*Eragrostis leptocarpa*	
22	*Cullen sp*	*Cullen cinereum*	
23	*Eulalia-like*	*Eulalia aurea*	
24	*Tribulus*	*Tribulus eichlerianus*	
25	*Cynodon dactylon*	*Cynodon dactylon* var *dactylon*	* introduced
26	*Eragrostis setifolia*	*Eragrostis setifolia*	
27	*Datura sp*	*Datura ? leichardtii*	
28	*Zygophyllum*	*Zygophyllum ammophilum*	
29	*Minuria (entire blue/green leaf)*	*Minuria integerrima*	

30	*Euphorbia sp*	*Euphorbia drummondii*	
31	*Scleroleana sp*	*Sclerolaena muricata* var *muricata*	
32	*Minuria (terminal/dentate)*	*Minuria denticulata*	
33	*Cucumis*	*Cucumis melo*	
34	*Euphorbia sp*	*Euphorbia stevenii*	
35	*Glinus lotoides*	*Glinus lotoides*	
36	*Sida sp*	*Sida fibulifera*	
37	*Erodium sp*	*Erodium cygnorum*	
38	*Abitilon sp*	*Abutilon fraseri* ssp *fraseri*	
39	*Rutidosis helichrysoides*	*Rutidosis helichrysoides* var *helichrysoides*	
40	*Cruciferae*	*Arabidella eremigera*	mainly in NE SA
41	*Sporobolus mitchellii*	*Sporobolus mitchellii*	
42	*Malvastrum americanum*	*Malvastrum americanum* var *americanum*	
43	*Grass-very-open-head*	*Setaria dielsii*	
44	*Not Einadia*	*Einadia nutans* ssp *nutans*	
45	*Einadia nutans*	*Einadia nutans* ssp *eremaea*	
46	*Solanum "Tall wavy leaf margin"*	*Solanum chenopodinum*	
47	*Malvaceae Tall*	*Abutilon otocarpum*	
48	*Cullen Tall*	No specimen	
49	*Glinus sp*	No specimen	
50	*Epaltes australis*	*Epaltes australis*	
51	*Cucumis "Hairy fruit"*	*Cucumis melo*	
52	*Rubiaceae like*	*Ammannia multiflora*	
53	*Synaptanthera like*	*Polygonum plebium*	
54	*Ludwigia peploides*	*Ludwigia peploides ssp. montevidensis*	* introduced
55	*Cyperaceae*	*Cyperus pygmaeus*	
56	*Verbena officinalis*	*Verbena officinalis*	
57	*Alternanthera*	*Alternanthera nodiflora*	
58	*Euphorbia drummondii*	*Euphorbia drummondii*	
59	*Malvaceae broad leaf*	*Abutilon fraseri* ssp. *diplotrichum*	
60	*Sida broad leaf*	*Sida fibulifera*	
61	*Compositae*	*Calotis porphyroglossa*	
62	*Boerhavia sp*	*Boerhavia dominii*	
63	*Rumex*	*Rumex ? crystallinus/tenax (sterile)*	
64	*Eragrostis basedowii*	*Eragrostis basedowii*	
65	*Bergia like*	*Bergia trimera*	
66	*Fleabane?*	*Conyza sumatrensis*	
67	*Grass-very-open-head*	*Setaria dielsii*	
68	*Senna sp*	*Senna artemisioides* ssp *sturtii*	
69	*Amaranthus sp*	*Amaranthus grandiflorus*	

70	*Sclerolaena uniflora/diacantha*	*Sclerolaena diacantha*	
71	*Sporobolus mitchellii*	*Sporobolus mitchellii*	
72	*Wahlenbergia sp*	*Wahlenbergia communis*	
73	*Stemodia sp (florulenta?)*	*Stemodia florulenta*	
74	*Scaevola*	*Scaevola collaris*	
75	*Sida ammomphila*	*Sida ammophila*	
76	*Paractaenum novae-hollandiae*	*Paractaenum novae-hollandiae ssp. reversum*	
77	*Amaranthus sp*	*Amaranthus grandiflorus*	
78	*Atriplex limbata*	*Atriplex limbata*	
79	*Boerhavia sp*	*Boerhavia coccinea*	
80	*Atriplex velutinella*	*Atriplex velutinella*	
81	*Triraphis mollis*	*Triraphis mollis*	
82	*Euphorbia drummondii*	*Euphorbia drummondii*	
83	*Eragrostis setifolia*	*Eragrostis setifolia*	
84	*Pterocaulon sphacelatum*	*Epaltes australis*	
85	*Indigofera sp*	*Indigofera psammophila*	
86	*Brachyscome sp*	*Brachyscome ciliaria* ssp *lanuginosa*	
87	*Ipomaea sp*	*Ipomoea polymorpha*	
88	*Sclerolaena uniflora/diacantha*	*Sclerolaena diacantha*	
89	*Swainsona sp*	*Cullen discolor*	
90	*Pseudognaphalium luteoalbum*	*Helichrysum luteoalbum*	
91	*Swainsona microphylla*	*Swainsona laxa*	
92	*Abutilon otocarpum*	*Abutilon ? leucopetalum*	
93	*Grass*	*Leptochloa fusca* ssp. *muelleri*	
94	*Eragrostis dielsii?*	*Eragrostis dielsii* var *dielsii*	
95	*Aristida holathera*	*Aristida holathera* var *holathera*	
96	*Acacia salicina*	*Acacia salicina*	
97	*Epaltes australis*	*Epaltes australis*	
99	*Sauropus trachyspermus*	*Sauropus trachyspermus*	
100	*Cyperus gymnocaulos*	*Cyperus gymnocaulos*	
101	*Cucumis sp*	*Austrobryonia micrantha*	
102	*Frankenia sp*	*Frankenia cupularis*	
103	*Chloris Short*	*Chloris pectinata*	
104	*Wahlenbergia sp*	*Wahlenbergia communis*	
105	*Josephinia eugeniae*	*Josephinia eugeniae*	* introduced
106	*Sclerolaena sp*	*Sclerolaena tatei*	
107	*Echinochloa*	*Echinochloa crus-galli*	* introduced
108	*Astrebla lappacae*	*Astrebla lappacea*	
109	*Lysiana sp*	*Lysiana subfalcata*	
110	*Amyema sp*	*Amyema preissii*	
111	*Epaltes cunninghamii*	*Epaltes cunninghamii*	

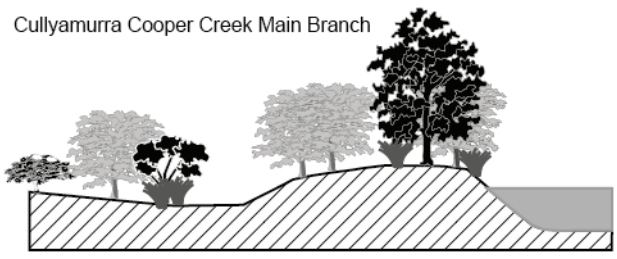
112	*Mentha australis*	*Mentha australis*	
113	*Compositae "light green"*	*Brachyscome rara*	
114	*Twiner*	*Asperula gemella*	
115	*Atriplex muelleri*	*Atriplex muelleri*	relatively few SA records
116	*Chloris Tall*	*Chloris virgata*	* introduced
117	*Panicum like*	*Pseudoraphis spinescens*	relatively few NE SA records
118	*Rutidosis helichrysoides*	*Rutidosis helichrysoides* var *helichrysoides*	
119	*Atriplex spongiosa/holocarpa*	*Atriplex holocarpa*	
120	*Amaranthus sp (fine)*	*Dysphania cristata*	
121	*Indigofera sp*	*Indigofera psammophila*	
122	*Panicum fine*	*Panicum laevinode*	
123	*Paspalidium-like ?*	*Eriochloa crebra*	
124	*Eragrostis fine*	*Eragrostis leptocarpa*	
125	*Eragrostis setifolia*	*Eragrostis setifolia*	
126	*Cullen sp*	*Cullen* sp	
127	*Phyllanthus sp*	*Phyllanthus ? lacunellus*	
128	*Senecio sp*	*Senecio lanibracteus*	
98 A	*Phyllanthus lacunarius*	*Phyllanthus ? lacunellus*	
98 B		*Euphorbia drummondii*	

6.4 Appendix 4 – All site vegetation data

Cullyamurra WH

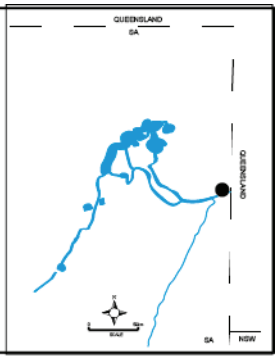
Cullyamurra WH (1-2)

Cullyamurra Cooper Creek Main Branch

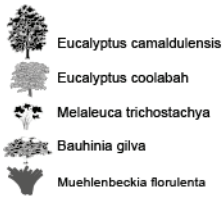


pH 0-50cm 6.6

EC 0-50cm 93.3



Key to Species



Eucalyptus camaldulensis

Eucalyptus coolabah

Melaleuca trichostachya

Bauhinia gilva

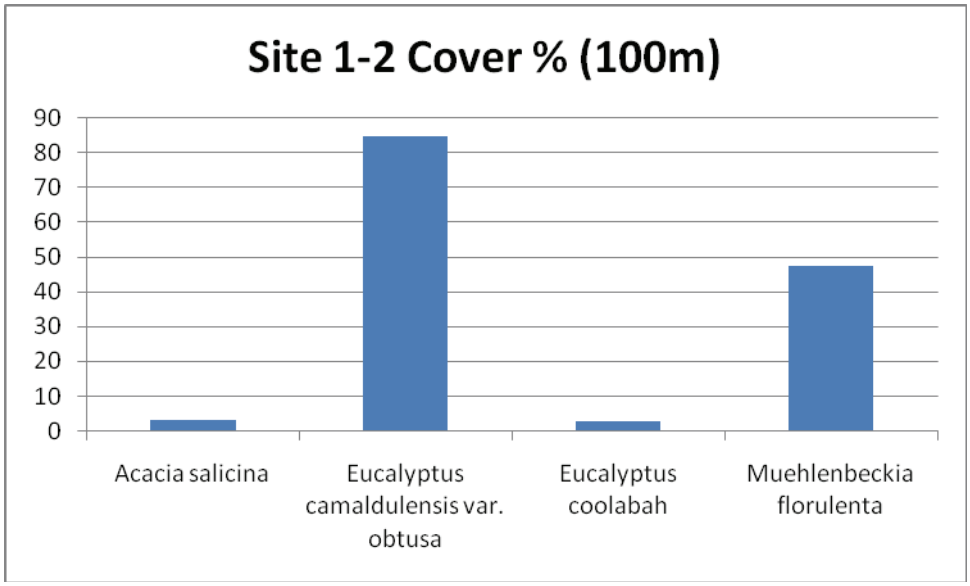
Muehlenbeckia florulenta

Site	Latitude	Longitude	Photo Bearing
Cullyamurra 1-1	-27.7075	140.88156	
Cullyamurra 1-2	-27.7034	140.86262	300
Cullyamurra 1-3	-27.7015	140.83898	

	Species Presence			
Plant Species	**Site 1-1**	**Site 1-2**	**Site 1-3**	**All Sites**
Acacia salicina	1	1	1	3
Alternanthera nodiflora	1	1	1	3
Amaranthus grandiflorus			1	1
Amaranthus interruptus	1			1
Arabidella eremigena	1	1		2
Asperula gemella	1	1	1	3
Bauhinia gilva	1		1	2
Boerhavia dominii	1		1	2
Brachiaria praetervisa	1		1	2
Chenopodium auricomum	1	1	1	3
Cullen cinereum	1			1
Cynodon dactylon			1	1
Datura ? leichardtii	1			1
Einadia nutans ssp. eremaea	1		1	2
Enchylaena tomentosa var. glabra		1		1
Eragrostis dielsii var. dielsii			1	1
Eragrostis leptocarpa	1			1
Eragrostis setifolia	1		1	2
Eremophila bignoniiflora			1	1
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Eulalia aurea			1	1
Euphorbia drummondii	1	1		2
Euphorbia stevenii		1		1
Glinus lotoides	1		1	2
Gnaphalium diamantinense	1	1		2
Goodenia glauca		1		1
Haloragis aspera	1	1	1	3
Lavatera plebeia	1		1	2

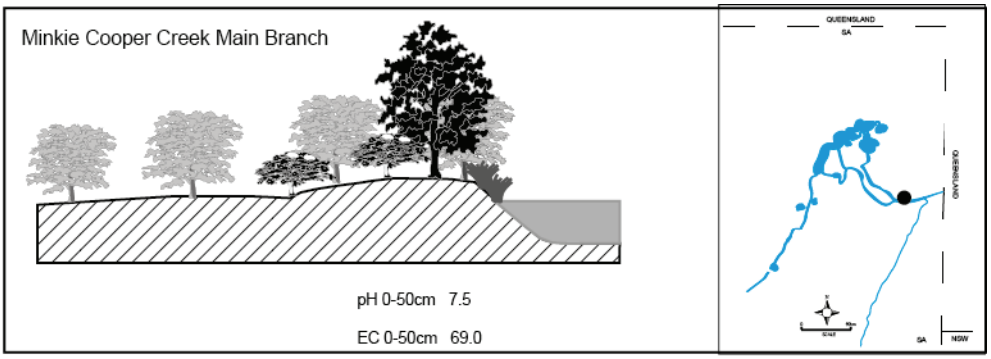
	Species Presence			
Plant Species	**Site 1-1**	**Site 1-2**	**Site 1-3**	**All Sites**
Muehlenbeckia florulenta	1	1	1	3
Mukia maderaspatana	1		1	2
Nicotiana velutina			1	1
Persicaria attenuata ssp. attenuata	1	1		2
Portulaca intraterranea	1			1
Pseudoraphis spinescens	1	1		2
Pterocaulon sphacelatum	1	1	1	3
Salsola kali	1		1	2
Sclerolaena muricata var muricata	1		1	2
Setaria jubiflora	1	1	1	3
Sida sp			1	1
Solanum esuriale	1			1
Solanum nigrum	1	1	1	3
Sonchus oleraceus	1	1	1	3
Sporobolus mitchellii	1	1	1	3
Tetragonia tetragonioides	1	1		2
Teucrium racemosum			1	1
Tribulus eichlerianus			1	1
Verbena officinalis		1	1	2
Grand Total	**35**	**23**	**33**	

Perennial Species Site 1-2	**Cover % (100m)**
Acacia salicina	3
Eucalyptus camaldulensis var. obtusa	84.8
Eucalyptus coolabah	2.9
Muehlenbeckia florulenta	47.5

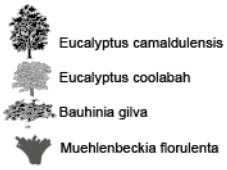


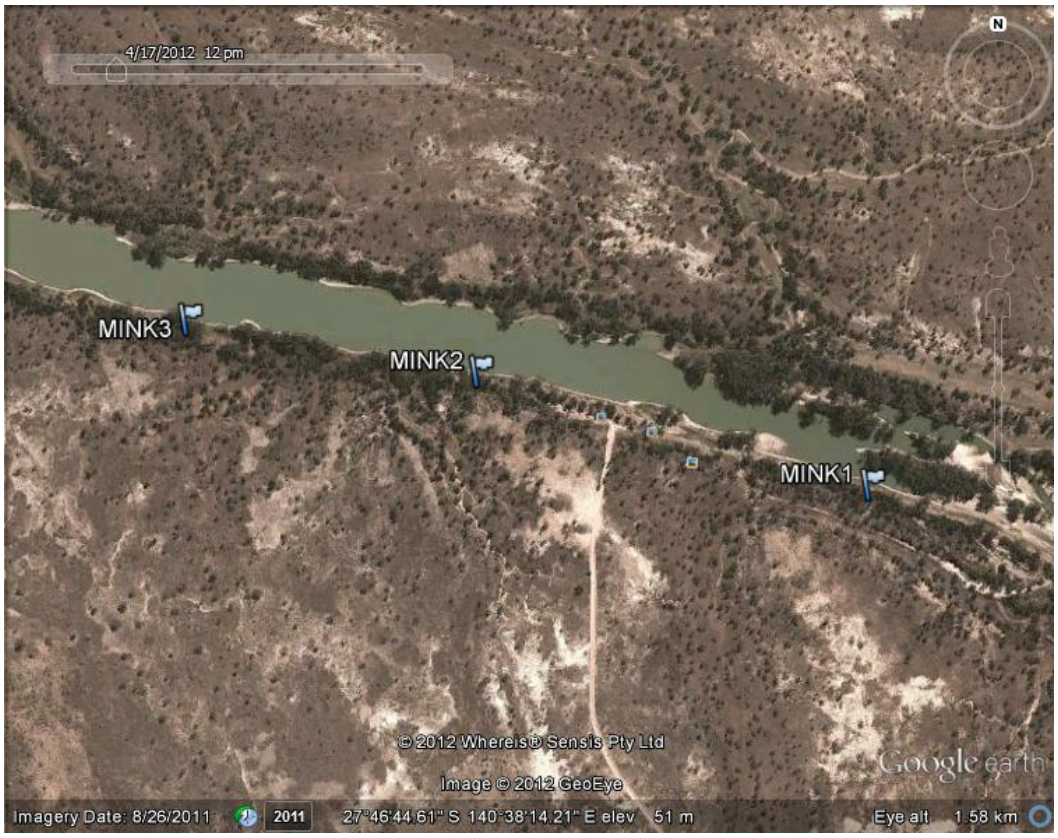
Minkie WH

Minkie WH (2-2)



Key to Species



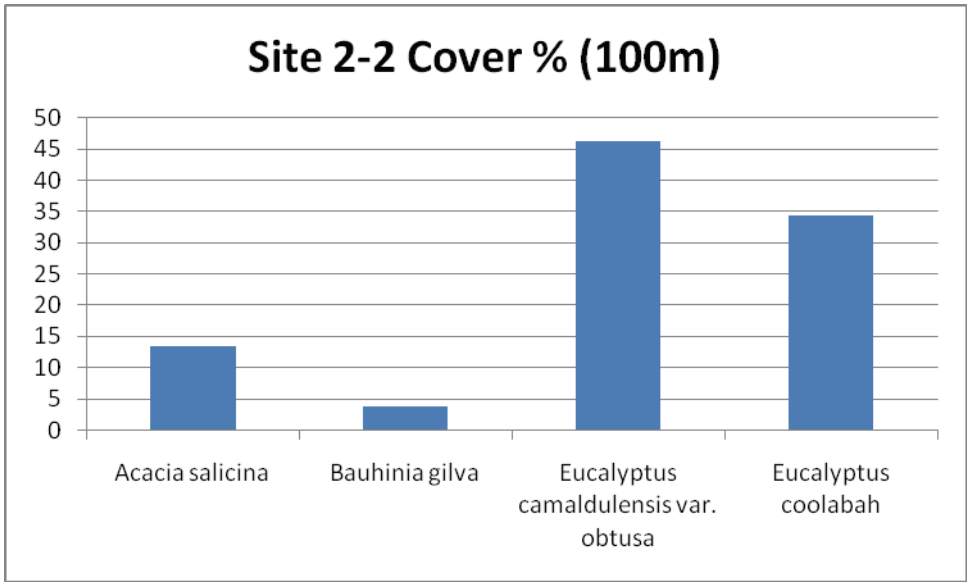


\Site	Latitude	Longitude	Photo Bearing
Minkie 1-1	-27.7803	140.64308	
Minkie 1-2	-27.7786	140.63643	266
Minkie 1-3	-27.7778	140.63148	

	Species Presence			
Plant Species	**Site 2-1**	**Site 2-2**	**Site 3-3**	**All Sites**
Abutilon fraseri ssp fraseri			1	1
Acacia salicina	1	1	1	3
Alternanthera nodiflora		1	1	2
Amaranthus grandiflorus		1		1

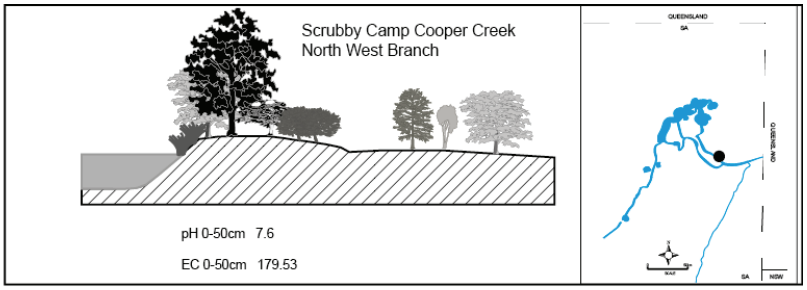
	Species Presence			
Plant Species	**Site 2-1**	**Site 2-2**	**Site 3-3**	**All Sites**
Asperula gemella			1	1
Atalaya hemiglauca	1			1
Bauhinia gilva	1	1		2
Boerhavia dominii	1			1
Brachiaria praetervisa	1	1	1	3
Cucumis melo	1	1	1	3
Cullen cinereum	1	1		2
Dactyloctenium radulans			1	1
Einadia nutans ssp. eremaea	1	1	1	3
Enchylaena tomentosa var. glabra	1	1	1	3
Enneapogon avenaceus	1			1
Eragrostis dielsii var. dielsii	1			1
Eragrostis setifolia	1	1	1	3
Erodium cygnorum	1			1
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Euphorbia drummondii		1		1
Euphorbia stevenii			1	1
Glinus lotoides	1		1	2
Haloragis aspera		1	1	2
Lavatera plebeia	1	1	1	3
Minuria denticulata	1	1	1	3
Minuria integerrima		1	1	2
Muehlenbeckia florulenta		1		1
Mukia maderaspatana		1		1
Nicotiana velutina	1	1	1	3
Portulaca intraterranea	1	1	1	3
Pseudoraphis spinescens		1		1
Pterocaulon sphacelatum	1	1	1	3
Rutidosis helichrysoides var helichrysoides			1	1
Salsola kali	1	1		2
Sauropus trachyspermus	1			1
Sclerolaena muricata var muricata		1		1
Setaria jubiflora	1	1	1	3
Sida fibulifera	1			1
Solanum esuriale	1	1	1	3
Solanum nigrum		1	1	2
Sonchus oleraceus		1	1	2
Sporobolus mitchellii		1		1
Stemodia florulenta	1	1	1	3
Tetragonia tetragonioides	1	1	1	3
Teucrium racemosum	1		1	2
Tribulus eichlerianus	1	1		2
Verbena officinalis	1		1	2
Zygophyllum ammophilum	1	1	1	3
Grand Total	**32**	**34**	**31**	

Perennial Species Site 2-2	**Cover % (100m)**
Acacia salicina	13.5
Bauhinia gilva	3.7
Eucalyptus camaldulensis var. obtusa	46.3
Eucalyptus coolabah	34.3

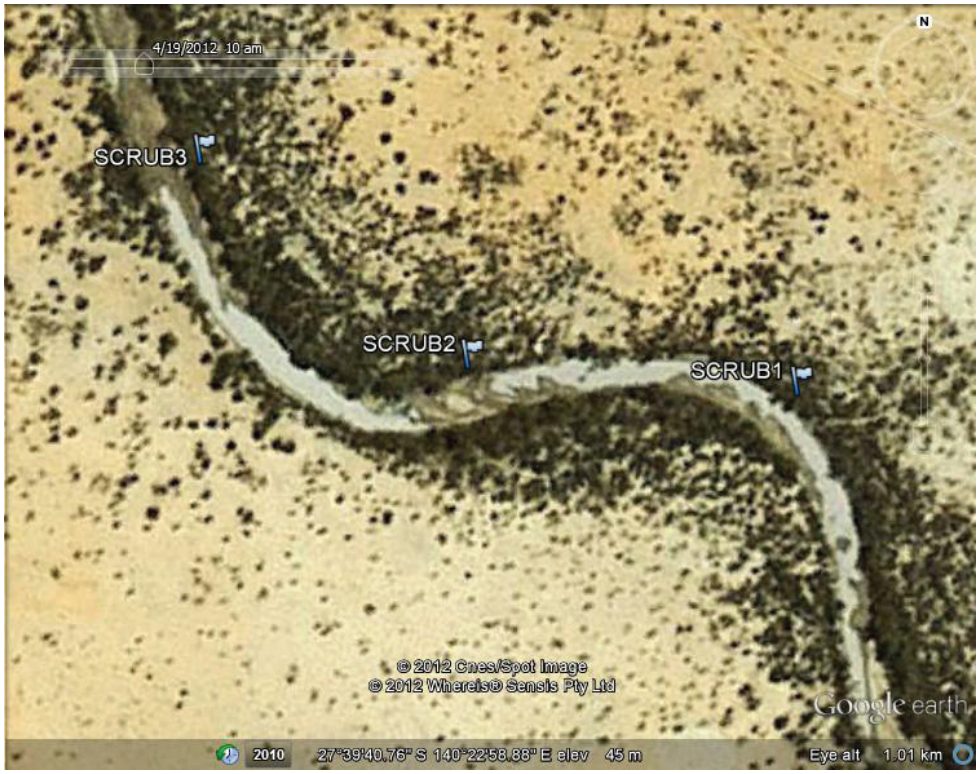

Site 2-2 Cover % (100m)
50
45
40
35
30
25
20
15
10
5
0
Acacia salicina
Bauhinia gilva
Eucalyptus camaldulensis var. obtusa
Eucalyptus coolabah

Scrubby Camp WH

Scrubby Camp WH (3-2)



Key to Species

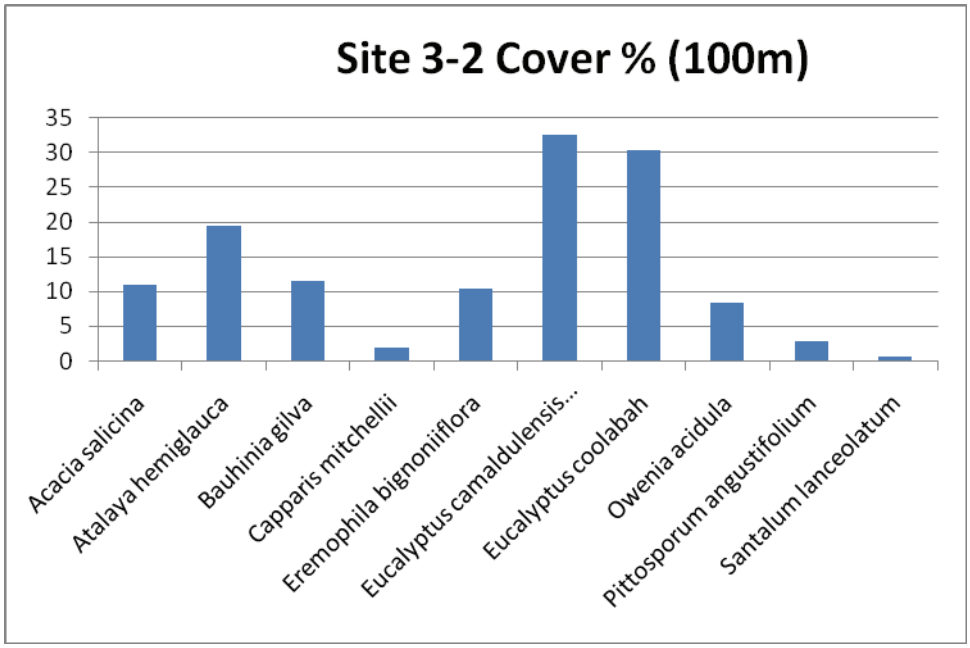


Site	Latitude	Longitude	Photo Bearing
Scrubby Camp 1-1	-27.6614	140.38658	
Scrubby Camp 1-2	-27.6611	140.38279	245
Scrubby Camp 1-3	-27.6591	140.37971	

	Species Presence			
Plant Species	**Site 3-1**	**Site 3-2**	**Site 3-3**	**All Sites**
Acacia salicina	1	1	1	3
Amaranthus grandiflorus	1			1
Atalaya hemiglauca	1	1	1	3
Bauhinia gilva	1	1	1	3
Boerhavia dominii	1		1	2

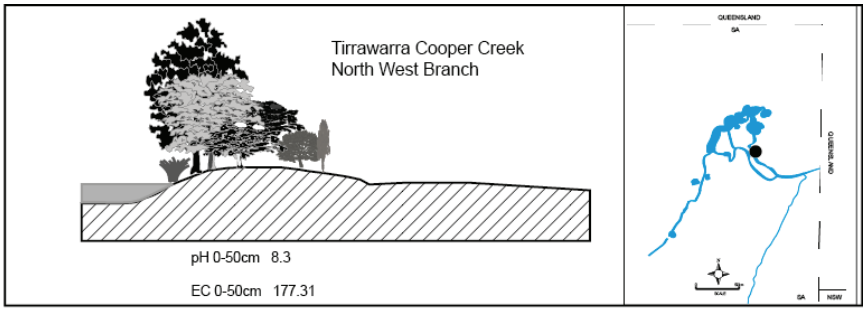
	Species Presence			
Plant Species	**Site 3-1**	**Site 3-2**	**Site 3-3**	**All Sites**
Brachiaria praetervisa	1	1	1	3
Brassica tournefortii		1		1
Capparis mitchellii		1		1
Chenopodium auricomum	1			1
Cucumis melo	1		1	2
Cullen cinereum	1			1
Dactyloctenium radulans	1			1
Einadia nutans ssp. eremaea	1	1		2
Einadia nutans ssp. nutans		1		1
Enchylaena tomentosa var. glabra	1	1	1	3
Eremophila bignoniiflora	1	1	1	3
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Lavatera plebeia	1	1	1	3
Malvastrum americanum	1	1		2
Muehlenbeckia florulenta	1		1	2
Owenia acidula	1	1		2
Pittosporum angustifolium	1	1		2
Portulaca intraterranea	1			1
Santalum lanceolatum		1		1
Setaria dielsii	1	1	1	3
Setaria jubiflora	1	1	1	3
Solanum chenopodinum		1		1
Solanum esuriale	1			1
Solanum nigrum	1	1	1	3
Sonchus oleraceus	1	1		2
Tetragonia tetragonioides	1			1
Teucrium racemosum		1		1
Tribulus eichlerianus	1			1
Verbena officinalis	1	1	1	3
Zygophyllum ammophilum	1	1	1	3
Grand Total	**30**	**26**	**17**	

Perennial Species Site 3-2	**Cover % (100m)**
Acacia salicina	10.9
Atalaya hemiglauca	19.4
Bauhinia gilva	11.6
Capparis mitchellii	1.9
Eremophila bignoniiflora	10.5
Eucalyptus camaldulensis var. obtusa	32.5
Eucalyptus coolabah	30.4
Owenia acidula	8.4
Pittosporum angustifolium	2.9
Santalum lanceolatum	0.6

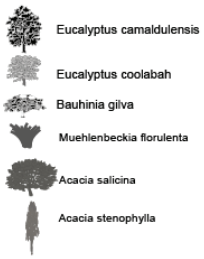

Site 3-2 Cover % (100m)
35
30
25
20
15
10
5
0
Acacia salicina
Atalaya hemiglauca
Bauhinia gilva
Capparis mitchellii
Eremophila bignoniiflora
Eucalyptus camaldulensis...
Eucalyptus coolabah
Owenia acidula
Pittosporum angustifolium
Santalum lanceolatum

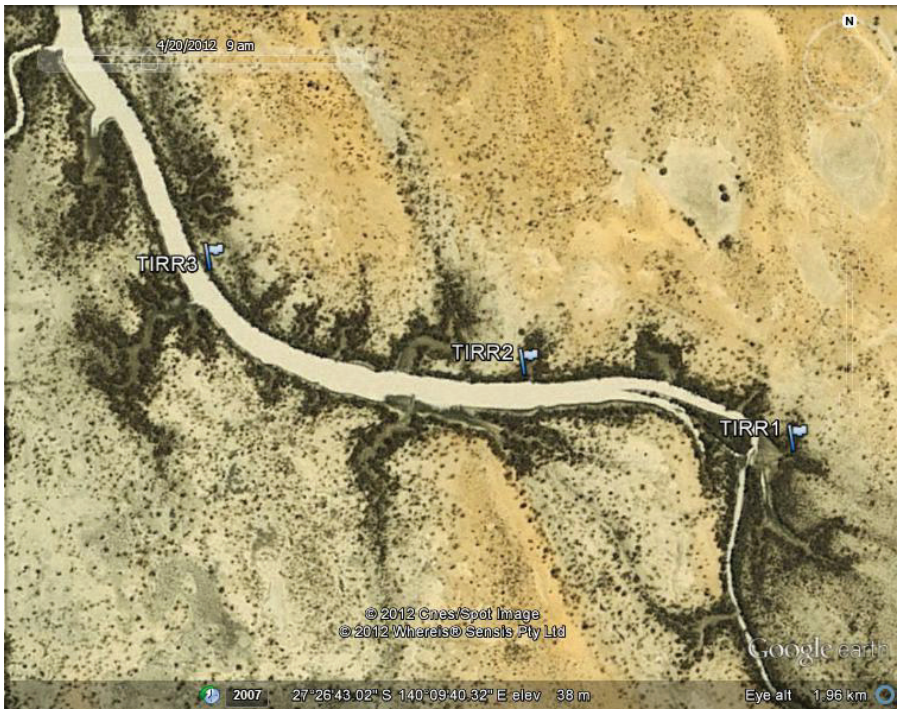
Tirrawarra WH

Tirrawarra WH (4-5)



Key to Species



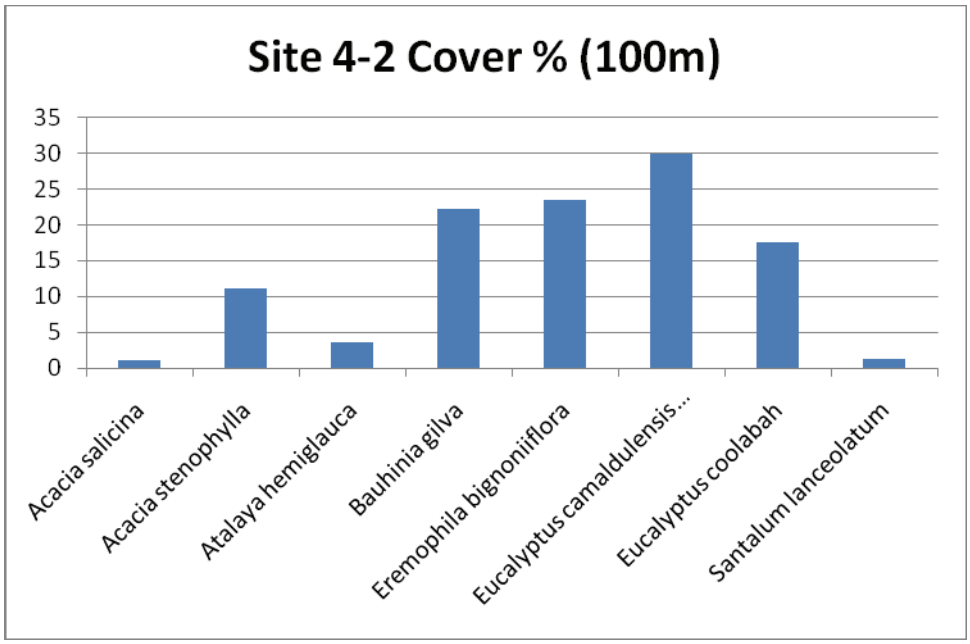


Site	Latitude	Longitude	Photo Bearing
Tirrawarra 1-1	-27.4474	140.16985	
Tirrawarra 1-2	-27.4457	140.1631	260
Tirrawarra 1-3	-27.4434	140.1552	

	Species Presence			
Plant Species	**Site 4-1**	**Site 4-2**	**Site 4-3**	**All Sites**
Acacia stenophylla	1	1	1	3
Aeschynomene indica	1			1
Amaranthus grandiflorus		1		1
Asperula gemella	1			1
Atalaya hemiglauca		1	1	2

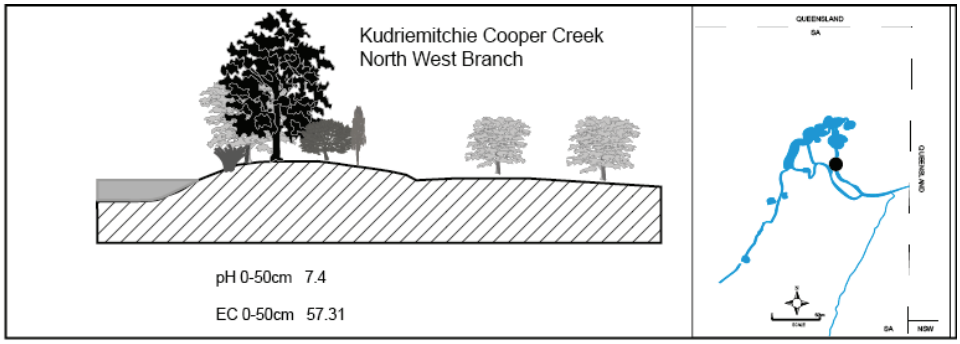
	Species Presence			
Plant Species	**Site 4-1**	**Site 4-2**	**Site 4-3**	**All Sites**
Atriplex muelleri			1	1
Bauhinia gilva		1	1	2
Brachyscome rara	1			1
Brassica tournefortii	1			1
Chenopodium auricomum	1	1	1	3
Einadia nutans ssp. eremaea		1	1	2
Einadia nutans ssp. nutans		1	1	2
Enchylaena tomentosa var. glabra			1	1
Epaltes cunninghamii	1			1
Eragrostis setifolia	1		1	2
Eremophila bignoniiflora	1	1	1	3
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Haloragis aspera	1		1	2
Lavatera plebeia	1	1		2
Lysiana subfalcata	1	1	1	3
Malvastrum americanum		1		1
Marsilea drummondii	1			1
Mentha australis	1			1
Muehlenbeckia florulenta	1	1	1	3
Pittosporum angustifolium		1		1
Pterocaulon sphacelatum			1	1
Rutidosis helichrysoides var helichrysoides	1	1	1	3
Santalum lanceolatum		1	1	2
Sclerolaena muricata var muricata			1	1
Senecio lanibracteus	1		1	2
Setaria jubiflora	1	1	1	3
Solanum nigrum	1			1
Teucrium racemosum	1		1	2
Verbena officinalis	1	1	1	3
Zygophyllum ammophilum		1		1
Grand Total	**23**	**21**	**24**	

Perennial Species Site 4-2	**Cover % (100m)**
Acacia salicina	1.1
Acacia stenophylla	11.2
Atalaya hemiglauca	3.6
Bauhinia gilva	22.3
Eremophila bignoniiflora	23.5
Eucalyptus camaldulensis var. obtusa	30
Eucalyptus coolabah	17.5
Santalum lanceolatum	1.2

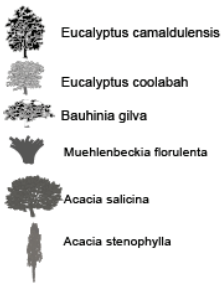

Site 4-2 Cover % (100m)
35
30
25
20
15
10
5
0
Acacia salicina
Acacia stenophylla
Atalaya hemiglauca
Bauhinia gilva
Eremophila bignoniiflora
Eucalyptus camaldulensis...
Eucalyptus coolabah
Santalum lanceolatum

Kudriemitchie WH

Kudriemitchie WH (5-2)



Key to Species

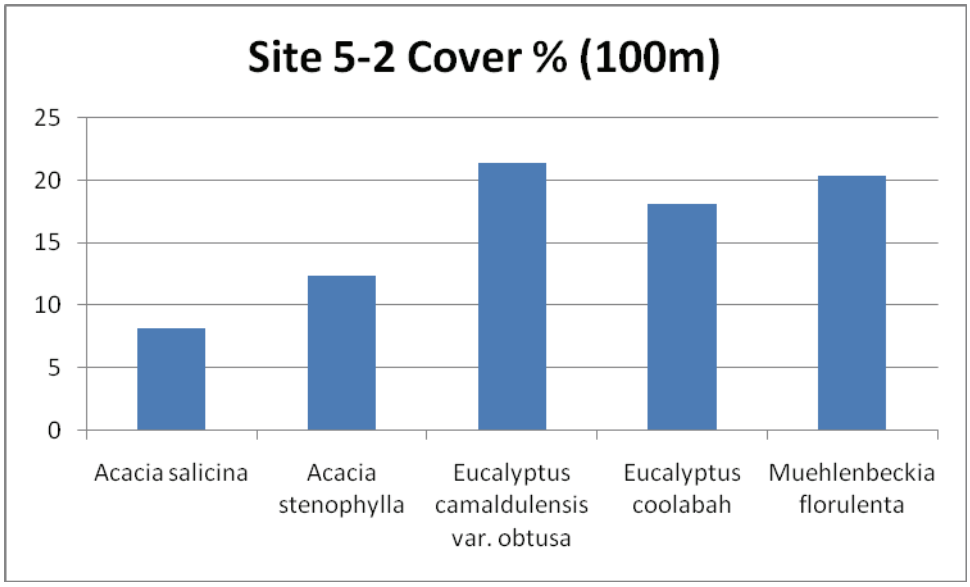


Site	Latitude	Longitude	Photo Bearing
Kudriemitchie 1-1	-27.3632	140.20368	
Kudriemitchie 1-2	-27.3588	140.20347	342
Kudriemitchie 1-3	-27.3534	140.20153	

	Species Presence			
Plant Species	**Site 5-1**	**Site 5-2**	**Site 5-3**	**All Sites**
Acacia stenophylla	1	1	1	3
Aeschynomene indica	1	1	1	3
Alternanthera nodiflora			1	1

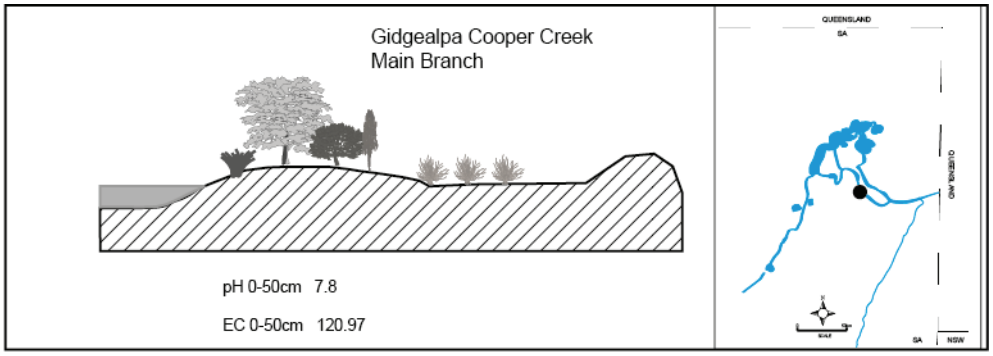
	Species Presence			
Plant Species	**Site 5-1**	**Site 5-2**	**Site 5-3**	**All Sites**
Amaranthus grandiflorus		1	1	2
Asperula gemella	1	1	1	3
Bauhinia gilva	1	1	1	3
Boerhavia dominii		1	1	2
Chenopodium auricomum			1	1
Cucumis melo	1		1	2
Cullen cinereum			1	1
Einadia nutans ssp. eremaea	1	1		2
Epaltes cunninghamii	1		1	2
Eragrostis dielsii var. dielsii		1		1
Eragrostis setifolia	1	1	1	3
Eremophila bignoniiflora	1		1	2
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Euphorbia drummondii	1			1
Glinus lotoides	1			1
Haloragis aspera	1	1		2
Lavatera plebeia	1	1	2	4
Muehlenbeckia florulenta	1	1	1	3
Nicotiana velutina		1	1	2
Portulaca intraterranea		1	1	2
Pseudoraphis spinescens	1	1	1	3
Rutidosis helichrysoides var helichrysoides	1	1	1	3
Sclerolaena bicornis		1		1
Senecio lanibracteus	1	1		2
Setaria jubiflora	1	1	1	3
Solanum esuriale		1		1
Solanum nigrum		1	1	2
Sonchus oleraceus			1	1
Sporobolus mitchellii	1		1	2
Stemodia florulenta	1	1		2
Tetragonia tetragonioides		1	1	2
Teucrium racemosum	1	1		2
Trianthema triquetra		1		1
Tribulus eichlerianus		1	1	2
Verbena officinalis	1	1	1	3
Zygophyllum ammophilum		1		1
Grand Total	**25**	**31**	**30**	

Perennial Species Site 5-2	**Cover % (100m)**
Acacia salicina	8.2
Acacia stenophylla	12.4
Eucalyptus camaldulensis var. obtusa	21.4
Eucalyptus coolabah	18.1
Muehlenbeckia florulenta	20.4


Site 5-2 Cover % (100m)
25
20
15
10
5
0
Acacia salicina
Acacia stenophylla
Eucalyptus camaldulensis var. obtusa
Eucalyptus coolabah
Muehlenbeckia florulenta

Gidgealpa WH

Gidgealpa WH (6-2)



Key to Species

Eucalyptus coolabah

Muehlenbeckia florulenta

Acacia salicina

Acacia stenophylla

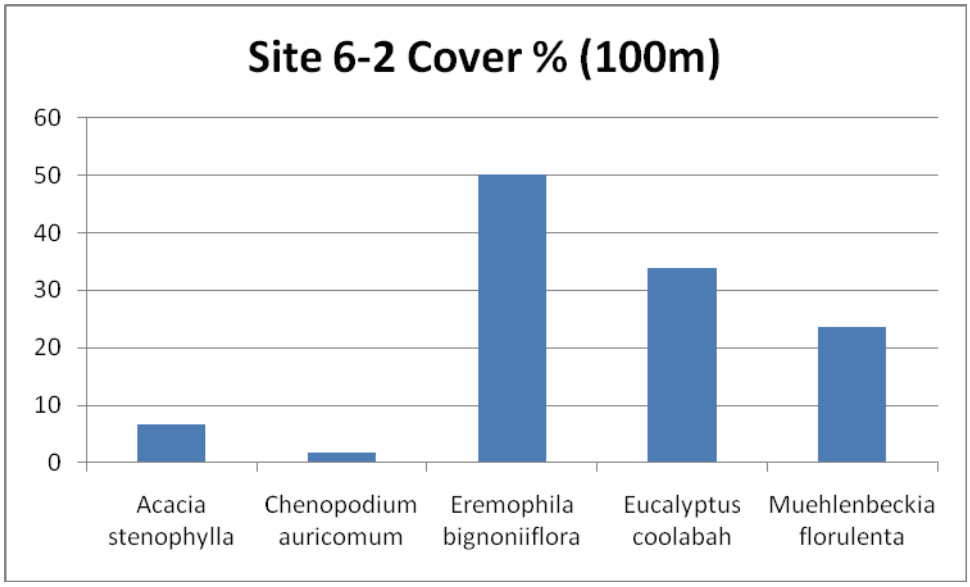
Chenopodium auricomum

Site	Latitude	Longitude	Photo Bearing
Gidgealpa 1-1	-27.6859	140.20206	
Gidgealpa 1-2	-27.6822	140.20118	354
Gidgealpa 1-3	-27.6782	140.19708	

	Species Presence			
Plant Species	**Site 6-1**	**Site 6-2**	**Site 6-3**	**All Sites**
Acacia stenophylla	1	1	1	3
Aeschynomene indica		1	1	2
Alternanthera nodiflora	1	1	1	3
Amaranthus grandiflorus	1		1	2

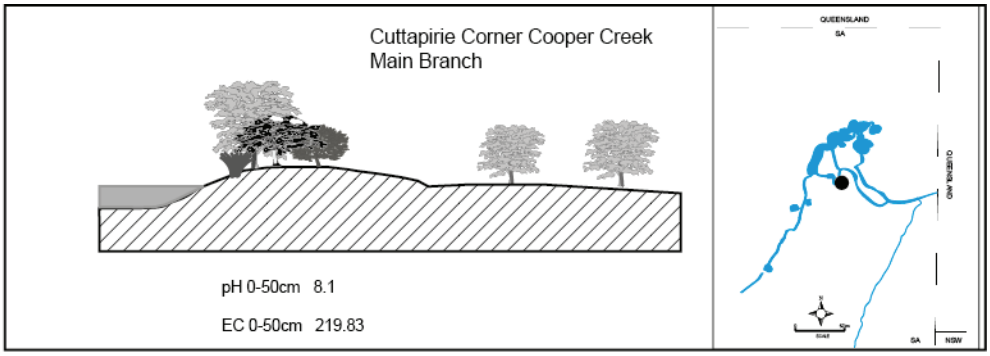
	Species Presence			
Plant Species	**Site 6-1**	**Site 6-2**	**Site 6-3**	**All Sites**
Amyema preissii			1	1
Atriplex muelleri	1	1		2
Bauhinia gilva			1	1
Boerhavia dominii	1			1
Brachiaria praetervisa		1	1	2
Centipeda minima			1	1
Chenopodium auricomum	1	1	1	3
Citrullus lanatus			1	1
Cucumis melo		1		1
Dactyloctenium radulans			1	1
Einadia nutans ssp. eremaea	1	1		2
Einadia nutans ssp. nutans			1	1
Enchylaena tomentosa var. glabra	1	1	1	3
Epaltes cunninghamii	1	1	1	3
Eragrostis dielsii var. dielsii			1	1
Eragrostis setifolia			1	1
Eremophila bignoniiflora	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Frankenia sp			1	1
Goodenia glauca			1	1
Haloragis aspera	1		1	2
Heliotropium supinum			1	1
Lavatera plebeia	1		1	2
Lysiana subfalcata	1		1	2
Mentha australis		1		1
Minuria denticulata			1	1
Muehlenbeckia florulenta	1	1	1	3
Nicotiana velutina			1	1
Panicum laevinode			1	1
Portulaca intraterranea	1		1	2
Salsola kali			1	1
Santalum lanceolatum	1			1
Sclerolaena bicornis	1			1
Sclerolaena muricata var muricata	1	1		2
Setaria jubiflora		1	1	2
Sida ammophila			1	1
Solanum esuriale	1			1
Solanum nigrum	1		1	2
Sonchus oleraceus	1	1		2
Tetragonia tetragonioides	1	1	1	3
Teucrium racemosum	1		1	2
Trianthema triquetra			1	1
Tribulus eichlerianus	1	1	1	3
Trigonella suavissima			1	1
Verbena officinalis	1	1	1	3
Zygophyllum ammophilum	1	1	1	3
Grand Total	**28**	**22**	**41**	

Perennial Species Site 6-2	**Cover % (100m)**
Acacia stenophylla	6.6
Chenopodium auricomum	1.7
Eremophila bignoniiflora	50.2
Eucalyptus coolabah	33.8
Muehlenbeckia florulenta	23.5

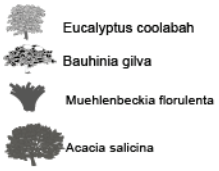

Site 6-2 Cover % (100m)
60
50
40
30
20
10
0
Acacia stenophylla
Chenopodium auricomum
Eremophila bignoniiflora
Eucalyptus coolabah
Muehlenbeckia florulenta

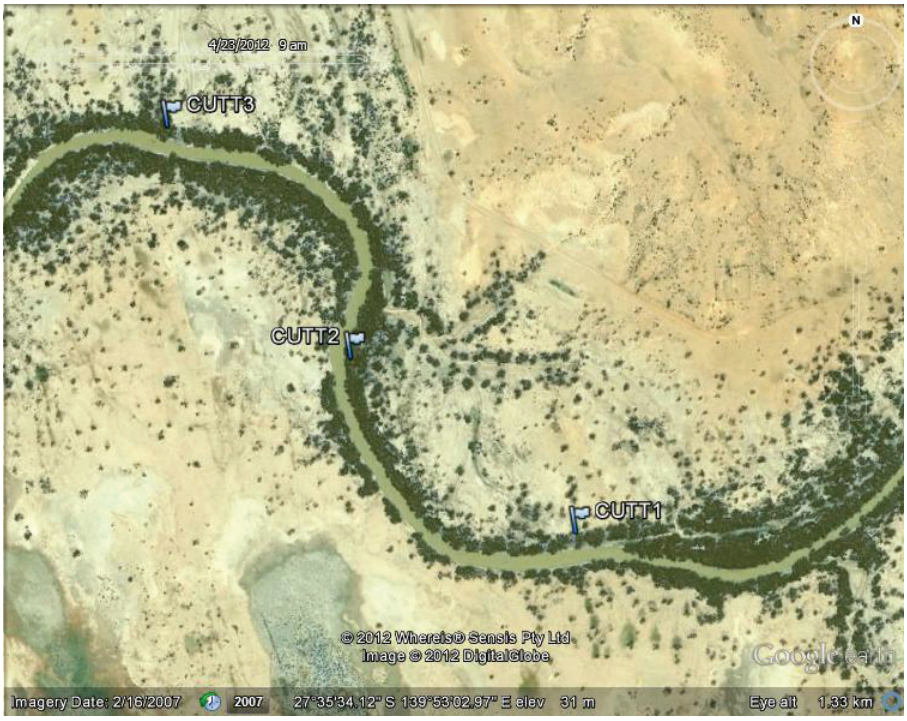
Cuttapirie Corner WH

Cuttapirie Corner WH (7-2)



Key to Species



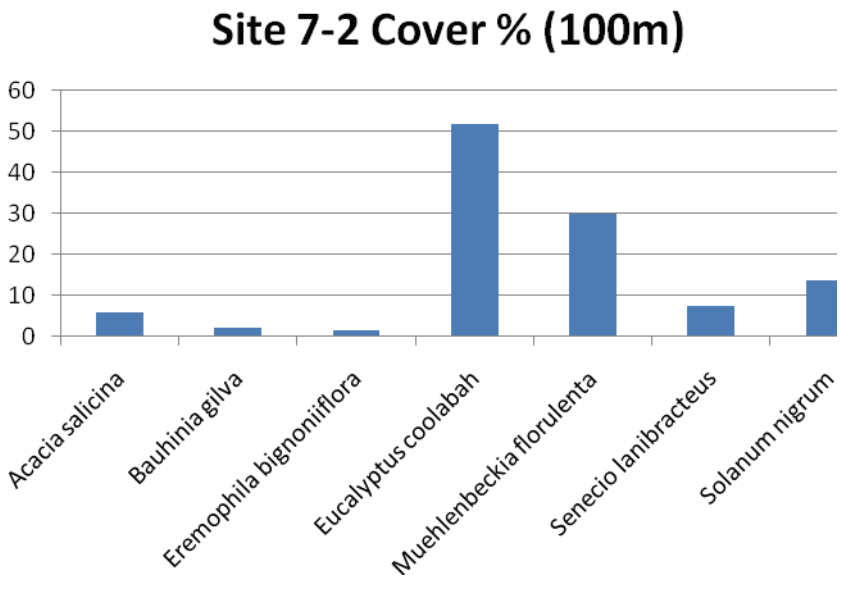


Site	Latitude	Longitude	Photo Bearing
Cuttapirie Corner 1-1	-27.5954	139.88624	
Cuttapirie Corner 1-2	-27.5928	139.88246	160
Cuttapirie Corner 1-3	-27.5894	139.87937	

	Species Presence			
Plant Species	**Site 7-1**	**Site 7-2**	**Site 7-3**	**All Sites**
Acacia salicina	1	1	1	3
Acacia stenophylla			1	1
Amaranthus grandiflorus			1	1
Amaranthus interruptus			1	1
Atriplex holocarpa			1	1

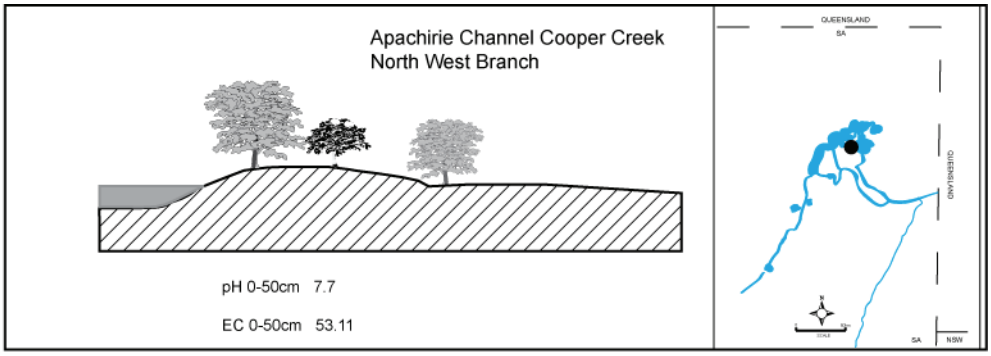
	Species Presence			
Plant Species	**Site 7-1**	**Site 7-2**	**Site 7-3**	**All Sites**
Bauhinia gilva	1	1	1	3
Boerhavia dominii	1			1
Brachiaria praetervisa			1	1
Chenopodium auricomum			1	1
Cucumis melo	1		1	2
Einadia nutans ssp. eremaea	1		1	2
Enchylaena tomentosa var. glabra	1		1	2
Eremophila bignoniiflora		1	1	2
Eucalyptus coolabah	1	1	1	3
Glinus lotoides		1		1
Lavatera plebeia	1	1	1	3
Muehlenbeckia florulenta		1	1	2
Nicotiana velutina		1	1	2
Portulaca intraterranea	1		1	2
Rutidosis helichrysoides var helichrysoides	1	1		2
Santalum lanceolatum			1	1
Sclerolaena bicornis	1			1
Sclerolaena intricata	1			1
Senecio lanibracteus	1	1	1	3
Solanum nigrum	1	1	1	3
Sonchus oleraceus		1	1	2
Tetragonia tetragonioides		1	1	2
Trianthema triquetra	1		1	2
Tribulus eichlerianus	1		1	2
Verbena officinalis		1		1
Zygophyllum ammophilum	1		1	2
Grand Total	**17**	**14**	**25**	

Perennial Species Site 7-2	**Cover % (100m)**
Acacia salicina	5.8
Bauhinia gilva	2.2
Eremophila bignoniiflora	1.5
Eucalyptus coolabah	51.8
Muehlenbeckia florulenta	30
Senecio lanibracteus	7.4
Solanum nigrum	13.8



Lake Apachirie Channel

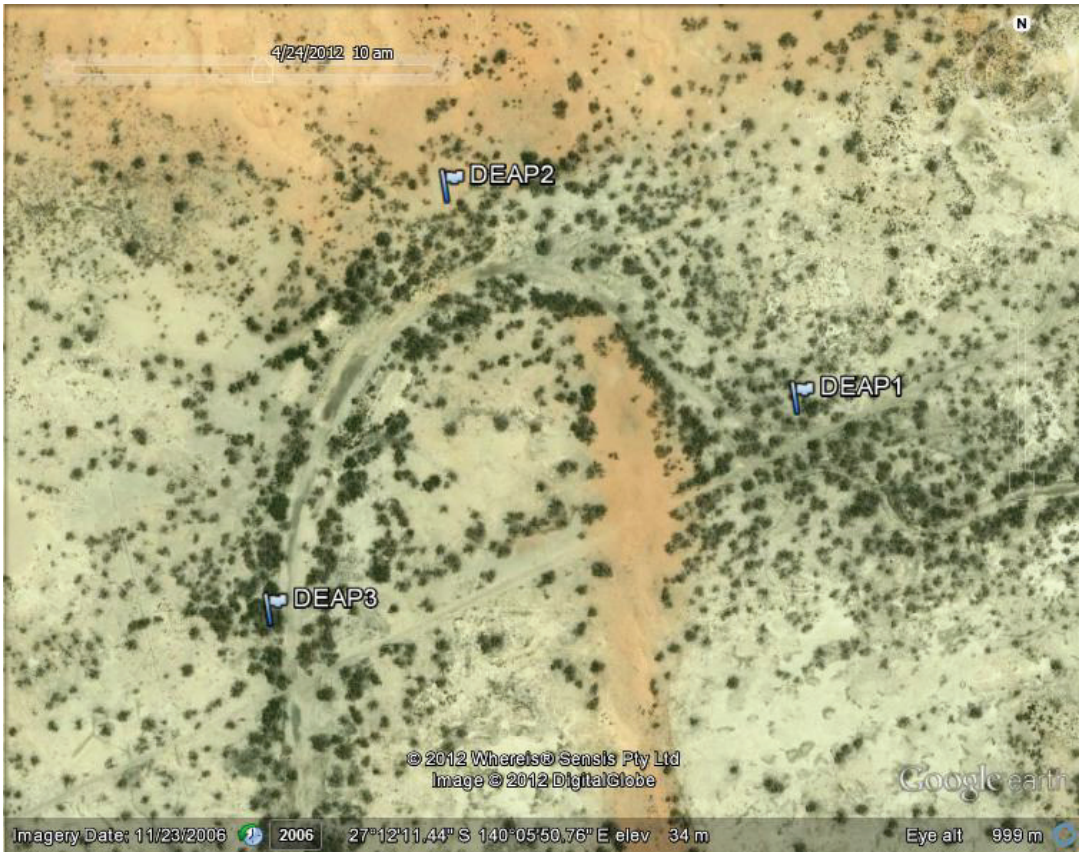
Lake Apachirie Channel (8-2)



Key to Species

Eucalyptus coolabah

Bauhinia gilva

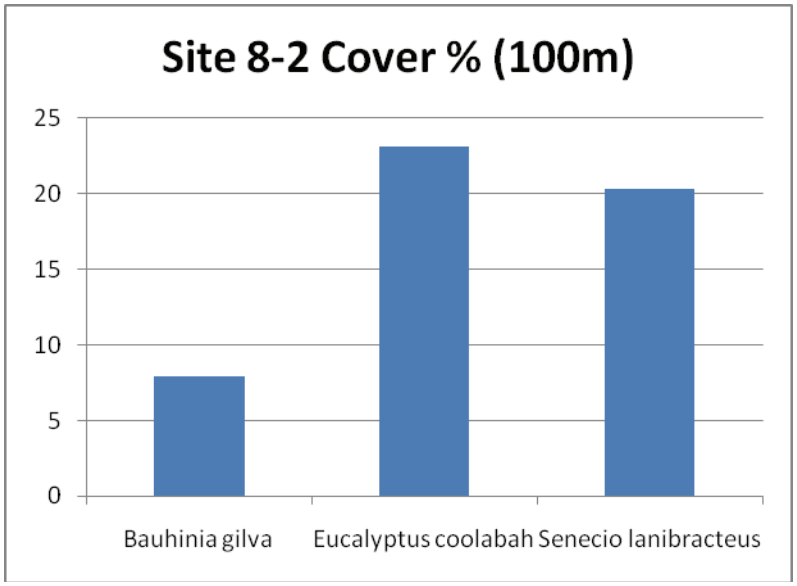


Site	Latitude	Longitude	Photo Bearing
Apachirie Channel 1-1	-27.2031	140.10012	
Apachirie Channel 1-2	-27.2011	140.09648	88
Apachirie Channel 1-3	-27.205	140.09464	

	Species Presence			
Plant Species	**Site 8-1**	**Site 8-2**	**Site 8-3**	**All Sites**
Abutilon fraseri ssp fraseri		1		1
Acacia salicina	1		1	2
Alternanthera nodiflora	1	1	1	3
Ammannia multiflora	1	1	1	3
Bauhinia gilva		1		1
Bergia trimera	1			1
Boerhavia dominii			1	1

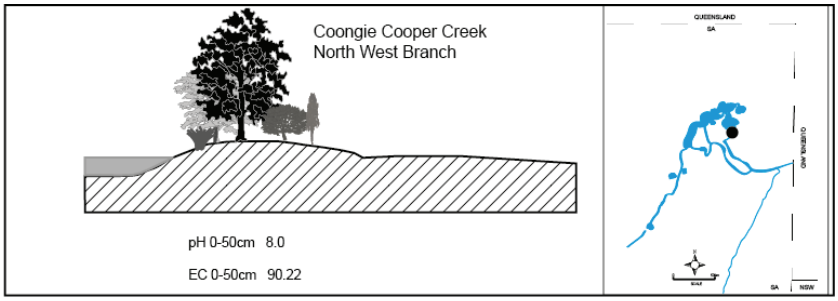
	Species Presence			
Plant Species	**Site 8-1**	**Site 8-2**	**Site 8-3**	**All Sites**
Calotis porphyroglossa	1	1	1	3
Cucumis melo	1		1	2
Cullen australasicum	1	1		2
Cyperus pygmaeus	1	1		2
Dactyloctenium radulans		1		1
Epaltes australis	1	1	1	3
Eragrostis basedowii		1		1
Eragrostis dielsii var. dielsii		1		1
Eucalyptus coolabah	1	1	1	3
Euphorbia drummondii	1		1	2
Glinus lotoides	1	1	1	3
Haloragis aspera		1		1
Helichrysum luteoalbum	1			1
Heliotropium supinum	1	1		2
Lavatera plebeia			1	1
Ludwigia peploides ssp. montevidensis	1	1		2
Muehlenbeckia florulenta			1	1
Polygonum plebium	1	1		2
Portulaca intraterranea	1	1	1	3
Rumex crystallinus		1		1
Senecio lanibracteus	1	1	1	3
Sesbania cannabina var. cannabina	1	1	1	3
Sida fibulifera			1	1
Solanum nigrum	1		1	2
Solanum oligacanthum	1	1		2
Sporobolus mitchellii	1	1		2
Stemodia florulenta	1	1	1	3
Teucrium racemosum	1	1	1	3
Tragus australianus		1		1
Trigonella suavissima		1		1
Verbena officinalis	1		1	2
Grand Total	**25**	**27**	**21**	

Perennial Species Site 8-2	**Cover % (100m)**
Bauhinia gilva	7.9
Eucalyptus coolabah	23.1
Senecio lanibracteus	20.3

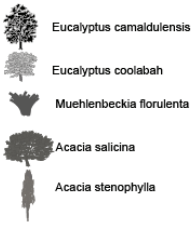


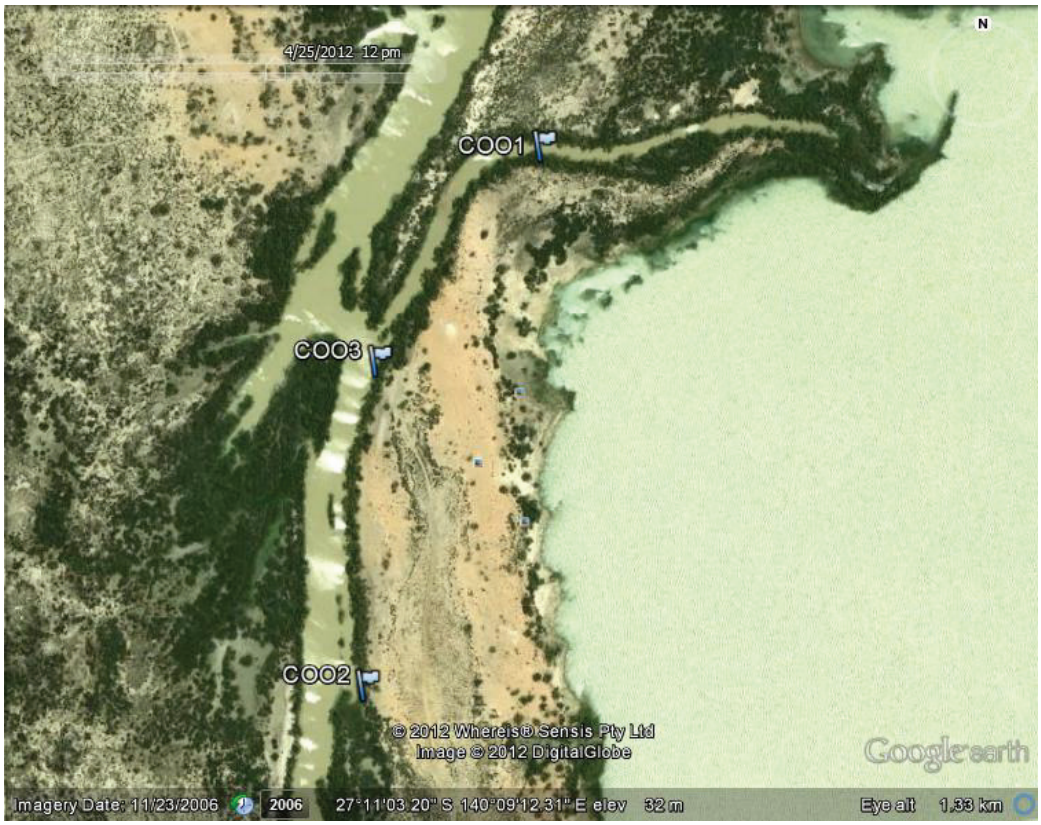
Coongie Camp Ground WH

Coongie Camp Ground WH (9-2)



Key to Species



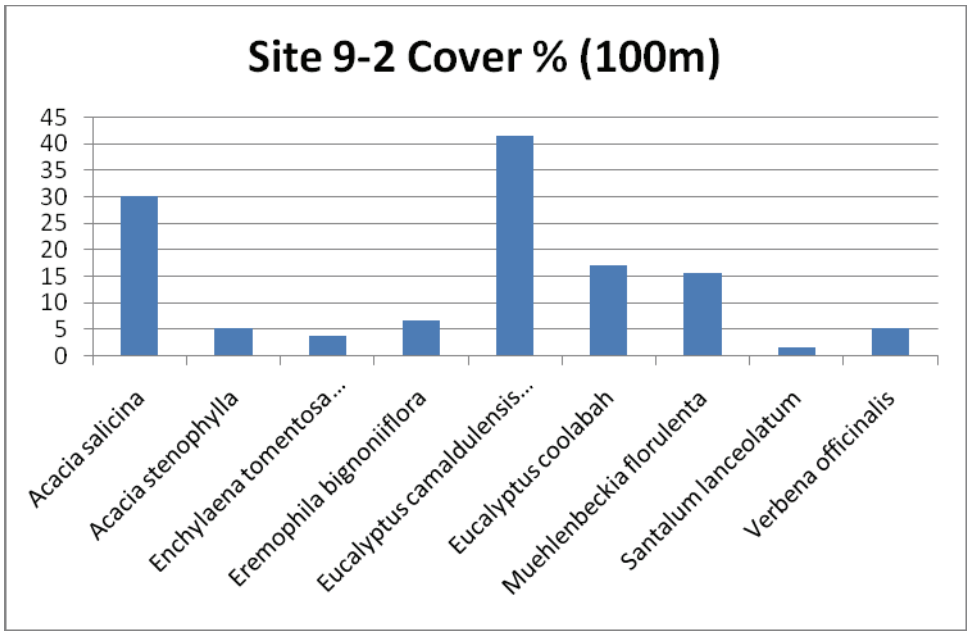


Site	Latitude	Longitude	Photo Bearing
Coongie 1-1	-27.181	140.15373	
Coongie 1-2	-27.188	140.15115	342
Coongie 1-3	-27.1838	140.15133	

	Species Presence			
Plant Species	**Site 9-1**	**Site 9-2**	**Site 9-3**	**All Sites**
Acacia salicina				
Acacia stenophylla		1	1	2
Aeschynomene indica		1		1
Atriplex nummularia	1		1	2
Atriplex velutinella	1			1
Bauhinia gilva	1		1	2

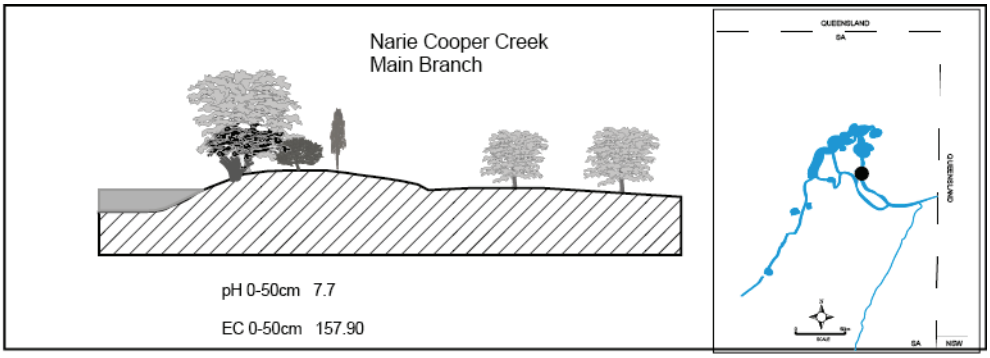
	Species Presence			
Plant Species	**Site 9-1**	**Site 9-2**	**Site 9-3**	**All Sites**
Conyza sumatrensis		1		1
Crinum flaccidum		1	1	2
Cucumis melo		1		1
Cyperus gymnocaulos		1	1	2
Einadia nutans ssp. eremaea	1	1	1	3
Enchylaena tomentosa var. glabra	1	1	1	3
Eragrostis dielsii var. dielsii			1	1
Eremophila bignoniiflora		1		1
Eucalyptus camaldulensis var. obtusa	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Euphorbia stevenii			1	1
Muehlenbeckia florulenta	1	1	1	3
Mukia maderaspatana	1			1
Nicotiana velutina	1	1	1	3
Portulaca intraterranea	1		1	2
Pterocaulon sphacelatum			1	1
Salsola kali			1	1
Santalum lanceolatum	1	1	1	3
Sclerolaena intricata	1			1
Senecio lanibracteus	1	1		2
Sida ammophila			1	1
Solanum nigrum	1	1	1	3
Sonchus oleraceus	1			1
Stemodia florulenta			1	1
Tecticornia indica ssp. leiostachya			1	1
Trianthema triquetra			1	1
Tribulus eichlerianus	1			1
Verbena officinalis	1	1	1	3
Grand Total	**19**	**18**	**24**	

Perennial Species Site 9-2	**Cover % (100m)**
Acacia salicina	30.2
Acacia stenophylla	5.2
Enchylaena tomentosa var. glabra	3.8
Eremophila bignoniiflora	6.6
Eucalyptus camaldulensis var. obtusa	41.5
Eucalyptus coolabah	17
Muehlenbeckia florulenta	15.6
Santalum lanceolatum	1.5
Verbena officinalis	5.2

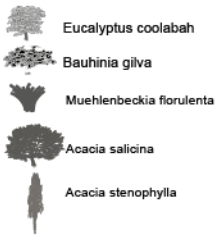

Site 9-2 Cover % (100m)
45
40
35
30
25
20
15
10
5
0
Acacia salicina
Acacia stenophylla
Enchylaena tomentosa...
Eremophila bignoniiflora
Eucalyptus camaldulensis...
Eucalyptus coolabah
Muehlenbeckia florulenta
Santalum lanceolatum
Verbena officinalis

Narie WH

Narie WH (10-2)



Key to Species

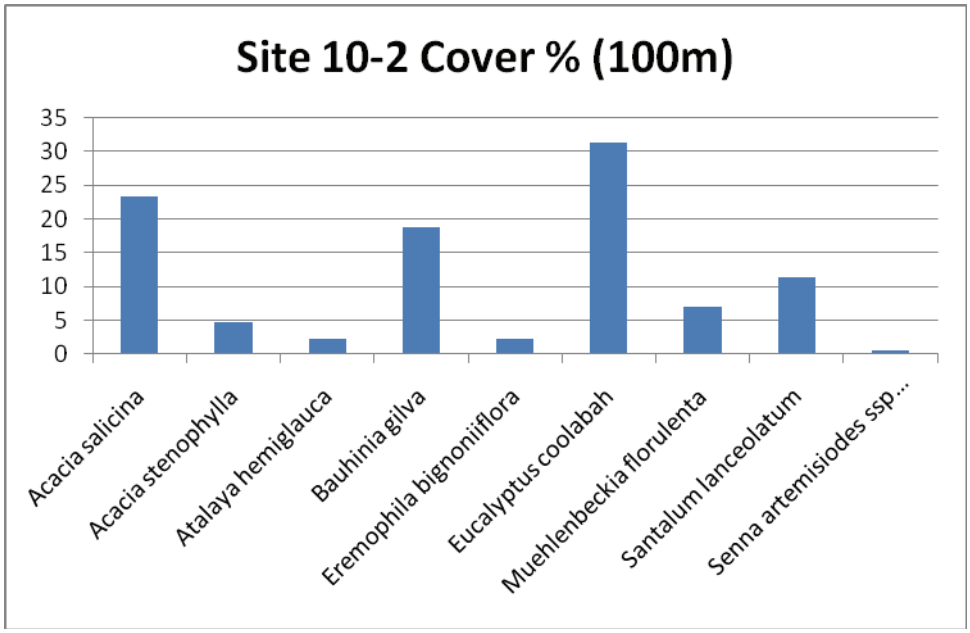


Site	Latitude	Longitude	Photo Bearing
Narie 1-1	-27.4568	140.07564	
Narie 1-2	-27.4537	140.07164	130
Narie 1-3	-27.4502	140.06781	

	Species Presence			
Plant Species	**Site 10-1**	**Site 10-2**	**Site 10-3**	**All Sites**
Acacia salicina	1	1	1	3
Acacia stenophylla		1	1	2
Atalaya hemiglauca		1	1	2
Bauhinia gilva	1	1	1	3

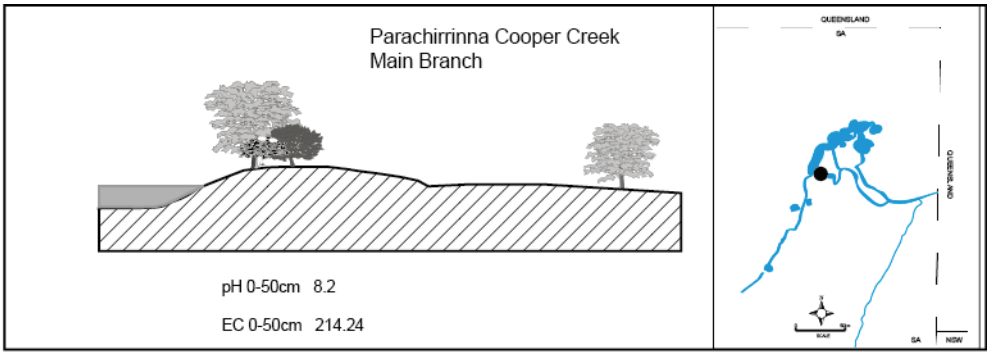
	Species Presence			
Plant Species	**Site 10-1**	**Site 10-2**	**Site 10-3**	**All Sites**
Boerhavia dominii			1	1
Cucumis melo	1	1		2
Einadia nutans ssp. eremaea	1	1		2
Enchylaena tomentosa var. glabra	1	1	1	3
Eremophila bignoniiflora	1	1		2
Eucalyptus coolabah	1	1	1	3
Glinus lotoides	1			1
Haloragis aspera			1	1
Lavatera plebeia	1	1	1	3
Lysiana subfalcata		1		1
Malvastrum americanum			1	1
Muehlenbeckia florulenta	1	1	1	3
Nicotiana velutina	1		1	2
Rutidosis helichrysoides var helichrysoides	1		1	2
Santalum lanceolatum		1	1	2
Senecio lanibracteus	1	1	1	3
Senna artemisioides ssp sturtii		1		1
Setaria dielsii		1		1
Solanum esuriale		1		1
Solanum nigrum	1	1	1	3
Sonchus oleraceus	1	1		2
Verbena officinalis	1	1	1	3
Zygophyllum ammophilum		1	1	2
Grand Total	**16**	**21**	**18**	

Perennial Species Site 10-2	**Cover % (100m)**
Acacia salicina	23.4
Acacia stenophylla	4.7
Atalaya hemiglauca	2.3
Bauhinia gilva	18.8
Eremophila bignoniiflora	2.3
Eucalyptus coolabah	31.4
Muehlenbeckia florulenta	7.1
Santalum lanceolatum	11.4
Senna artemisioides ssp sturtii	0.5



Parachirrinna WH

Parachirrinna WH (11-2)

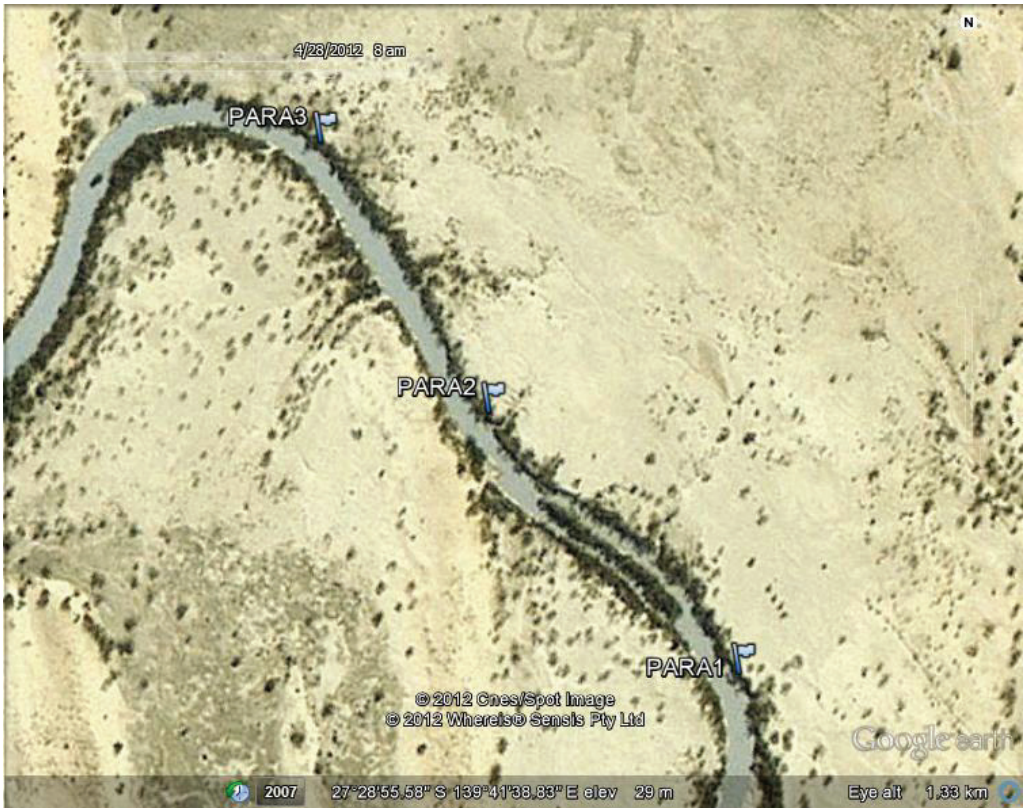


Key to Species

Eucalyptus coolabah

Bauhinia gilva

Acacia salicina

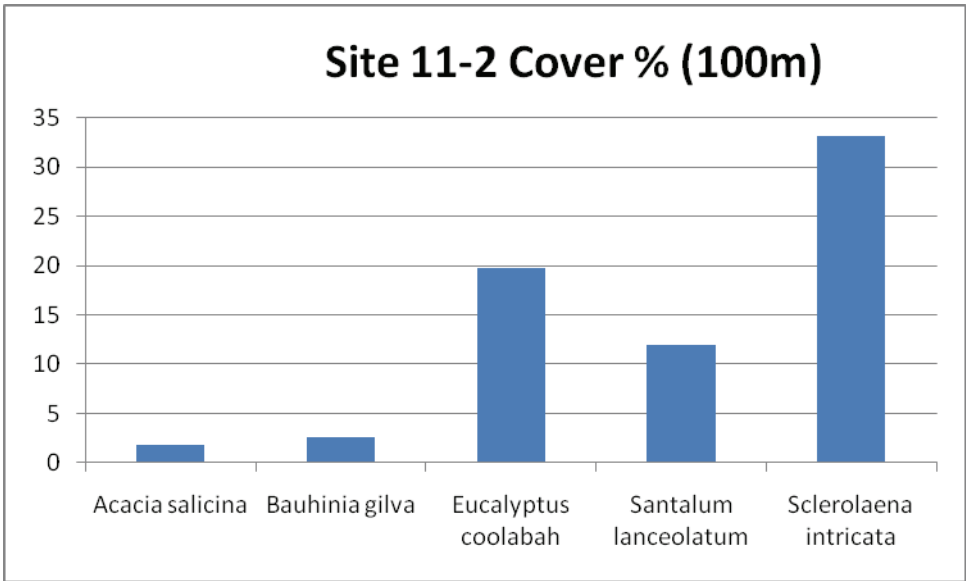


Site	Latitude	Longitude	Photo Bearing
Parachirrinna 1-1	-27.4857	139.6975	
Parachirrinna 1-2	-27.4822	139.69379	314
Parachirrinna 1-3	-27.4787	139.6913	

	Species Presence			
Plant Species	**Site 11-1**	**Site 11-2**	**Site 11-3**	**All Sites**
Acacia salicina	1	1	1	3
Acacia stenophylla	1		1	2
Alternanthera nodiflora		1		1
Amaranthus grandiflorus	1		1	2
Bauhinia gilva		1		1

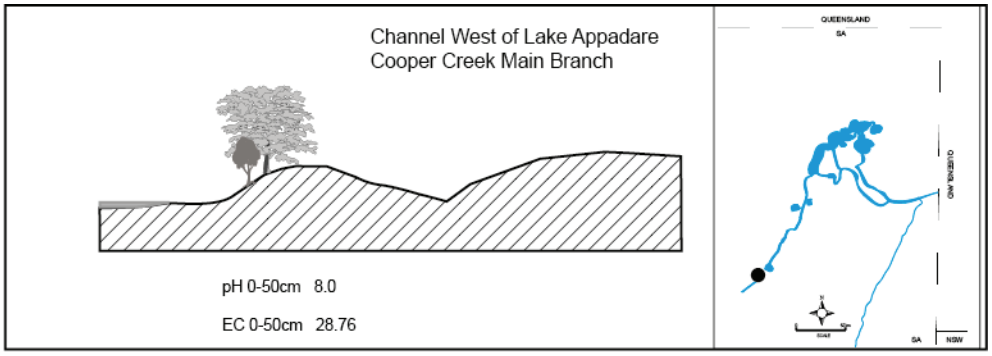
	Species Presence			
Plant Species	**Site 11-1**	**Site 11-2**	**Site 11-3**	**All Sites**
Boerhavia dominii		1	1	2
Cucumis melo	1	1	1	3
Dactyloctenium radulans	1	1	1	3
Einadia nutans ssp. eremaea	1	1	1	3
Enchylaena tomentosa var. glabra	1	1	1	3
Eragrostis dielsii var. dielsii	1			1
Eragrostis setifolia	1	1		2
Eucalyptus coolabah	1	1	1	3
Haloragis aspera		1		1
Lavatera plebeia	1	1	1	3
Lysiana subfalcata			1	1
Muehlenbeckia florulenta	1		1	2
Nicotiana velutina	1		1	2
Portulaca intraterranea	1		1	2
Rutidosis helichrysoides var helichrysoides			1	1
Santalum lanceolatum	1	1	1	3
Sclerolaena bicornis	1	1		2
Sclerolaena diacantha	1			1
Sclerolaena intricata	1	1	1	3
Senecio lanibracteus	1	1	1	3
Solanum nigrum	1	1	1	3
Sonchus oleraceus	1		1	2
Stemodia florulenta		1		1
Tetragonia tetragonioides	1	1		2
Teucrium racemosum			1	1
Trianthema triquetra	1	1	1	3
Verbena officinalis		1	1	2
Zygophyllum ammophilum			1	1
Grand Total	**23**	**21**	**24**	

Perennial Species Site 11-2	**Cover % (100m)**
Acacia salicina	1.8
Bauhinia gilva	2.6
Eucalyptus coolabah	19.8
Santalum lanceolatum	11.9
Sclerolaena intricata	33.1



Cooper Channel west of Lake Appadare

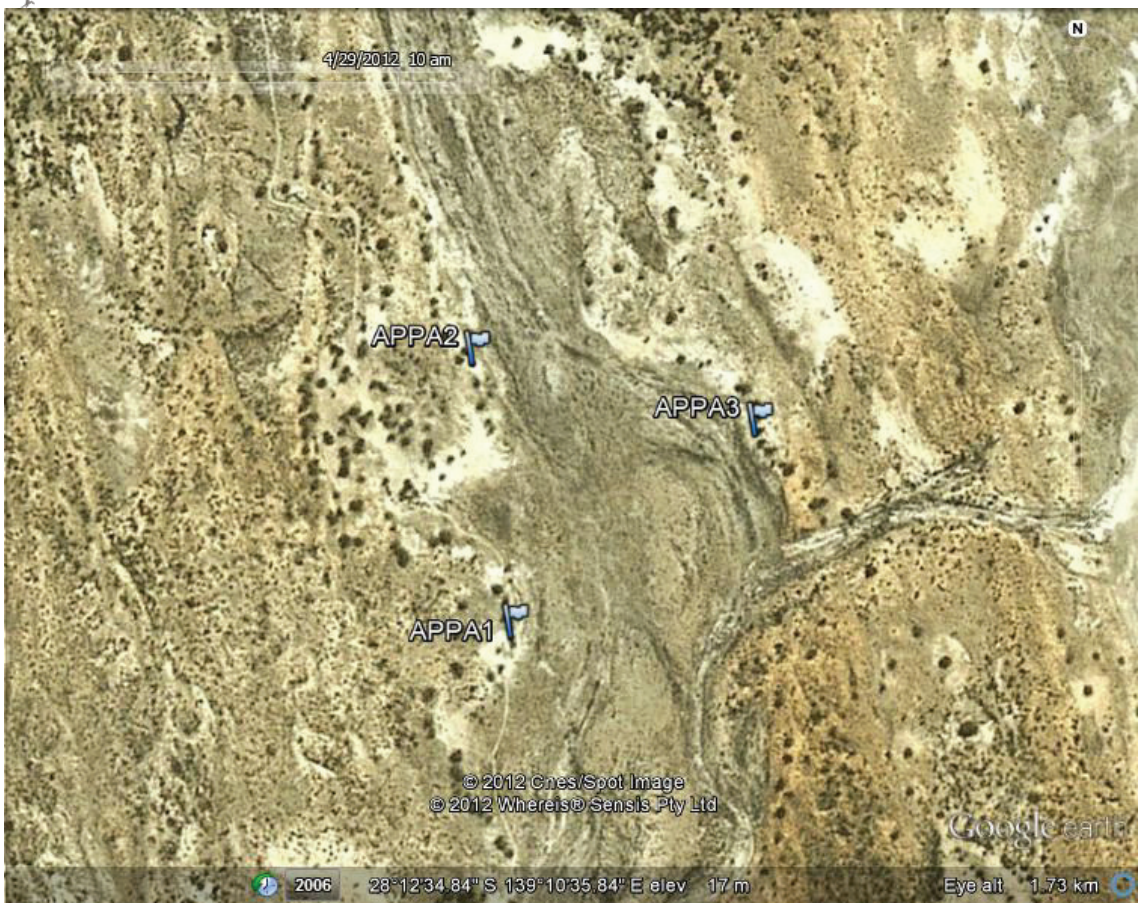
Cooper Channel west of Lake Appadare (12-2)



Key to Species

Eucalyptus coolabah

Acacaia murrayana

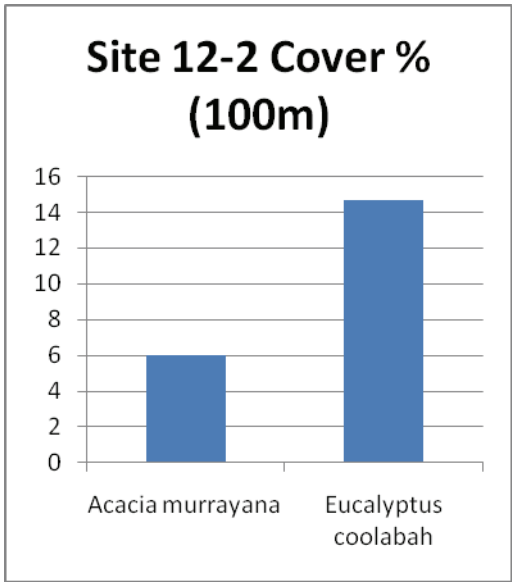


Site	Latitude	Longitude	Photo Bearing
West of Appadare 1-1	-28.2125	139.17559	
West of Appadare 1-2	-28.2083	139.17491	330
West of Appadare 1-3	-28.2094	139.17992	

	Species Presence			
Plant Species	**Site 12-1**	**Site 12-2**	**Site 12-3**	**All Sites**
Acacia ligulata	1			1
Acacia murrayana		1		1
Acacia victoriae	1			1
Amaranthus grandiflorus	1	1	1	3
Aristida holathera var holathera	1	1		2
Atriplex limbata			1	1

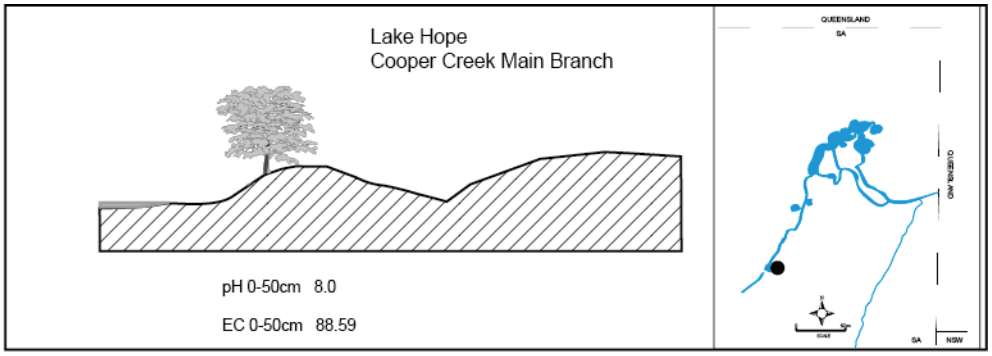
	Species Presence			
Plant Species	**Site 12-1**	**Site 12-2**	**Site 12-3**	**All Sites**
Atriplex velutina		1	1	2
Boerhavia coccinea			1	1
Brachyscome ciliaria ssp lanuginosa	1	1		2
Crotalaria cunninghamii	1	1		2
Crotalaria eremaea ssp. eremaea	1	1	1	3
Crotalaria smithiana			1	1
Cullen discolor	1			1
Cynanchum floribundum		1		1
Cyperus gymnocaulos	1		1	2
Dactyloctenium radulans	1			1
Einadia nutans ssp. eremaea			1	1
Enchylaena tomentosa var. glabra	1	1	1	3
Enneapogon avenaceus			1	1
Epaltes australis	1		1	2
Eragrostis dielsii var. dielsii	1		1	2
Eragrostis setifolia			1	1
Eriachne aristidea	1	1	1	3
Eucalyptus coolabah	1	1	1	3
Euphorbia drummondii	1	1	1	3
Haloragis aspera	1		1	2
Helichrysum luteoalbum	1			1
Indigofera psammophila	1			1
Ipomoea polymorpha	1			1
Nicotiana velutina	1	1	1	3
Paractaenum novae-hollandiae ssp. reversum	1	1	1	3
Phyllanthus lacunellus	1	1		2
Portulaca intraterranea	1	1	1	3
Pterocaulon sphacelatum	1		1	2
Salsola kali	1	1		2
Scaevola collaris	1		1	2
Sclerolaena diacantha	1			1
Sclerolaena intricata	1		1	2
Senecio lanibracteus			1	1
Sida ammophila	1	1	1	3
Solanum oligacanthum	1		1	2
Sporobolus mitchellii	1		1	2
Stemodia florulenta	1		1	2
Swainsona laxa		1		1
Tephrosia sphaerospora	1			1
Trachymene glaucifolia		1		1
Trianthema triquetra	1		1	2
Trichodesma zeylanicum	1	1		2
Triraphis mollis	1		1	2
Verbena officinalis	1		1	2
Wahlenbergia communis			1	1
Grand Total	**38**	**22**	**32**	

Perennial Species Site 12-2	**Cover % (100m)**
Acacia murrayana	6
Eucalyptus coolabah	14.7


Site 12-2 Cover %
(100m)
16
14
12
10
8
6
4
2
0
Acacia murrayana
Eucalyptus coolabah

Lake Hope, lake margin

Lake Hope, lake margin (13-2)



Key to Species

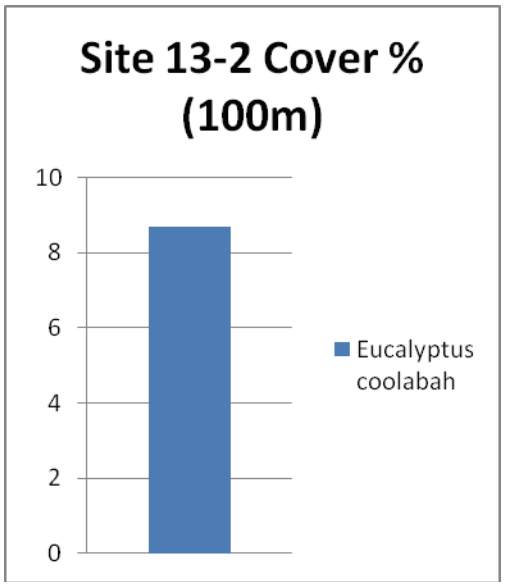
Eucalyptus coolabah

Site	Latitude	Longitude	Photo Bearing
Lake Hope 1-1	-28.3801	139.24719	
Lake Hope 1-2	-28.3865	139.25378	136
Lake Hope 1-3	-28.3914	139.25693	

	Species Presence			
Plant Species	**Site 13-1**	**Site 13-2**	**Site 13-3**	**All Sites**
Amaranthus grandiflorus	1		1	2
Boerhavia coccinea			1	1
Brassica tournefortii			1	1
Cullen discolor			1	1
Cynanchum floribundum			1	1
Cyperus gymnocaulos	1	1	1	3
Dactyloctenium radulans	1			1
Enchylaena tomentosa var. glabra	1		1	2
Enneapogon avenaceus	1			1
Epaltes australis	1	1		2
Eucalyptus coolabah	1	1	1	3

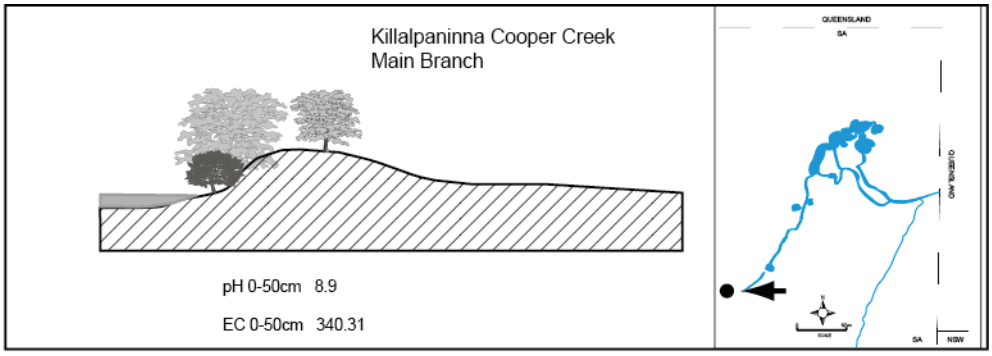
	Species Presence			
Plant Species	**Site 13-1**	**Site 13-2**	**Site 13-3**	**All Sites**
Euphorbia drummondii			1	1
Haloragis aspera			1	1
Nicotiana velutina	1		1	2
Paractaenum novae-hollandiae ssp. reversum	1		1	2
Phyllanthus lacunellus	1	1	1	3
Portulaca intraterranea	1		1	2
Ptilotus atriplicifolius			1	1
Salsola kali	1		1	2
Scaevola collaris		1	1	2
Sclerolaena diacantha	1			1
Sclerolaena intricata			1	1
Senecio gregorii	1		1	2
Sesbania cannabina var. cannabina	1	1		2
Sida ammophila			1	1
Sida sp.	1			1
Solanum oligacanthum	1		1	2
Sporobolus mitchellii	1	1		2
Stemodia florulenta	1	1	1	3
Trianthema triquetra	1		1	2
Triraphis mollis	1			1
Verbena officinalis			1	1
Zygochloa paradoxa			1	1
Grand Total	**22**	**8**	**26**	

Perennial Species Site 13-2	**Cover % (100m)**
Eucalyptus coolabah	8.7



Lake Killalpaninna

Lake Killalpaninna (14-2)



Key to Species

Eucalyptus coolabah

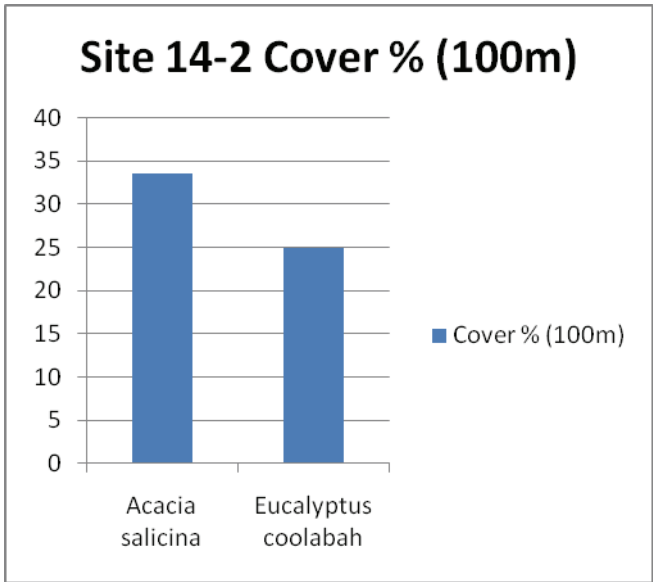
Acacia salicina

Site	Latitude	Longitude	Photo Bearing
Killalpaninna 1-1	-28.6156	138.56036	
Killalpaninna 1-2	-28.5934	138.55452	155
Killalpaninna 1-3	-28.6006	138.55709	

	Species Presence			
Plant Species	**Site 14-1**	**Site 14-2**	**Site 14-3**	**All Sites**
Acacia salicina	1	1	1	3
Alternanthera nodiflora		1		1
Amaranthus grandiflorus		1		1
Aristida holathera var holathera		1		1
Atriplex nummularia	1			1
Austrobryonia micrantha			1	1

	Species Presence			
Plant Species	**Site 14-1**	**Site 14-2**	**Site 14-3**	**All Sites**
Cynanchum floribundum		1		1
Cyperus gymnocaulos	1	1	1	3
einadia nutans ssp. eremaea			1	1
Enchylaena tomentosa var. glabra	1	1	1	3
Epaltes australis	1	1	1	3
Eragrostis dielsii var. dielsii		1		1
Eucalyptus coolabah	1	1	1	3
Euphorbia drummondii		1	1	2
Heliotropium curassivicum	1	1		2
Nicotiana velutina	1	1	1	3
Phyllanthus lacunellus	1	1	1	3
Salsola kali		1		1
Sauropus trachyspermus	1		1	2
Sesbania cannabina var. cannabina			1	1
Sida ammophila		1		1
Solanum oligacanthum	1	1	1	3
Sporobolus mitchellii	1			1
Stemodia florulenta	1	1	1	3
Teucrium racemosum	1		1	2
Trianthema triquetra	1		1	2
Verbena officinalis	1		1	2
Zygochloa paradoxa		1		1
Grand Total	**16**	**19**	**17**	

Perennial Species Site 13-2	**Cover % (100m)**
Acacia salicina	33.6
Eucalyptus coolabah	24.9



6.5 Appendix 5 – Purdie-Cooper-Coongie plant species list

10 July 1997

Name

Nomenclature generally follows Flora of South Australia but more recent name changes in some families (esp. Asteraceae) follow Flora New South Wales; some other names not included in FI.SA have been kept in pending hopeful field clarification.

Survey & Date

Moll 83 = Mollenmans 1983/84; RP*86 = R.Purdie 1986, * denotes field notes (no specimen); R&G = Reid & Gillen 1988; G&D 93 = Gillen & Drewien 1993; G&R 90 = Gillen & Reid 1990; RB 96 = Robert Brandle 1996 (unpub). ERIN = WWW site. Mollenmans report used for collection dates prior to his 1983/84 survey.

W. = species recorded in WARLUS 6 or WARLUS 1 area(s) in SW Queensland

Name	Family	Survey & Date	W.
Dipteracanthus australasicus ssp australasicus	Acanth	RP 86; RB 96	6
Dipteracanthus australasicus ssp glabratus	Acanth	R&G 88; RB 96	
Rostellularia adscendens ssp adscendens var pogonanthera (R. pogonanthera; Justicia procumbens)	Acanth	1924; R&G 88; RB 96	1; 6
Cheilanthes austrotenuifolia (C. tenuifolia)	Adiant	1889	
Cheilanthes sieberi ssp pseudovellea (C. vellea)	Adiant	1889	1; 6
Glinus lotioides	Aizoa	Moll 83; R&G 88; G&D 93; RB 96	1; 6
Glinus oppositifolia	Aizoa	R&G 88;	
Glinus orygioides (Mollugo orygioides)	Aizoa	1889	6
Gunniopsis quadrifida	Aizoa	Moll 83; RP*86; R&G 88; RB 96	6
Gunniopsis septifraga	Aizoa	R&G 88;	
Mollugo cerviana	Aizoa	R&G 88; G&R 90;	1
Trianthema pilosa	Aizoa	R&G 88;	1; 6
Trianthema triquetra	Aizoa	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Zaleya galericulata	Aizoa	Moll 83; RP 86; R&G 88; G&D 93; RB 96	1; 6
Alternanthera angustifolia	Amara	R&G 88; RB 96	6
Alternanthera denticulata	Amara	R&G 88; G&R 90; RB 96	1; 6
Alternanthera nodiflora	Amara	Moll 83; RP 86; R&G 88; G&R 90; RB 96	1; 6
Amaramthus grandiflorus	Amara	Moll 83; R&G 88;	1
Amaranthus mitchellii	Amara	Moll 83; R&G 88; G&D 93; RB 96	1; 6
Ptilotus atriplicifolius var atriplicifolius	Amara	Moll 83; R&G 88; G&R 90;	6
Ptilotus latifolius	Amara	Moll 83; R&G 88;	1; 6

Name	Family	Survey & Date	W.
Ptilotus macrocephalus	Amara	R&G 88; G&R 90;	1; 6
Ptilotus murrayi	Amara	<1960	1; 6
Ptilotus nobilis	Amara	R&G 88; G&R 90; RB 96	1; 6
Ptilotus obovatus var obovatus	Amara	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Ptilotus polystachyus var polystachyus	Amara	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Ptilotus polystachyus var polystachyus f. rubriflorus	Amara	R&G 88;	6
Calostemma luteum	Amary	RP*86; R&G 88;	1; 6
Crinum flaccidum	Amary	Moll 83; R&G 88; G&D 93;	1; 6
Crinum luteolum (C. pedunculatum)	Amary	1924	
Daucus glochidiatus	Apiac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Eryngium plantagineum	Apiac	R&G 88;	1
Eryngium supinum	Apiac	Moll 83; R&G 88;	1; 6
Trachymene glaucifolia	Apiac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Cynanchum floribundum	Asclep	Moll 83; RP 86; R&G 88; G&R 90;	6
Rhyncharrhena linearis	Asclep	Moll 83;	1; 6
Sarcostemma australe (S. viminale ssp australe)	Asclep	R&G 88; G&R 90; RB 96	1; 6
Pleurosorus rutifolius (Grammitis rutaefolia)	Asplen	1889	
Actinobole uliginosum	Astera	G&R 90;	
Angianthus pusillus	Astera	= Chrysocoryne pusilla	
Angianthus tomentosus	Astera	R&G 88;	
Brachycome basaltica var gracilis	Astera	R&G 88;	
Brachycome campylocarpa	Astera	R&G 88;	6
Brachycome ciliaris var ciliaris	Astera	G&R 90;	6
Brachycome ciliaris var lanuginosa	Astera	Moll 83; R&G 88;	1
Brachycome dichromosomatica	Astera	G&R 90;	
Brachycome linearloba	Astera	R&G 88;	
Brachycome melanocarpa	Astera	1889	1
Brachycome sp. nov.	Astera	R&G 88;	
Calocephalus knappii	Astera	R&G 88;	
Calocephalus platycephalus	Astera	Moll 83; R&G 88; G&D 93; G&R 90; RB 96	6
Calotis ancyrocarpa	Astera	Moll 83; R&G 88;	1; 6
Calotis cymbacantha	Astera	1889	
Calotis erinacea	Astera	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Calotis hispidula	Astera	RP 86; Moll 83; R&G 88; G&D 93; G&R 90;	1; 6
Calotis latiuscula	Astera	R&G 88;	1
Calotis multicaulis	Astera	Moll 83; R&G 88;	1; 6
Calotis plumulifera	Astera	R&G 88; G&D 93; G&R 90; RB 96	
Calotis porphyroglossa	Astera	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Centipeda cunninghamii	Astera	Moll 83; RP 86; R&G 88; RB 96	6
Centipeda minima	Astera	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Centipeda thespidioides	Astera	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Chrysocephalum apiculatum (Helichrysum apiculatum)	Astera	G&R 90;	6
Chrysocephalum eremaeum	Astera	RP 86; G&R 90;	
Chrysocephalum podolepidium (Helichrysum podolepidium)	Astera	R&G 88;	6
Chrysocephalum pterochaetum (Helipterum pterochaetum)	Astera	R&G 88; G&R 90; RB 96	1; 6
Chrysocephalum semicalvum (Helichrysum ambiguum)	Astera	1924	
Chrysocoryne pusilla (Angianthus pusilla)	Astera	G&R 90;	
Craspedia chrysantha	Astera	Moll 83; R&G 88; RB 96	1

Name	Family	Survey & Date	W.
Craspedia pleiocephala	Astera	1916	1
Dichromochlamys dentatifolius (Pterigeron dentatifolius)	Astera	R&G 88; G&R 90; RB 96	
Dimorphocoma minutula*	Astera	G&D 93;	
Epaltes australis	Astera	Moll 83; RP 86; R&G 88; G&D 93;	
Epaltes cunninghamii	Astera	Moll 83; R&G 88; G&D 93;	1
Erodiophyllum elderi	Astera	1889	
Gnaphalium indicum	Astera	= G. polycaulon	
Gnaphalium indutum	Astera	1924	
Gnaphalium luteoalbum	Astera	= Pseudognaphalium luteoalbum	
Gnaphalium polycaulon*	Astera	Moll 83; R&G 88;	
Gnephosis arachnoidea (Gnephosis foliata)	Astera	Moll 83; R&G 88; G&R 90;	1
Gnephosis eriocarpa	Astera	Moll 83; R&G 88; G&D 93; RB 96	1
Gnephosis skirrophora (Trichanthodium skirrophorum)	Astera	RB 96	
Gnephosis tenuissima*	Astera	RB 96	
Helichrysum ambiguum	Astera	= Chrysocephalum semicalvum	
Helichrysum apiculatum var apiculatum	Astera	= Chrysocephalum apiculatum	
Helichrysum basedowii	Astera	= Leptorhynchos baileyi	
Helichrysum eremaeum	Astera	= Chrysocephalum eremaeum	
Helichrysum monochaetum [? = Chrysocephalum]	Astera	G&R 90;	
Helichrysum podolepidium	Astera	= Chrysocephalum podolepidium	
Helichrysum semifertile	Astera	R&G 88; G&R 90;	6
Helipterum corymbiflorum	Astera	= Rhodanthe corymbiflora	
Helipterum demissum (H. exiguum)	Astera	= Hyalosperma demissum	
Helipterum floribundum	Astera	= Rhodanthe floribunda	
Helipterum hyalospermum	Astera	= Hyalosperma glutinosum ssp glutinosum	
Helipterum jessenii	Astera	= Hyalosperma semisterile	
Helipterum microglossum	Astera	= Rhodanthe microglossa	
Helipterum molle	Astera	= Leucochrysum molle	
Helipterum moschatum	Astera	= Rhodanthe moschata	
Helipterum pterochaetum	Astera	= Chrysocephalum pterochaetum	
Helipterum strictum	Astera	= Rhodanthe stricta	
Helipterum troedelii	Astera	= Rhodanthe troedelii	
Helipterum uniflorum	Astera	= Rhodanthe uniflora	
Hyalosperma demissum (Helipterum demissum)	Astera	1889	
Hyalosperma glutinosum ssp glutinosum (Helipterum hyalospermum)	Astera	1889	1
Hyalosperma semisterile (Helipterum jessenii)	Astera	G&R 90;	
Ixiochlamys nana	Astera	G&R 90;	
Ixiolaena brevicompta	Astera	Moll 83; R&G 88;	1; 6
Ixiolaena chloroleuca	Astera	R&G 88; RB 96	
Ixiolaena leptolepis	Astera	R&G 88; G&R 90; RB 96	1; 6
Ixiolaena tomentosa	Astera	RB 96	6
Leptorhynchos baileyi (Helichrysum basedowii)	Astera	1889	1; 6
Leptorhynchos tetrachaetus (L. pulchellus)	Astera	1889	
Leucochrysum molle (Helipterum molle)	Astera	G&R 90;	1
Millotia greevesii ssp greevesii var greevesii	Astera	G&R 90;	

Name	Family	Survey & Date	W.
Minuria cunninghamii	Astera	Moll 83; R&G 88; G&R 90;	6
Minuria denticulata	Astera	Moll 83; RP 86; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Minuria integerrima (?=Ixiochlamys integerrima 6)	Astera	Moll 83; R&G 88;	1; 6
Minuria leptophylla	Astera	R&G 88; G&R 90; RB 96	1; 6
Minuria rigida	Astera	Moll 83; R&G 88; G&D 93;	6
Myriocephalus rudallii	Astera	Moll 83; R&G 88;	1; 6
Myriocephalus stuartii	Astera	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Othonna gregorii	Astera	G&D 93; RB 96 [?= Senecio gregorii?]	
Pentzia suffructicosa*	Astera	R&G 88;	
Pluchea rubelliflora	Astera	G&D 93;	
Pluchea tetranthera	Astera	Moll 83; R&G 88; G&R 90; RB 96	6
Podolepis arachnoidea (P. rutidochlamys)	Astera	1884	
Podolepis canescens	Astera	1889	1; 6
Podolepis capillaris	Astera	G&R 90;	
Podolepis muelleri (P. lessonii)	Astera	1916	
Polycalymma stuartii	Astera	= Myriocepahlus stuartii (FSA); RB det	
Pseudognaphalium luteo-album (Gnaphalium luteoalbum)	Astera	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	
Pterocaulon serrulatum (S. glandulosum)	Astera	1975	6
Pterocaulon sphacelatum	Astera	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Rhodanthe corymbiflora (Helipterum corymbiflorum)	Astera	1889	1; 6
Rhodanthe floribunda (Helipterum floribundum)	Astera	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Rhodanthe microglossa (Helipterum microglossum)	Astera	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Rhodanthe moschata (Helipterum moschatum)	Astera	Moll 83; R&G 88; G&R 90;	1; 6
Rhodanthe stricta (Helipterum strictum)	Astera	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Rhodanthe troedelii (Helipterum troedelii)	Astera	1916	
Rhodanthe uniflora (Helipterum uniflorum)	Astera	G&R 90; RB 96	6
Rutidosis helichrysoides	Astera	RP 86; R&G 88; G&D 93; RB 96	1; 6
Senecio cunninghamii var. serratus (inc. S. cunning.)	Astera	Moll 83; R&G 88; G&D 93;	6
Senecio glossanthus (S. brachyglossus)	Astera	1889; G&R 90;	1; 6
Senecio gregorii	Astera	Moll 83; R&G 88; G&R 90;	1; 6
Senecio lautus	Astera	R&G 88;	1; 6
Senecio lautus ssp dissectifolius	Astera	Moll 83;	
Senecio lautus ssp maritimus	Astera	Moll 83;	
Senecio odoratus	Astera	1975	
Sonchus asper*	Astera	Moll 83; R&G 88;	6
Sonchus megalocarpus	Astera	1975	
Sonchus oleraceus*	Astera	Moll 83; R&G 88;	1; 6
Streptoglossa adscendens	Astera	Moll 83; RP 86; R&G 88; G&R 90; RB 96	6
Trichanthodium skirrophorum	Astera	= Gnephosis skirrophora	
Vittadinia dissecta var hirta (V. triloba)	Astera	1975	1
Vittadinia eremaea	Astera	RB 96	
Vittadinia pterochaeta	Astera	1982	

Name	Family	Survey & Date	W.
Vittadinia sp	Astera	Moll 83;	
Azolla filiculoides	Azolla	Moll 83; R&G 88;	
Coldenia procumbens	Borag	1889	
Cynoglossum australe (C. australe var drummondii)	Borag	1889	1
Halgania cyanea	Borag	R&G 88; G&R 90;	1
Halgania cyanea var latisepala	Borag	RP 86;	
Heliotropium curassavicum*	Borag	Moll 83; R&G 88; G&D 93;	1; 6
Heliotropium europaeum*	Borag	Moll 83;	
Heliotropium filaginoides	Borag	1889; RP 86; RB 96	6
Heliotropium ovalifolium	Borag	1889	6
Heliotropium supinum*	Borag	R&G 88; G&D 93;	
Heliotropium tenuifolium	Borag	R&G 88; G&R 90; RB 96	1; 6
Heliotropium undulatum	Borag	1975	
Omphalolappula concava	Borag	Moll 83; R&G 88; G&R 90;	
Plagiobothrys plurisepaleus	Borag	R&G 88; G&R 90;	
Trichodesma zeylanicum	Borag	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Alyssum linifolium*	Brassic	1924	
Arabidella eremigena	Brassic	R&G 88; G&R 90;	1; 6
Arabidella glaucescens	Brassic	1975; G&R 90; RB 96	
Arabidella procumbens	Brassic	Moll 83; R&G 88;	
Arabidella trisecta	Brassic	RP 86; R&G 88; G&R 90;	1; 6
Blennodia canescens	Brassic	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Blennodia pterosperma	Brassic	Moll 83; R&G 88; G&R 90;	1; 6
Blennodia sp aff canescens	Brassic	Moll 83;	
Brassica tournefortii*	Brassic	Moll 83; R&G 88; G&R 90; RB 96	6
Harmsiodixa blennodioides	Brassic	R&G 88; G&R 90;	1; 6
Harmsiodixa brevipes var brevipes	Brassic	R&G 88; G&R 90;	
Harmsiodixa puberula	Brassic	G&R 90;	6
Lepidium cf pseudoruderale	Brassic	R&G 88;	
Lepidium muelleri-ferdinandii	Brassic	Moll 83; R&G 88; G&D 93;	
Lepidium oxytrichum	Brassic	G&R 90; RB 96	1; 6
Lepidium papillosum	Brassic	1916; RB 96	6
Lepidium phlebopetalum	Brassic	R&G 88; G&R 90;	
Lepidium rotundum	Brassic	1975	1; 6
Menkea crassa	Brassic	R&G 88; G&R 90;	
Pachymitus cardaminoides (Sisymbrium cardaminoides)	Brassic	1889	
Phlegmatospermum cochlearinum	Brassic	R&G 88;	
Phlegmatospermum eremaeum	Brassic	R&G 88;	
Scambopus curvipes (Blennodia curvipes)	Brassic	1924	
Stenopetalum lineare	Brassic	G&R 90; RB 96	6
Stenopetalum nutans	Brassic	G&R 90; RB 96	1; 6
Stenopetalum velutinum	Brassic	1943-57	
Cassia artemisioides	Caesal	= Senna artemisioides nssp artemisioides	
Cassia desolata	Caesal	= Senna artemisioides nssp sturtii	
Cassia desolata var planipes	Caesal	= Senna artemisioides ssp petiolaris	
Cassia helmsii	Caesal	= Senna artemisioides ssp helmsii	
Cassia nemophila var coriaceae	Caesal	= Senna artemisioides nssp coriacea	
Cassia nemophila var nemophila	Caesal	= Senna artemisioides ssp filifolia	
Cassia nemophila var zygophylla	Caesal	= Senna artemisioides ssp zygophylla	
Cassia oligophylla	Caesal	= Senna artemisioides ssp oligophylla	
Cassia phyllodinea	Caesal	= Senna artemisioides ssp petiolaris	
Cassia pleurocarpa var pleurocarpa	Caesal	= Senna pleurocarpa var pleurocarpa	
Cassia pruinosa	Caesal	= Senna glutinosa nssp luerssenii	

Name	Family	Survey & Date	W.
Cassia sturtii	Caesal	= Senna artemisioides nssp sturtii	
Lysiphyllum gilvum	Caesal	Moll 83; RP*86; R&G 88; G&D 93; RB 96	1; 6
Senna artemisioides nssp artemisioides (Cassia artemisioides)	Caesal	R&G 88; G&R 90; RB 96	1; 6
Senna artemisioides nssp coriacea (Cassia nemophila/ eremophila var coriacea)	Caesal	G&R 90; G&D 93; RB 96	1
Senna artemisioides nssp sturtii (Cassia sturtii; C. desolata var desolata)	Caesal	R&G 88; G&R 90; RB 96	1; 6
Senna artemisioides ssp filifolia (Cassia nemophila var nemophila)	Caesal	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Senna artemisioides ssp helmsii (Cassia helmsii)	Caesal	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Senna artemisioides ssp oligophylla (Cassia oligophylla)	Caesal	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Senna artemisioides ssp petiolaris (Cassia phyllodinea; C. desolata var planipes)	Caesal	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Senna artemisioides ssp zygophylla (Cassia nemophila var zygophylla)	Caesal	Moll 83; R&G 88; G&R 90;	1; 6
Senna glutinosa nssp luerssenii (Cassia pruinosa)	Caesal	R&G 88;	1; 6
Senna pleurocarpa var pleurocarpa (Cassia pleurocarpa var pleuroco.)	Caesal	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Callitriche sonderi	Callit	R&G 88;	
Callitriche stagnalis*	Callit	1924	6
Isotoma petraea	Campan	R&G 88;	1; 6
Pratia puberula	Campan	1889	1
Wahlenbergia aridicola	Campan	R&G 88; RB 96	
Wahlenbergia communis	Campan	R&G 88;	
Wahlenbergia gracilenta	Campan	R&G 88;	
Wahlenbergia gracilis (Wahlenbergia sieberi)	Campan	1975	6
Wahlenbergia queenslandica	Campan	G&R 90;	
Wahlenbergia sieberi	Campan	= Wahlenbergia gracilis	
Wahlenbergia sp	Campan	Moll 83; G&D 93;	
Wahlenbergia tumidifructa	Campan	R&G 88; G&R 90; G&D 93; RB 96	6
Capparis mitchellii	Cappar	Moll 83; R&G 88; RB 96	1; 6
Polycarpaea arida	Caryoph	R&G 88; G&R 90;	6
Polycarpaea indica	Caryoph	1889	
Polycarpaea spirostylis ssp glabra (inc. P. spyrostylis)	Caryoph	G&R 90;	6
Spergularia diandra*	Caryoph	R&G 88;	
Casuarina pauper (C. cristata ssp pauper)	Casuar	RP 86;	
Centrolepis eremica	Centrol	R&G 88;	
Atriplex acutibractea ssp	Chenop	RB 96	
Atriplex angulata	Chenop	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Atriplex crassipes	Chenop	Moll 83; R&G 88; G&D 93;	1; 6
Atriplex eardleyae	Chenop	Moll 83; R&G 88; G&D 93;	1; 6
Atriplex elachophylla	Chenop	RB 96	1; 6
Atriplex fissivalvis	Chenop	R&G 88; RB 96	1; 6
Atriplex holocarpa	Chenop	R&G 88; G&R 90; RB 96	1; 6
Atriplex incrassata	Chenop	Moll 83;	
Atriplex intermedia	Chenop	G&D 93;	
Atriplex leptocarpa	Chenop	Moll 83; R&G 88;	
Atriplex limbata	Chenop	Moll 83; R&G 88; G&D 93; G&R 90; RB 96	1; 6
Atriplex lindleyi	Chenop	Moll 83; G&D 93;	1; 6
Atriplex lindleyi ssp conduplicata	Chenop	R&G 88; RB 96	

Name	Family	Survey & Date	W.
Atriplex lindleyi ssp inflata (A. inflata)	Chenop	1982; R&G 88; RB 96	
Atriplex lobativalvis	Chenop	Moll 83; R&G 88;	
Atriplex macopterocarpa	Chenop	ERIN/AD; 1980	
Atriplex muelleri	Chenop	Moll 83; R&G 88; RB 96	1; 6
Atriplex nummularia	Chenop	Moll 83; RP*86; R&G 88; G&D 93;	1; 6
Atriplex nummularia ssp omissa	Chenop	ERIN/CANB; 1981	
Atriplex pseudocampanulata	Chenop	R&G 88; G&D 93; G&R 90;	
Atriplex pumilio	Chenop	G&D 93;	
Atriplex quinii	Chenop	R&G 88; RB 96	6
Atriplex rhagodioides	Chenop	?1982	
Atriplex sp. aff pumilio	Chenop	R&G 88;	
Atriplex sp. aff. eardleyae	Chenop	Moll 83;	
Atriplex sp. aff. holocarpa	Chenop	Moll 83;	
Atriplex spongiosa	Chenop	Moll 83; R&G 88; G&D 93; G&R 90; RB 96	1; 6
Atriplex stipitata	Chenop	G&R 90;	1
Atriplex sturtii	Chenop	G&D 93;	
Atriplex velutinella	Chenop	Moll 83; R&G 88; G&D 93;	6
Atriplex vesicaria	Chenop	Moll 83; R&G 88; RB 96	1; 6
Atriplex vesicaria ssp calcicola	Chenop	G&R 90;	
Babbagia acroptera	Chenop	= Osteocarpum acropterum	
Babbagia dipterocarpa	Chenop	= Osteocarpum dipterocarpum	
Babbagia pentaptera	Chenop	= Osteocarpum pentapterum	
Chenopodium auricomum	Chenop	Moll 83; RP*86; R&G 88; G&R 90; G&D 93;	1; 6
Chenopodium cristatum	Chenop	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Chenopodium desertorum ssp anidophyllum	Chenop	ERIN/AD, CANB (J.Reid 88)	*??*
Chenopodium desertorum ssp desertorum	Chenop	G&R 90;	1
Chenopodium gaudichaudiana (Rhagodia gaudichaudiana)	Chenop	Moll 83; G&R 90;	
Chenopodium melanocarpum	Chenop	ERIN/?; 1945	
Chenopodium murale	Chenop	ERIN/AD; 1989	*??*
Chenopodium nitrariaceum	Chenop	Moll 83; R&G 88; G&D 93;	
Chenopodium pumilio	Chenop	R&G 88;	6
Dissocarpus biflorus var bifl.	Chenop	Moll 83; R&G 88; G&D 93;	1
Dissocarpus biflorus var cephalocarpa	Chenop	Moll 83;	6
Dissocarpus latifolius (D. paradoxus var latifolius)	Chenop	Moll 83; G&R 90;	1
Dissocarpus paradoxus	Chenop	R&G 88; G&R 90; RB 96	1; 6
Dysphania glomulifera (D. myriocephala)	Chenop	1924	1; 6
Dysphania glomulifera ssp eremaea	Chenop	ERIN/?; 1988	
Dysphania platycarpa	Chenop	R&G 88;	
Dysphania rhadinostachya ssp rhadinostachya	Chenop	ERIN/AD; 1991	
Einadia nutans	Chenop	Moll 83; R&G 88; RB 96	6
Einadia nutans ssp eremaea	Chenop	G&R 90; G&D 93;	
Enchylaena tomentosa	Chenop	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Enchylaena tomentosa var glabra	Chenop	G&D 93;	6
Halosarcia halocmenoides	Chenop	1975	?1; 6
Halosarcia indica ssp leiostachys	Chenop	Moll 83; R&G 88; G&D 93;	?1
Halosarcia pergranulata	Chenop	ERIN/CBG; 1980	
Halosarcia pergranulata ssp divaricata	Chenop	ERIN/CBG; 1980	
Halosarcia pruiflora	Chenop	ERIN/?; 1986	

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Maireana aphylla	Chenop	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Maireana appressa	Chenop	R&G 88; RB 96	
Maireana astrotricha	Chenop	R&G 88; G&R 90;	6
Maireana campanulata	Chenop	ERIN/AD; 1991	??
Maireana ciliata	Chenop	R&G 88;	6
Maireana coronata	Chenop	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Maireana eriantha	Chenop	R&G 88; RB 96	6
Maireana georgei	Chenop	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Maireana integra	Chenop	R&G 88; RB 96	1; 6
Maireana microcarpa	Chenop	Moll 83; R&G 88;	1; 6
Maireana pyramidata	Chenop	Moll 83; R&G 88; G&R 90;	1
Maireana radiata	Chenop	R&G 88; RB 96	
Maireana schistocarpa	Chenop	ERIN/AD; 1983	??
Maireana sedifolia	Chenop	R&G 88;	
Maireana spongiocarpa	Chenop	R&G 88;	1
Maireana triptera	Chenop	ERIN/AD; ?	??
Maireana villosa	Chenop	RB 96	1; 6
Malacocera albolanata	Chenop	R&G 88; G&D 93;	6
Malacocera tricornis	Chenop	R&G 88;	1
Neobassia proceriflora	Chenop	Moll 83; R&G 88; RB 96	1; 6
Osteocarpum acropterum (Babbagia acroptera)	Chenop	Moll 83; R&G 88; G&R 90; G&D 93;	6
Osteocarpum dipterocarpum (Babbagia dipterocarpa)	Chenop	Moll 83; R&G 88; RB 96	1; 6
Osteocarpum pentapterum (Babbagia pentaptera)	Chenop	RB 96	6
Rhagodia gaudichaudiana	Chenop	= Chenopodium gaudichaudiana	
Rhagodia spinescens	Chenop	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Salsola kali var strobilifera	Chenop	1924 *[not recognised in FSA]*	
Salsola kali* var kali	Chenop	Moll 83; RP*86; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Sclerochlamys brachyptera (Bassia brachyp.; Kochia brachyp.)	Chenop	Moll 83; R&G 88;	6
Sclerolaena andersonii	Chenop	= Sclerolaena glabra	
Sclerolaena bicornis	Chenop	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Sclerolaena bicuspis	Chenop	1889	
Sclerolaena brachyptera	Chenop	RB 96	1
Sclerolaena calcarata	Chenop	Moll 83; R&G 88; G&D 93; RB 96	1; 6
Sclerolaena constricta	Chenop	G&D 93;	
Sclerolaena convexula	Chenop	R&G 88; G&R 90; RB 96	1; 6
Sclerolaena costata	Chenop	Moll 83;	
Sclerolaena cuneata	Chenop	G&R 90; RB 96	
Sclerolaena decurrens	Chenop	R&G 88; G&R 90; G&D 93; RB 96	6
Sclerolaena diacantha	Chenop	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Sclerolaena divaricata	Chenop	R&G 88;	1; 6
Sclerolaena eriacantha	Chenop	R&G 88; G&R 90; RB 96	1; 6
Sclerolaena glabra (S. andersonii)	Chenop	Moll 83; R&G 88; RB 96	1; 6
Sclerolaena holtiana(?)	Chenop	Moll 83;	
Sclerolaena intricata	Chenop	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Sclerolaena johnsonii	Chenop	R&G 88;	
Sclerolaena lanicuspis	Chenop	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Sclerolaena longicuspis	Chenop	RB 96	1; 6
Sclerolaena muricata var muricata	Chenop	Moll 83; R&G 88; G&D 93;	6
Sclerolaena parallelicuspis	Chenop	Moll 83; R&G 88; G&D 93; RB 96	1
Sclerolaena parviflora	Chenop	G&R 90;	
Sclerolaena patenticuspis	Chenop	R&G 88; G&R 90;	
Sclerolaena sp. aff. tatei	Chenop	Moll 83;	
Sclerolaena tricuspis	Chenop	1982	1

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Sclerolaena uniflora	Chenop	G&R 90; RB 96	
Sclerolaena ventricosa	Chenop	Moll 83; R&G 88; G&R 90;	1
Sclerostegia medullosa	Chenop	RB 96	
Sclerostegia tenuis	Chenop	R&G 88;	1; 6
Dicrastylis costelloi	Chloan	Moll 83;	6
Dicrastylis lewellinii	Chloan	G&R 90;	
Newcastelia cephalantha	Chloan	1975	1; 6
Cleome viscosa	Cleoma	R&G 88;	1; 6
Hypericum gramineum	Clusiac	Moll 83	6
Hypericum japonicum	Clusiac	1889	
Bonamia media	Convol	1889	1; 6
Convolvulus erubescens	Convol	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Convolvulus remotus	Convol	R&G 88; RB 96	
Cressa cretica	Convol	R&G 88; G&D 93;	6
Cuscuta victoriana	Convol	R&G 88;	
Evolvulus alsinoides var decumbens	Convol	G&R 90;	6
Evolvulus alsinoides var villosicalyx	Convol	Moll 83; R&G 88; RB 96	1; 6
Ipomoea muelleri	Convol	R&G 88; G&R 90; RB 96	1; 6
Ipomoea polymorpha	Convol	R&G 88; G&R 90;	1; 6
Ipomoea racemigera	Convol	R&G 88;	
Polymeria angustata?	Convol	1889	
Polymeria longifolia	Convol	1889	1; 6
Crassula colorata var acuminata	Crassul	G&R 90;	
Crassula sieberana	Crassul	R&G 88;	
Crassula sieberana ssp tetramera	Crassul	G&R 90;	
Citrullus colocynthis*	Cucurb	R&G 88;	6
Citrullus lanatus*	Cucurb	R&G 88; G&R 90;	
Cucumis melo	Cucurb	G&D 93; RB 96	
Cucumis melo ssp agrestis	Cucurb	Moll 83; RP 86; R&G 88;	
Mukia maderaspatana	Cucurb	Moll 83; RP 86; R&G 88; G&R 90; G&D 93;	6
Mukia micrantha	Cucurb	RP 86; R&G 88; G&D 93;	6
Bulboschoenus caldwellii (Scirpus maritimus)	Cypera	1974	
Bulboschoenus cardwellii	Cypera	R&G 88;	
Bulbostylis turbinata	Cypera	1924	
Cyperus bifax (Cyperus rotundus ssp retzii)	Cypera	R&G 88;	1; 6
Cyperus bulbosus	Cypera	R&G 88; RB 96	1; 6
Cyperus cunninghamii	Cypera	Moll 83;	
Cyperus dactylotes	Cypera	1924	1; 6
Cyperus difformis	Cypera	RP 86; R&G 88;	1; 6
Cyperus eragrostis*	Cypera	1885	
Cyperus exaltatus	Cypera	Moll 83; R&G 88; G&D 93;	1; 6
Cyperus gilesii	Cypera	1960	1; 6
Cyperus gymnocaulos	Cypera	Moll 83; RP*86; R&G 88; G&D 93;	1; 6
Cyperus iria	Cypera	R&G 88;	1; 6
Cyperus laevigatus	Cypera	R&G 88;	6
Cyperus pygmaeus	Cypera	R&G 88; G&D 93;	6
Cyperus rigidellus	Cypera	R&G 88;	1
Cyperus sp. aff. cunninghamii	Cypera	Moll 83;	
Cyperus squarrosus	Cypera	R&G 88;	
Cyperus vaginatus	Cypera	1924	
Eleocharis acuta	Cypera	Moll 83; R&G 88;	
Eleocharis pallens	Cypera	Moll 83; R&G 88;	1; 6
Fimbristylis dichotoma	Cypera	RP 86; R&G 88; G&R 90; RB 96	1; 6
Fimbristylis velata	Cypera	R&G 88; G&R 90;	
Isolepis australiensis (ex Scirpus)	Cypera	R&G 88;	6
Isolepis hookeriana	Cypera	R&G 88;	

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(Scirpus hookerianus)			
Isolepis marginata* (Scirpus marginatus)	Cypera	1889	
Isolepis sp. aff. congrua (ex Scirpus)	Cypera	R&G 88;	
Schoenoplectus dissacanthus	Cypera	R&G 88;	
Schoenoplectus litoralis	Cypera	R&G 88;	
Scirpus hookerianus	Cypera	= Isolepis hookeriana	
Scirpus marginatus	Cypera	= Isolepis marginata	
Scirpus maritimus (Bulboschoenus maritimus)	Cypera	= Bulboschoenus caldwellii	
Drosera indica	Drosera	R&G 88;	6
Bergia ammannioides	Elatina	R&G 88; G&D 93;	
Bergia trimera	Elatina	R&G 88; G&D 93; G&R 90;	6
Elatine gratioloides	Elatina	RP 86;	
Adriana hookeri	Euphorb	Moll 83; G&R 90;	6
Euphorbia australis	Euphorb	Moll 83;	1; 6
Euphorbia boophthana	Euphorb	1975	1
Euphorbia coghlanii	Euphorb	R&G 88; RB 96	1; 6
Euphorbia drummondii	Euphorb	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Euphorbia parvicaruncula	Euphorb	Moll 83; G&R 90; RB 96	6
Euphorbia stevenii	Euphorb	1980; RB 96	1
Euphorbia tannensis ssp eremophila var eremophila	Euphorb	Moll 83; RP 86; R&G 88; G&R 90; RB 96	6
Euphorbia wheeleri	Euphorb	Moll 83; R&G 88; G&R 90;	1; 6
Phyllanthus fuernrohrii	Euphorb	Moll 83; R&G 88;	6
Phyllanthus lacunarius	Euphorb	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	
Phyllanthus maderaspatensis var angustifolius	Euphorb	1968	1; 6
Phyllanthus rhytidospermus	Euphorb	= Sauropus trachyspermus	
Phyllanthus sp. aff. lacunarius	Euphorb	Moll 83;	
Sauropus trachyspermus (Phyllanthus rhytidospermus)	Euphorb	Moll 83; R&G 88; G&R 90; G&D 93;	6
Aeschynomeme indica	Fabaca	Moll 83; RP*86; R&G 88;	1; 6
Clianthus formosus	Fabace	1924	
Crotalaria cunninghamii	Fabace	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Crotalaria eremaea ssp eremaea	Fabace	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Crotalaria eremaea ssp strehlowii	Fabace	R&G 88;	
Crotalaria smithiana	Fabace	Moll 83; R&G 88; G&D 93;	6
Glycine canescens	Fabace	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	6
Glycine clandestina var	Fabace	RB 96	
Glycine falcata	Fabace	1889	6
Glycine tomentella (G. tomentosa)	Fabace	1889	
Indigofera brevidens var brevidens	Fabace	R&G 88; G&R 90;	1; 6
Indigofera colutea	Fabace	R&G 88;	1; 6
Indigofera leucotricha	Fabace	RB 96	6
Indigofera linifolia	Fabace	R&G 88; G&R 90; RB 96	1; 6
Indigofera linnaei	Fabace	R&G 88; G&R 90; RB 96	1; 6
Isotropis wheeleri	Fabace	R&G 88; G&R 90;	1; 6
Lotus cruentus	Fabace	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Medicago polymorpha*(?)	Fabace	Moll 83;	6
Psoralea australasica	Fabace	Moll 83; R&G 88; RB 96	6
Psoralea cinerea	Fabace	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Psoralea graveolens	Fabace	RB 96	

Name	Family	Survey & Date	W.
Psoralea pallida	Fabace	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	6
Psoralea patens (= either P. austral. or P. pall.)	Fabace	R&G 88; G&D 93;	1
Rhynchosia minima	Fabace	Moll 83; RP 86; R&G 88;	1; 6
Sesbania cannabina	Fabace	RP 86; R&G 88; G&D 93;	1; 6
Swainsona campylantha	Fabace	R&G 88; RB 96	1; 6
Swainsona flavicarinata	Fabace	R&G 88;	6
Swainsona lessertiifolia	Fabace	1980	
Swainsona microphylla ssp affinis	Fabace	R&G 88; G&R 90;	1; 6
Swainsona oligophylla	Fabace	RP 86; R&G 88;	1; 6
Swainsona oroboides	Fabace	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Swainsona phacoides	Fabace	Moll 83; R&G 88; G&R 90;	6
Swainsona rigida	Fabace	Moll 83; R&G 88;	6
Swainsona stipularis	Fabace	1889	
Templetonia egena (?)	Fabace	Moll 83;	
Tephrosia sphaerospora	Fabace	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	6
Tephrosia supina	Fabace	G&R 90; RB 96	1; 6
Trigonella suavissima	Fabace	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Vigna lanceolata	Fabace	R&G 88;	1; 6
Frankenia angustipetala	Franken	Moll 83; *[FSA = F. serpyllifolia]*	
Frankenia cinerea	Franken	Moll 83;	
Frankenia cordata	Franken	R&G 88;	
Frankenia crispa	Franken	R&G 88;	
Frankenia cupularis	Franken	R&G 88; G&D 93;	
Frankenia foliosa	Franken	1982	
Frankenia gracilis	Franken	1975 *[FSA = F. serpyllifolia]*	
Frankenia plicata	Franken	R&G 88;	
Frankenia pseudoflabellata	Franken	Moll 83; *[FSA = F. cupularis]*	
Frankenia pulverulenta*	Franken	R&G 88;	
Frankenia serpyllifolia	Franken	Moll 83; RP 86; R&G 88; G&D 93; RB 96	1; 6
Frankenia uncinata	Franken	Moll 83; *[FSA = F. serpyllifolia]*	1; 6
Centaurium spicatum	Gentian	Moll 83; G&R 90; G&D 93;	6
Centaurium tenuiflorum	Gentian	R&G 88;	
Erodium sp	Geran	G&D 93;	
Erodium angustilobum	Geran	G&R 90;	
Erodium aureum*	Geran	Moll 83; G&R 90; G&D 93; RB 96	
Erodium cicutarium*	Geran	R&G 88;	
Erodium crinitum	Geran	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Erodium cygnorum ssp cygnorum	Geran	G&R 90;	
Erodium cygnorum ssp glandulosum	Geran	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Goodenia cycloptera	Gooden	R&G 88; G&R 90; RB 96	1; 6
Goodenia fascicularis	Gooden	R&G 88; G&R 90; G&D 93; RB 96	1; 6
Goodenia glauca	Gooden	Moll 83; R&G 88; G&D 93;	6
Goodenia havilandii	Gooden	G&R 90;	1
Goodenia heterochila	Gooden	R&G 88;	6
Goodenia lobata	Gooden	Moll 83; R&G 88;	
Goodenia lunata	Gooden	R&G 88; RB 96	1
Goodenia sp	Gooden	G&D 93; RB 96	
Goodenia sp. aff. havilandii	Gooden	Moll 83;	
Goodenia triodiophila	Gooden	R&G 88;	6
Lechenaultia divaricata	Gooden	Moll 83; RP 86; R&G 88; RB 96	1; 6
Scaevola aemula	Gooden	Moll 83;	
Scaevola collaris	Gooden	R&G 88; G&D 93;	6
Scaevola depauperata	Gooden	Moll 83; RP 86; R&G 88; G&R 90;	1; 6
Scaevola ovalifolia var ovalifolia (inc. S. oval.)	Gooden	RP 86; Moll 83;	1; 6
Scaevola parvibarbata	Gooden	R&G 88; G&R 90;	6
Scaevola parvifolia	Gooden	G&R 90;	

Name	Family	Survey & Date	W.
Scaevola spinescens	Gooden	RP*86; R&G 88; G&R 90; RB 96	1; 6
Codonocarpus cotinifolius	Gyroste	1975; G&R 90;	1; 6
Gyrostemon ramulosus	Gyroste	1924	1
Gonocarpus sp. aff. tetragynus	Halorag	R&G 88;	
Haloragis aspera	Halorag	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	6
Haloragis glauca	Halorag	1934	1; 6
Haloragis glauca f. sclopetifera	Halorag	Moll 83;	6
Haloragis gossei	Halorag	R&G 88; G&R 90;	1; 6
Myriophyllum muelleri	Halorag	1924	
Myriophyllum verrucosum	Halorag	RP 86; R&G 88; G&D 93;	6
Juncus planifolius	Juncac	1889	
Triglochin calcitrapum	Juncag	R&G 88; G&R 90;	6
Triglochin hexagonum	Juncag	R&G 88;	
Mentha australis	Lamiac	Moll 83; R&G 88; G&D 93;	6
Prostanthera striatiflora	Lamiac	1889	
Teucrium albicaule (T. racemosum var tripartitum)	Lamiac	Moll 83; R&G 88; G&R 90;	
Teucrium racemosum var racemosum (inc. T. racem.)	Lamiac	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Teucrium racemosum var tripartitum	Lamiac	= Teucrium albicaule	
Lemna disperma	Lemnac	R&G 88;	
Bulbine alata	Liliac	Moll 83; R&G 88; G&D 93; G&R 90;	6
Bulbine semibarbata	Liliac	RB 96	6
Corynotheca lateriflora (Caesia lateriflora)	Liliac	RP 86;	
Corynotheca micrantha var. divaricata	Liliac	RP 86;	6
Thysanotus exiliflorus	Liliac	1889	
Tricoryne elatior	Liliac	1889	
Amyema maidenii	Loranth	R&G 88; G&R 90; RB 96	1; 6
Amyema preissii	Loranth	Moll 83; R&G 88; G&D 93; G&R 90;	6
Amyema quandang	Loranth	1889; RB 96	1; 6
Diplatia grandibractea	Loranth	Moll 83; R&G 88; G&D 93;	6
Lysiana exocarpi ssp exocarpi	Loranth	Moll 83; RP 86; R&G 88; G&R 90; G&D 93; RB 96	6
Lysiana linearifolia	Loranth	1924	1; 6
Lysiana subfalcata	Loranth	RP 86; G&D 93;	6
Ammannia multiflora	Lythra	RP 86; R&G 88; G&D 93;	6
Lythrum hyssopifolia	Lythra	R&G 88;	
Abutilon cryptopetalum	Malvac	G&R 90;	
Abutilon fraseri	Malvac	Moll 83; R&G 88; G&R 90;	1; 6
Abutilon halophilum	Malvac	R&G 88; G&R 90; RB 96	6
Abutilon leucopetalum	Malvac	R&G 88; RB 96	1; 6
Abutilon malvaefolium	Malvac	R&G 88; G&D 93; RB 96	1; 6
Abutilon otocarpum	Malvac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Abutilon theophrasti*	Malvac	R&G 88;	
Alyogyne pinoniana	Malvac	1980	
Hibiscus brachysiphonius	Malvac	R&G 88; G&R 90; RB 96	1; 6
Hibiscus krichauffianus	Malvac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Hibiscus sp	Malvac	G&D 93;	
Hibiscus trionum var vesicarius*	Malvac	R&G 88;	1; 6
Lavatera plebeia	Malvac	Moll 83; R&G 88; G&D 93; RB 96	1; 6
Lawrencia glomerata	Malvac	G&D 93;	6
Malvastrum americanum*	Malvac	R&G 88; RB 96	1; 6
Sida ammophila	Malvac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	6
Sida argillacea	Malvac	RB 96	6
Sida calyxhymenia	Malvac	R&G 88; *[cf S. petrophila]*	
Sida corrugata (?)	Malvac	Moll 83;	1
Sida cunninghamii	Malvac	Moll 83; R&G 88; G&R 90; G&D 93;	1

Name	Family	Survey & Date	W.
		RB 96	
Sida fibulifera	Malvac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Sida goniocarpa	Malvac	G&R 90; RB 96	1; 6
Sida intricata	Malvac	G&R 90;	
Sida petrophila	Malvac	RB 96 *[FSA = S. calyxhymenia]*	
Sida rohlenae	Malvac	RB 96	6
Sida sp. C	Malvac	G&R 90;	
Sida sp. D	Malvac	Moll 83;	
Sida trichopoda	Malvac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1
Marsilea drummondii	Marsil	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Marsilea hirsuta	Marsil	R&G 88; G&R 90; RB 96	1; 6
Marsilea mutica	Marsil	1924	
Owenia acidula	Meliac	Moll 83; RP*86; R&G 88; G&D 93; RB 96	1; 6
Nymphoides crenata	Menyan	1924	
Acacia adsurgens	Mimos	RP 86 [det as A. rhodophloia for Reid]	6
Acacia aneura	Mimos	RP*86; RP 86; R&G 88; G&R 90; RB 96	1; 6
Acacia brachystachya	Mimos	1980	1; 6
Acacia cambagei	Mimos	RP*86; R&G 88; RB 96	1; 6
Acacia coriacea	Mimos	G&R 90;	6
Acacia cowleana	Mimos	ERIN/Perth 1987	6
Acacia cyperophylla	Mimos	Moll 83; RP*86; R&G 88; RB 96	1; 6
Acacia dictyophleba	Mimos	Moll 83; R&G 88;	1; 6
Acacia farnesiana	Mimos	Moll 83; R&G 88; RB 96	1; 6
Acacia ligulata [= A. bivenosa ssp wayi]	Mimos	Moll 83; RP*86; R&G 88; G&R 90; G&D 93;	1; 6
Acacia murrayana	Mimos	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Acacia oswaldii	Mimos	Moll 83; RP 86; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Acacia pickardii	Mimos	ERIN/?; 1977	
Acacia ramulosa	Mimos	G&R 90;	1; 6
Acacia rhodophloia	Mimos	G&R 90 [det as A. adsurgens by RP]	
Acacia salicina	Mimos	Moll 83; RP 86; R&G 88; G&D 93;	1; 6
Acacia sp.	Mimos	1982?	
Acacia stenophylla	Mimos	Moll 83; RP*86; R&G 88; G&D 93;	1; 6
Acacia tetragonophylla	Mimos	Moll 83; RP 86; R&G 88; G&R 90; RB 96	1; 6
Acacia victoriae ssp arida	Mimos	Moll 83; RP 86; RB 96	6
Acacia victoriae ssp victoriae	Mimos	Moll 83; RP 86; R&G 88; G&D 93; G&R 90; RB 96	1; 6
Neptunia dimorphantha	Mimos	RP 86; R&G 88; RB 96	1; 6
Eremophila bignoniiflora	Myopor	Moll 83; R&G 88; G&D 93;	1; 6
Eremophila clarkei (E. goodwinii sensu Black)	Myopor	1889	1; 6 E.go
Eremophila dalyana	Myopor	RP 86; R&G 88; RB 96	1; 6
Eremophila duttonii	Myopor	G&R 90;	1; 6
Eremophila freelingii	Myopor	RP*86; R&G 88; RB 96	1; 6
Eremophila glabra	Myopor	1889	1; 6
Eremophila latrobei	Myopor	RP*86; RP 86; R&G 88; RB 96	1; 6
Eremophila latrobei ssp glabra	Myopor	RB 96	6
Eremophila longifolia	Myopor	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Eremophila macdonnellii	Myopor	Moll 83; R&G 88;	6
Eremophila macgillivrayi	Myopor	Moll 83;	1
Eremophila maculata	Myopor	Moll 83; RP*86; R&G 88;	1; 6
Eremophila obovata var obovata	Myopor	R&G 88; RB 96	1; 6
Myoporum acuminatum	Myopor	1889	1
Corymbia tumescens ms	Myrta	ERIN/?	
Eucalyptus camaldulensis var	Myrtac	Moll 83; RP 86; R&G 88; G&D 93;	1; 6

Name	Family	Survey & Date	W.
obtusa		RB 96	
Eucalyptus centralis	Myrtac	RB 96	
Eucalyptus coolabah (Eucalyptus microtheca)	Myrtac	Moll 83; RP 86; R&G 88; G&D 93;	1; 6
Eucalyptus coolabah ssp arida	Myrtac	RB 96 [ssp not recognised in FSA]	
Eucalyptus coolabah ssp coolabah	Myrtac	ERIN/NSW; 1979 [ssp not recognised in FSA]	
Eucalyptus dumosa	Myrtac	ERIN/?; 1976	
Eucalyptus terminalis	Myrtac	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Melaleua uncinata	Myrtac	G&R 90;	1
Melaleuca glomerata	Myrtac	1889	
Melaleuca linariifolia	Myrtac	RP*86; R&G 88;	1; 6
Melaleuca linariifolia var trichostachya (M. trichostachya)	Myrtac	ERIN/BRI; 1968 (as M. trichostachya)	
Boerhavia coccinea	Nyctag	RB 96	
Boerhavia diffusa	Nyctag	= other Boerhavia species	1; 6
Boerhavia dominii	Nyctag	R&G 88; G&R 90; RB 96	
Boerhavia hairy dominii	Nyctag	G&R 90;	
Boerhavia schomburgkiana	Nyctag	R&G 88; G&D 93; G&R 90; RB 96	
Boerhavia sp	Nyctag	RB 96	
Boerhavia spp	Nyctag	1924	
Commicarpus australis (C. chinensis)	Nyctag	1924	
Ludwigia peploides ssp montevidensis*	Onagr	Moll 83; RP*86; G&D 93;	
Ophioglossum polyphyllum	Ophiog	G&R 90;	
Caladenia deformis	Orchid	1889	
Cymbidium canaliculatum	Orchid	1889	
Josephinia eugeniae	Pedalia	R&G 88;	1
Pittosporum phylliraeoides var microcarpa	Pittosp	Moll 83; RP 86; R&G 88;	1; 6
Plantago drummondii	Plantag	R&G 88; G&R 90; G&D 93; RB 96	1; 6
Plantago turrifera	Plantag	R&G 88;	
Plantago varia (as P. turrifera)	Plantag	Moll 83;	
Agrostis avenacea	Poac	Moll 83;	6
Agrostis avenacea var avenacea	Poac	R&G 88;	
Agrostis avenacea var perennis	Poac	R&G 88;	
Alopecurus geniculatus*	Poac	1916	6
Amphipogon caricinus	Poac	G&R 90;	1; 6
Aristida anthoxanthoides	Poac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Aristida browniana	Poac	= Aristida holathera	
Aristida contorta	Poac	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Aristida holathera	Poac	Moll 83; R&G 88; G&R 90;	1; 6
Aristida inaequiglumis	Poac	G&R 90;	6
Aristida latifolia	Poac	R&G 88; G&R 90; RB 96	1; 6
Aristida nitidula	Poac	RB 96	6
Aristida ramosa	Poac	1924	6
Aristida strigosa (?)	Poac	1924; G&R 90;	
Astrebla lappacea	Poac	Moll 83; R&G 88; RB 96	1; 6
Astrebla pectinata	Poac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Bothriochloa bladhii	Poac	1924	6
Bothriochloa ewartiana	Poac	ERIN/DNA (J.Reid 88)	*?1,6*
Bracharia gilesii	Poac	= Urochloa gilesii	
Bracharia praetervisa	Poac	= Urochloa praetervisa	
Brachiaria milliformis	Poac	= Urochloa subquadripara	
Brachiaria notochthona (Panicum notochthona)	Poac	= Urochloa notochthona	
Brachyachne ciliaris	Poac	1924; RB 96	6
Brachyachne ciliaris var	Poac	RB 96	
Cenchrus ciliaris*	Poac	R&G 88; G&R 90; RB 96	1; 6

Name	Family	Survey & Date	W.
Chloris pectinata	Poac	R&G 88; G&R 90; RB 96	1; 6
Chloris scariosa	Poac	= Oxychloris scariosa	
Chrysopogon fallax	Poac	G&R 90;	1; 6
Cymbopogon obtectus	Poac	G&R 90;	1; 6
Cymbopogon sp.	Poac	1975	
Cynodon dactylon	Poac	Moll 83; R&G 88;	1; 6
Dactyloctenium radulans	Poac	Moll 83; RP*86; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Dichanthium affine	Poac	G&R 90; = D. sericeum ssp sericeum (FNSW)	1; 6
Dichanthium sericeum	Poac	R&G 88; RB 96	1; 6
Dichanthium sericeum ssp humilius	Poac	G&D 93 [FSA does not recognise any ssp]	6
Dichanthium sericeum ssp sericeum	Poac	ERIN/AD, BRI, DNA; 1988 [FSA does not recognise any ssp]	*?1,6*
Digitaria ammophila	Poac	1980	1; 6
Digitaria brownii	Poac	R&G 88; G&R 90; RB 96	1; 6
Digitaria coenicola	Poac	R&G 88; G&R 90;	1; 6
Diplachne fusca	Poac	Moll 83; RP*86; R&G 88; G&D 93;	6
Echinochloa crus-galli*	Poac	1924	
Echinochloa inundata	Poac	Moll 83; R&G 88;	*1; 6*
Elytrophorus spicatus	Poac	ERIN/DNA (J.Reid 88)	*?1,6*
Enneapogon avenaceus	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Enneapogon cylindricus	Poac	Moll 83; G&R 90; RB 96	6
Enneapogon nigricans	Poac	R&G 88; G&R 90;	1
Enneapogon polyphyllus	Poac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Enteropogon acicularis	Poac	R&G 88; G&R 90;	1; 6
Enteropogon ramosus	Poac	RB 96	
Eragrostis australasica	Poac	Moll 83; RP*86; R&G 88; G&D 93;	1; 6
Eragrostis basedowii	Poac	Moll 83; R&G 88; G&R 90;	1; 6
Eragrostis confertiflora	Poac	ERIN/BRI; 1924	
Eragrostis confertifolia	Poac	1924 [?= E. confertiflora]	1; 6
Eragrostis dielsii	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Eragrostis elongata	Poac	R&G 88;	1; 6
Eragrostis eriopoda	Poac	Moll 83; G&R 90; RB 96	1; 6
Eragrostis falcata	Poac	R&G 88; G&D 93;	
Eragrostis laniflora	Poac	R&G 88; G&R 90;	1; 6
Eragrostis leptocarpa	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Eragrostis parviflora	Poac	R&G 88; G&D 93;	1; 6
Eragrostis setifolia	Poac	Moll 83; RP*86; R&G 88; G&R 90; G&D 93;	1; 6
Eragrostis speciosa	Poac	Moll 83;	6
Eragrostis tenellula (Eragrostis tenella; E. japonica)	Poac	R&G 88; G&R 90;	1; 6
Eragrostis xerophila	Poac	RP*86; G&R 90; RB 96	1; 6
Eriachne aristidea	Poac	Moll 83; R&G 88; G&R 90;	1; 6
Eriachne mucronata	Poac	R&G 88; G&R 90; RB 96	1; 6
Eriachne ovata	Poac	1924	6
Eriochloa australiensis	Poac	R&G 88; G&R 90;	6
Eriochloa crebra	Poac	ERIN/BRI, DNA (J.Reid 88)	*??*
Eriochloa pseudo-acrotricha	Poac	Moll 83; R&G 88; G&D 93;	1; 6
Eulalia aurea (Eulalia fulva)	Poac	R&G 88; RB 96	1; 6
Iseilema eremaeum	Poac	G&R 90; RB 96	
Iseilema membranaceum	Poac	R&G 88;	1; 6
Iseilema vaginiflorum	Poac	R&G 88; G&R 90; RB 96	1; 6
Leptochloa digitata	Poac	Moll 83; RB 96	1; 6
Neurachne munroi	Poac	G&R 90; RB 96	1; 6

Name	Family	Survey & Date	W.
Oxychloris scariosa (Chloris scariosa)	Poac	1924	1; 6
Panicum australiense	Poac	= Yakirra australiensis	
Panicum decompositum	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Panicum effusum	Poac	R&G 88;	1; 6
Panicum laevinode (Panicum whitei)	Poac	Moll 83; R&G 88; G&D 93;	1; 6
Panicum schinzii*	Poac	G&R 90;	
Paractaenum novae-hollandiae	Poac	Moll 83; R&G 88; G&R 90;	1; 6
Paractaenum novae-hollandiae ssp reversum	Poac	ERIN/AD; 1987 [check det Grasses of Qld]	
Paractaenum refractum	Poac	ERIN/BRI; 1987 [?= Plageosetum refactum]	??
Paraneurachne muelleri	Poac	ERIN/1986	??
Paspalidium gracile	Poac	1916	6
Paspalidium jubiflorum	Poac	ERIN/BRI (J.Reid 88)	??
Perotis rara	Poac	1889	1; 6
Plagiosetum refractum	Poac	Moll 83; R&G 88; G&R 90 [cf Paractaenum refractum]	1; 6
Pseudoraphis spinescens	Poac	R&G 88;	1; 6
Setaria dielsii	Poac	R&G 88;	
Setaria verticillata*	Poac	RB 96	
Sporobolus actinocladus	Poac	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Sporobolus caroli	Poac	1924; RB 96	1; 6
Sporobolus indicus var africanus*	Poac	R&G 88;	
Sporobolus mitchellii	Poac	Moll 83; R&G 88; G&D 93;	1; 6
Sporobolus virginicus	Poac	1982	
Stipa semibarbata	Poac	1889	
Themeda triandra	Poac	R&G 88; RB 96	1; 6
Tragus australianus	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Triodia basedowii	Poac	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Triodia irritans ssp irritans	Poac	ERIN/AD; 1984	??
Tripogon loliiformis	Poac	RP*86; R&G 88; G&R 90; RB 96	1; 6
Triraphis mollis	Poac	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Urochloa gilesii (Bracharia gilesii)	Poac	R&G 88;	1; 6
Urochloa notochthona (Brachiaria notochthona)	Poac	1924	
Urochloa praetervisa (Bracharia praetervisa)	Poac	RB 96	1; 6
Urochloa sp (Bracharia sp)	Poac	RB 96	
Urochloa subquadripara (Brachiaria milliformis)	Poac	R&G 88;	1; 6
Yakirra australiensis (Panicum australiense)	Poac	1889	1; 6
Zygochloa paradoxa	Poac	Moll 83; RP*86; R&G 88; G&R 90;	1; 6
Polygala isingii	Polygal	G&R 90;	6
Muehlenbeckia coccoloboides	Polygon	1971	
Muehlenbeckia cunninghamii	Polygon	Moll 83; RP*86; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Muehlenbeckia florulenta	Polygon	= M. cunninghamii in FNSW; RB det	
Persicaria attenuata (Polygonum attenuatum)	Polygon	1889	6
Persicaria lapathifolia (Polygonum lapathifolium)	Polygon	RP 86; R&G 88;	1
Polygonum attenuatum	Polygon	= Persicaria attenuata	
Polygonum lapathifolium	Polygon	= Persicaria lapathifolia	
Polygonum plebeium	Polygon	Moll 83; R&G 88; G&D 93; RB 96	6

Name	Family	Survey & Date	W.
Rumex crystallinus	Polygon	Moll 83; R&G 88; G&R 90; G&D 93;	6
Rumex vesicarius*	Polygon	R&G 88;	6
Calandrinia balonensis	Portul	G&R 90;	1; 6
Calandrinia disperma	Portul	G&R 90;	
Calandrinia eremaea	Portul	R&G 88; G&D 93; G&R 90; RB 96	
Calandrinia polyandra	Portul	R&G 88; G&R 90;	6
Calandrinia ptychosperma	Portul	R&G 88; G&R 90;	1; 6
Calandrinia pumila	Portul	R&G 88; G&R 90;	6
Calandrinia remota	Portul	Moll 83; R&G 88;	6
Calandrinia stagnensis	Portul	R&G 88; RB 96	
Portulaca filifolia	Portul	G&R 90;	1; 6
Portulaca intraterranea	Portul	Moll 83; R&G 88; G&R 90; G&D 93;	6
Portulaca oleracea	Portul	R&G 88; G&R 90; G&D 93; RB 96	1; 6
Grevillea juncifolia	Protea	RP 86; G&R 90;	1; 6
Grevillea pterosperma	Protea	1889	
Grevillea stenobotrya	Protea	Moll 83; R&G 88; G&R 90;	1; 6
Grevillea striata	Protea	Moll 83; RP*86; R&G 88; G&R 90; G&D 93;	1; 6
Hakea eyreana	Protea	Moll 83; RP*86; R&G 88; G&R 90; RB 96	6
Hakea ivoryi	Protea	1924	1
Hakea leucoptera	Protea	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Myosurus minimus	Ranunc	R&G 88;	6
Ranunculus pentandrus var platycarpus	Ranunc	R&G 88;	1
Ranunculus pumilio var pumilio	Ranunc	R&G 88;	6
Asperula gemella	Rubiac	Moll 83; R&G 88;	
Dentella pulvinata var pulvinata	Rubiac	Moll 83; RP 86; R&G 88; G&R 90; G&D 93;	6
Synaptantha tillaeacea	Rubiac	R&G 88; G&R 90;	6
Santalum lanceolatum	Santal	Moll 83; RP*86; R&G 88; G&D 93; RB 96	1; 6
Alectryon oleifolius (Heterodendrum oleifolium)	Sapind	1924	1; 6
Atalaya hemiglauca	Sapind	Moll 83; RP*86; R&G 88; G&D 93; G&R 90; RB 96	1; 6
Dodonaea microzyga	Sapind	1889	6
Dodonaea viscosa	Sapind	Moll 83; RB 96	
Dodonaea viscosa ssp angustissima (D. angustissima)	Sapind	Moll 83; RP*86; R&G 88; G&R 90; RB 96	1; 6
Heterodendrum oleaefolium	Sapind	= Alectryon oleifolius	
Elacholoma hornii	Scroph	ERIN/AD; 1976	
Glossostigma diandrum	Scroph	R&G 88;	
Glossostigma drummondii	Scroph	R&G 88;	
Limosella australis	Scroph	RP 86;	
Mimulus gracilis	Scroph	1974	6
Mimulus prostratus	Scroph	Moll 83; R&G 88;	1; 6
Mimulus repens	Scroph	G&D 93;	
Morgania floribunda	Scroph	= Stemodia florulenta	
Morgania glabra	Scroph	= Stemodia glabella	
Peplidium sp. D	Scroph	Moll 83; R&G 88;	
Stemodia florulenta (Morgania floribunda)	Scroph	Moll 83; RP 86; R&G 88; G&D 93;	1; 6
Stemodia glabella (Morgania glabra)	Scroph	Moll 83; RP 86; R&G 88; G&R 90; RB 96	6
Veronica peregrina ssp xalapensis	Scroph	R&G 88;	
Datura leichhardtii	Solan	RP 86; RB 96	6
Nicotiana excelsior	Solan	1924	
Nicotiana glauca	Solan	R&G 88;	1
Nicotiana velutina	Solan	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6

Name	Family	Survey & Date	W.
Solanum chenopodinum	Solan	1889	6
Solanum ellipticum	Solan	RP 86; R&G 88; G&R 90; RB 96	1; 6
Solanum esuriale	Solan	R&G 88; G&R 90; G&D 93; RB 96	1; 6
Solanum nigrum	Solan	R&G 88; G&D 93;	1; 6
Solanum oligacanthum	Solan	Moll 83; R&G 88; G&D 93;	6
Solanum sturtianum	Solan	1889	1
Gilesia biniflora	Stercu	R&G 88; G&R 90;	
Keraudrinia integrifolia	Stercu	R&G 88; G&R 90;	6
Keraudrinia nephrosperma	Stercu	G&R 90	
Melhania oblongifolia	Stercu	RP*86; R&G 88; G&R 90;	1; 6
Rulingia loxophylla	Stercu	R&G 88; G&R 90;	6
Tetragonia eremaea	Tetrag	RB 96	
Tetragonia tetragonioides	Tetrag	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Pimelea microcephala	Thymel	1924	1
Pimelea simplex ssp	Thymel	RB 96	
Pimelea simplex ssp continua	Thymel	Moll 83;	6
Pimelea simplex ssp simplex	Thymel	1982	
Pimelea trichostachya	Thymel	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Typha domingensis	Typhac	R&G 88;	
Parietaria debilis	Urticac	R&G 88;	
Verbena bonariensis*	Verben	1975	
Verbena macrostachya*	Verben	1889	6
Verbena officinalis*	Verben	Moll 83; R&G 88; G&D 93; RB 96	
Hybanthus monopetalus	Violac	1924	
Nitraria billardieri	Zygoph	R&G 88;	6 ns
Tribulus eichlerianus	Zygoph	RP 86; RB 96	
Tribulus hystrix	Zygoph	Moll 83; RP 86; R&G 88; G&R 90; RB 96	1; 6
Tribulus occidentalis	Zygoph	Moll 83; R&G 88; G&R 90;	1; 6
Tribulus terrestris*	Zygoph	Moll 83; R&G 88; G&R 90; G&D 93;	1; 6
Zygophyllum ammophilum	Zygoph	Moll 83; R&G 88; G&R 90; G&D 93; RB 96	1; 6
Zygophyllum apiculatum	Zygoph	RB 96	1
Zygophyllum aurantiacum	Zygoph	1975; RP 86;	6
Zygophyllum billardieri	Zygoph	1889	
Zygophyllum crenatum	Zygoph	1889	
Zygophyllum howittii	Zygoph	Moll 83; R&G 88; G&R 90; RB 96	1; 6
Zygophyllum humillimum	Zygoph	G&R 90; RB 96	
Zygophyllum iodocarpum	Zygoph	Moll 83; R&G 88; G&R 90;	1

6.6 Appendix 6 – Soil analyses

pH, EC & Carbonate Reaction – 0-50cm

Site	Ec (microsiemens)	pH	Ca reaction
Cull 1-1	203.3	5.98	N
1-2	200.3	6.44	N
1-3	165.6	6.76	N
1-4	145.8	6.85	N
1-5	80.9	6.97	N
2-1	49.4	6.56	N
2-2	68.5	6.12	N
2-3	104.9	6.23	N
2-4	67.2	6.6	N
2-5	76.3	6.71	N
3-1	37.7	6.7	N
3-2	65.8	6.48	N
3-3	37.32	6.99	N
3-4	30.57	6.94	N
3-5	65.9	6.84	N
Mink 1-1	72.5	8.03	N
1-2	69.9	7.68	N
1-3	104	8.28	N
1-4	90.9	8.29	N
1-5	83.3	8.12	N
2-1	57.8	7.18	N
2-2	56.6	7.42	N
2-3	53.8	7.46	N
2-4	46.6	7.4	N
2-5	50	7.68	N
3-1	90.1	6.83	N
3-2	78.8	7.17	N
3-3	68.5	6.74	N
3-4	57.8	7.06	N
3-5	54.4	7.26	N
Scru 1-1	431	7.02	N
1-2	269.9	7.91	N
1-3	234.1	8.02	M
1-4	194.6	8.18	M
1-5	191.5	7.96	M
2-1	263.9	7.78	N
2-2	198.9	8.05	N
2-3	187.3	7.98	N
2-4	188.2	8.16	N

Site	Ec (microsiemens)	pH	Ca reaction
2-5	215.9	7.88	N
3-1	104.8	6.66	N
3-2	69.8	7.02	N
3-3	54.4	7.21	N
3-4	52.3	7.07	N
3-5	36.36	6.79	N
Tirr 1-1	117	6.81	N
1-2	115.6	8.16	N
1-3	122.1	8.16	N
1-4	127.1	8.62	N
1-5	136.1	8.52	N
2-1	106.3	8.21	N
2-2	97.7	8.11	N
2-3	95.9	8.07	N
2-4	69.5	8.54	N
2-5	89.3	8.24	N
3-1	200.4	8.44	N
3-2	227.4	8.69	M
3-3	262.1	8.56	M
3-4	348.1	8.55	M
3-5	545	8.47	H
Kudr 1-1	57.6	7	N
1-2	64.2	7.08	N
1-3	65.3	7.24	N
1-4	60	7.28	N
1-5	49.9	7.56	N
2-1	31.22	7.59	N
2-2	41.7	7.62	N
2-3	42.9	7.56	N
2-4	55.7	7.31	N
2-5	169.6	7.7	M
3-1	45.4	7.27	N
3-2	46.7	7.27	N
3-3	41.5	7.11	N
3-4	47.1	7.47	N
3-5	40.8	7.28	N
Gidg 1-1	137.6	8.09	N
1-2	191.2	8.17	S
1-3	183.1	8.52	S
1-4	199.6	8.36	M
1-5	277.7	8.74	M
2-1	92	7.19	N
2-2	90.6	7.28	N
2-3	96.5	7.4	N
2-4	118.5	8.12	S

Site	Ec (microsiemens)	pH	Ca reaction
2-5	171.5	8.62	S
3-1	26.78	7.47	N
3-2	83.4	7.23	N
3-3	78.7	7.37	N
3-4	35.55	7.55	N
3-5	31.89	7.6	N
Cutt 1-1	169.6	8.26	S
1-2	176.7	8.53	M
1-3	189	8.53	M
1-4	181.3	8.67	M
1-5	189.9	8.71	H
2-1	135.5	7.25	N
2-2	141.3	7.44	N
2-3	117.9	7.23	N
2-4	81	7.75	N
2-5	69.6	7.51	N
3-1	227	8.32	S
3-2	279.7	8.25	M
3-3	431	8.14	M
3-4	534	8.11	M
3-5	373.9	8.1	M
Deap 1-1	52	7.78	N
1-2	44.6	7.87	N
1-3	38.9	8.23	N
1-4	45	8.35	N
1-5	112.4	8.75	N
2-1	41.8	7.62	N
2-2	38.2	7.48	N
2-3	31.83	7.63	N
2-4	42.7	7.36	N
2-5	48.8	7.34	N
3-1	87.4	7.07	N
3-2	78.6	7.2	N
3-3	56.5	7.42	N
3-4	45.1	7.33	N
3-5	32.83	7.41	N
Coon 1-1	113.4	7.12	N
1-2	110	7.64	N
1-3	126.3	7.52	N
1-4	121.3	8.17	N
1-5	138.9	8.54	N
2-1	68.3	7.22	N
2-2	55.9	7.32	N
2-3	93.2	7.98	N
2-4	40.4	7.64	N

Site	Ec (microsiemens)	pH	Ca reaction
2-5	30.04	7.67	N
3-1	74.9	8.61	N
3-2	117.3	8.5	M
3-3	93.4	8.74	N
3-4	78.1	8.85	N
3-5	91.9	8.78	N
Nari 1-1	110.6	7.29	N
1-2	69.3	7.28	N
1-3	64.3	7.59	N
1-4	48.4	7.48	N
1-5	45.8	7.52	N
2-1	205.1	7.75	N
2-2	207.9	7.84	N
2-3	184.2	7.86	M
2-4	162	7.99	M
2-5	169.7	7.81	M
3-1	226.8	7.92	N
3-2	221.2	7.91	N
3-3	207	7.82	N
3-4	236.2	7.32	N
3-5	210	7.71	N
Para 1-1	46.8	7.98	N
1-2	105.6	8.42	N
1-3	201.2	8.62	N
1-4	175.2	8.69	N
1-5	168	8.92	N
2-1	106.4	8.04	N
2-2	228	8.04	N
2-3	346.2	7.38	N
2-4	266.3	7.72	N
2-5	292.1	7.19	N
3-1	152.7	8.51	N
3-2	224.6	9.04	N
3-3	367.2	8.29	M
3-4	287.5	8.21	M
3-5	245.8	8.25	M
Apar 1-1	27.76	7.34	N
1-2	39.1	8.07	N
1-3	32.64	7.73	N
1-4	48.4	7.86	N
1-5	44.5	7.92	N
2-1	16.5	7.84	N
2-2	16.86	8.87	N
2-3	21.92	7.36	N
2-4	15.35	7.83	N

Site	Ec (microsiemens)	pH	Ca reaction
2-5	12.88	8.08	N
3-1	30.95	7.86	N
3-2	34	7.96	N
3-3	31.48	8.03	N
3-4	28.63	8.25	N
3-5	30.44	8.46	N
Hope 1-1	63.3	8.13	N
1-2	75.8	8.23	N
1-3	92.9	7.98	N
1-4	87.4	7.94	N
1-5	84.3	8.37	N
2-1	26.62	8.6	N
2-2	82.7	8.89	N
2-3	64.3	9.12	N
2-4	64.4	9.11	N
2-5	53.5	8.93	N
3-1	229.5	6.62	N
3-2	108.6	6.83	N
3-3	93.7	6.78	N
3-4	93.3	6.99	N
3-5	108.5	7.23	N
Kila 1-1	910	9.6	N
1-2	849	9.75	N
1-3	811	9.83	N
1-4	369.5	9.65	N
1-5	263.6	9.66	N
2-1	65.9	8.13	N
2-2	90.5	8.03	N
2-3	146.3	8.46	N
2-4	271.3	8.32	N
2-5	454	7.61	N
3-1	85.3	8.42	N
3-2	140.9	8.71	N
3-3	196.5	8.68	N
3-4	235.9	8.92	N
3-5	215	9.38	N
			N= Non-calcareous
			S= Slightly calcareous
			M= Moderately calcareous
			H= Highly calcareous

6.7 Appendix 7 – Soil analyses

Total carbon total nitrogen, carbonate reaction and repellent properties (0-5cm)

Site	C1 (%)	C2(%)	N1(%)	N2(%)	Ca Reaction	Wetting/Repelling
Cull 1	0.44186	0.41463	0	0	0	W
Cull 2	0.13568	0.16958	0	0	0	W
Cull 3	1.0737	1.0559	0	0	0	W
Cull 4	1.2602	1.137	0	0	0	W
Cull 5	0.30119	0.31001	0	0	0	W
Cull 6	0.68548	0.84492	0	0	0	W
Cull 7	1.0762	0.91643	0	0	0	W
Cull 8	1.2053	1.1225	0	0	0	W
Cull 9	0.94693	0.9846	0	0	0	W
Cull 10	2.276	1.8495	0.04052	0	0	W
Cull 11	1.6138	1.9046	0	0.00954	0	W
Cull 12	2.4184	2.1172	0.0164	0	0	W
Cull 13	0.95203	1.1813	0	0.03345	0	W
Cull 14	0.33005	0.32877	0	0	0	W
Cull 15	4.1303	3.928	0.05312	0.02874	0	W
Mink 1	2.3276	1.7643	0.1948	0.19038	0	W
Mink 2	1.5076	1.1356	0.04551	0.01871	0	W
Mink 3	0.93412	0.53597	0.00975	0	0	W
Mink 4	0.64241	0.61385	0.13137	0.1117	0	W
Mink 5	0.56995	0.50177	0	0	0	W
Mink 6	0.85739	0.63572	0.04861	0	0	W
Mink 7	0.4616	0.48712	0	0.01854	0	W
Mink 8	0.93789	1.1577	0	0	0	W
Mink 9	0.73241	0.24896		0.14491	0	W
Mink 10	0.82836	1.0334	0.02317	0.03082	0	W
Mink 11	0.63947	0.66635	0	0	0	W
Mink 12	0.77248	1.0237	0	0.00231	0	W
Mink 13	0.46086	0.53213	0	0	0	W
Mink 14	0.75443	1.431	0	0	0	W
Mink 15	2.5584	2.2754	0.09016	0.06604	0	W
Scru 1	3.5075	3.4406	0.187	0.2	0	W
Scru 2	3.0651	3.2879	0.62031	0.24702	0	W
Scru 3	3.8437	4.8143	0.23276	0.29719	0	W
Scru 4	3.778	3.9088	0.24263	0.26932	0	VSR
Scru 5	4.0346	4.4996	0.25319	0.27043	0	W
Scru 6	3.4723	3.8054	0.46889	0.29518	0	W
Scru 7	2.3049	2.8763	0.137	0.104	0	W
Scru 8	3.2891	3.5176	0.135	0.0861	0	W
Scru 9	2.6553	2.2559	0.09	0.048	0	W

Site	C1 (%)	C2(%)	N1(%)	N2(%)	Ca Reaction	Wetting/Repelling
Scru 10	4.4971	4.0559	0.1001	0.02925	0	W
Scru 11	6.9035	5.5858	0.287	0.11585	0	R
Scru 12	11.755	15.607	0.65984	0.84704	0	R
Scru 13	7.7345	6.0084	0.4086	0.3102	0	R
Scru 14	4.4179	3.9642	0.0847	0.18	0	SR
Scru 15	3.9387	3.5875	0	0.166	0	W
Tirr 1	4.6541	4.145	0.1487	0.1313	0	SR
Tirr 2	3.5285	6.0159	0.20574	0.10429	0	W
Tirr 3	4.0951	5.0436	0.1653	0.09728	0	SR
Tirr 4	2.1687	3.1523	0.11886	0.1963	0	W
Tirr 5	2.5843	2.5462	0.184	0.13158	0	W
Tirr 6	2.893	2.8409	0.1783	0.13	0	W
Tirr 7	3.7007	3.8228	0.1958	0.18677	0	R
Tirr 8	5.5926	4.9741	0.32131	0.26013	0	R
Tirr 9	2.6175	2.8884	0.2	0.11931	0	W
Tirr 10	1.8006	1.4837	0.09197	0.06064	0	W
Tirr 11	1.7993	2.7928	0.018	0.09	0	W
Tirr 12	0.78135	0.79715	0.042	0	0	W
Tirr 13	0.9591	1.1801	0.00963	0.06963	0	W
Tirr 14	0.96913	1.4689	0.01	0.038	0	W
Tirr 15	1.0095	1.0205	0.0338	0.029	0	W
Kudr 1	2.6627	2.2982	0.0296	0.01527	0	W
Kudr 2	3.7068	1.8878	0.08689	0	0	W
Kudr 3	1.2212	1.2234	0	0	0	W
Kudr 4	1.896	2.1087	0.00054	0.00218	0	W
Kudr 5	3.2194	2.5002	0.05875	0.02943	0	W
Kudr 6	2.6893	2.5653	0.03122	0.16805	0	W
Kudr 7	1.2444	1.2138	0.07	0.0598	0	W
Kudr 8	0.71828	0.68342	0.03884	0.03544	0	W
Kudr 9	0.71709	0.69205	0.03163	0.0326	0	W
Kudr 10	1.4795	1.3669	0.0803	0.06728	0	W
Kudr 11	1.1167	1.1331	0.04263	0.04558	0	W
Kudr 12	0.78997	0.61808	0.02138	0.0146	0	W
Kudr 13	0.83378	0.89006	0.04606	0.05237	0	W
Kudr 14	1.7973	1.867	0.07986	0.07136	0	W
Kudr 15	0.88132	1.0863	0.1269	0.1199	0	W
Gidg 1	3.097	2.904	0.166	0.16613	0	W
Gidg 2	3.1924	3.0093	0.17637	0.15191	0	W
Gidg 3	1.459	1.3535	0.0578	0.03436	0	W
Gidg 4	5.7811	5.047	0.36249	0.29549	0	R
Gidg 5	10.4	10.462	0.58284	0.56428	0	R
Gidg 6	6.3318	6.663	0.35857	0.34739	0	W
Gidg 7	1.96	2.1245	0.07968	0.07943	0	W
Gidg 8	7.7816	6.9164	0.40636	0.3562	0	W
Gidg 9	4.6303	4.6533	0.22713	0.22832	0	W

Site	C1 (%)	C2(%)	N1(%)	N2(%)	Ca Reaction	Wetting/Repelling
Gidg 10	1.2529	1.7737	0.02236	0.0512	0	W
Gidg 11	2.5861	2.4408	0.15263	0.11413	0	W
Gidg 12	1.5497	1.4553	0.04845	0.03721	0	W
Gidg 13	0.71489	0.79134	0	0	0	W
Gidg 14	2.3153	2.2278	0.11361	0.15368	0	W
Gidg 15	2.8522	2.4629	0.13551	0.08675	0	W
Cutt 1	1.6095	1.396	0.07414	0.05316	0	W
Cutt 2	1.0802	1.5448	0.02992	0.05743	0	W
Cutt 3	1.1045	1.2515	0.03138	0.04236	0	W
Cutt 4	0.55859	0.65877	0.00828	0.00746	0	W
Cutt 5	0.92295	0.72592	0.02387	0.01135	0	W
Cutt 6	0.84725	0.81454	0.01298	0.0145	0	W
Cutt 7	1.5796	1.6591	0.04505	0.05701	0	W
Cutt 8	0.94768	1.099	0.01104	0.02438	0	W
Cutt 9	1.3115	1.1877	0.04238	0.03924	0	W
Cutt 10	1.73	0.9297	0.04371	0.01487	0	W
Cutt 11	1.7819	2.1652	0.07138	0.10828	0	W
Cutt 12	2.0198	1.9082	0.08531	0.06577	0	W
Cutt 13	3.4856	4.4556	0.11973	0.157	0	W
Cutt 14	3.1063	3.2945	0.16243	0.15418	0	W
Cutt 15	3.8776	3.9862	0.17905	0.18374	0	W
Deap 1	0.31097	0.53561	0	0.01095	0	W
Deap 2	0.53561	0.91885	0.01095	0.02685	0	W
Deap 3	0.43433	0.50684	0.00465	0.00915	0	W
Deap 4	0.402	0.55067	0.00486	0.01181	0	W
Deap 5	0.62678	0.51151	0.01526	0.01392	0	W
Deap 6	0.55001	0.5592	0.00416	0.01104	0	W
Deap 7	4.1226	4.3077	0.25732	0.2615	0	W
Deap 8	2.0117	1.4857	0.10392	0.07059	0	W
Deap 9	1.5751	1.5962	0.07821	0.07906	0	W
Deap 10	2.4028	2.251	0.14892	0.13388	0	W
Deap 11	1.1029	1.5992	0.07887	0.03193	0	W
Deap 12	0.88172	0.72857	0	0	0	W
Deap 13	0.58607	0.6065	0	0.03641	0	W
Deap 14	0.84297	0.82905	0	0	0	W
Deap 15	0.69855	0.68393	0	0	0	W
Coon 1	0.98816	0.99215	0	0	0	W
Coon 2	0.50453	0.39146	0	0	0	W
Coon 3	0.28884	0.29183	0	0	0	W
Coon 4	2.8748	2.2609	0.0827	0.30506	0	W
Coon 5	4.9366	3.3341	0.20094	0.12799	0	R
Coon 6	1.6937	1.0235	0.02274	0	0	VSR
Coon 7	2.2101	2.6721	0.07487	0.14178	0	R
Coon 8	0.76567	0.87675	0.01025	0.00467	0	VSR
Coon 9	2.4796	3.8332	0.07553	0.14187	0	VSR

Site	C1 (%)	C2(%)	N1(%)	N2(%)	Ca Reaction	Wetting/Repelling
Coon 10	2.9554	3.038	0.12818	0.12591	0	R
Coon 11	2.4746	2.6206	0.07512	0.09427	0	R
Coon 12	1.3577	1.4711	0.01869	0.01784	0	R
Coon 13	1.1647	1.1343	0.03017	0.00908	0	VSR
Coon 14	0.31288	0.25778	0	0	0	W
Coon 15	0.53559	0.70889	0.09	0.1189	0	W
Nari 1	2.1858	2.2767	0.16399	0.127	0	W
Nari 2	1.6136	1.8418	0.09194	0.07621	0	W
Nari 3	1.3383	1.2948	0.06044	0.04308	0	W
Nari 4	2.6134	2.9572	0.14417	0.18037	0	W
Nari 5	3.2321	2.7349	0.19465	0.17015	0	W
Nari 6	8.0506	10.833	0.41618	0.55514	0	W
Nari 7	6.6225	7.426	0.44941	0.49811	0	R
Nari 8	14.379	13.964	0.95622	0.88706	0	R
Nari 9	11.328	15.462	0.61298	0.75124	0	R
Nari 10	10.667	9.3479	0.65671	0.56736	0	R
Nari 11	7.3674	9.52	0.4491	0.59431	0	R
Nari 12	5.8725	6.2027	0.33961	0.35574	0	W
Nari 13	5.9026	4.8833	0.34218	0.28147	0	W
Nari 14	6.357	5.6674	0.37269	0.34219	0	W
Nari 15	7.3601	5.5746	0.40285	0.31405	0	W
Para 1	0.43367	0.42603	0	0	0	W
Para 2	0.39366	0.32802	0	0	0	W
Para 3	0.24209	0.27661	0	0	0	W
Para 4	0.3732	0.36711	0	0	0	W
Para 5	0.35693	0.45079	0	0	0	W
Para 6	0.21978	0.14631	0	0	0	W
Para 7	0.48954	0.44783	0	0	0	W
Para 8	0.31132	0.34794	0	0	0	W
Para 9	0.26287	0.23843	0	0	0	W
Para 10	0.98383	0.85464	0	0	0	W
Para 11	0.24507	0.2263	0	0	0	W
Para 12	1.0172	1.3054	0	0	0	W
Para 13	0.40689	0.3813	0	0	0	W
Para 14	0.2443	0.23713	0	0	0	W
Para 15	0.5364	0.60686	0	0	0	W
Apar 1	0.05005	0.07319	0	0	0	W
Apar 2	0.05418	0.04584	0	0	0	W
Apar 3	0.09298	0.08781	0.01819	0	0	W
Apar 4	0.09787	0.12467	0	0	0	W
Apar 5	0.17154	0.19872	0	0	0	W
Apar 6	0.31168	0.20774	0.03069	0.00644	0	VSR
Apar 7	0.15112	0.15728	0.02583	0.00957	0	VSR
Apar 8	0.11542	0.12309	0	0	0	W
Apar 9	0.08024	0.05309	0	0.00328	0	W

Site	C1 (%)	C2(%)	N1(%)	N2(%)	Ca Reaction	Wetting/Repelling
Apar 10	0.07417	0.20389	0	0	0	W
Apar 11	0.11737	0.12537	0.02132	0.01688	0	W
Apar 12	0.1644	0.18052	0	0	0	W
Apar 13	0.09931	0.08995	0	0	0	W
Apar 14	0.06722	0.1014	0	0	0	W
Apar 15	0.08942	0.07227	0	0	0	W
Hope 1	0.05913	0.04497	0	0	0	W
Hope 2	0.07862	0.07869	0	0	0	W
Hope 3	0.05392	0.09635	0	0	0	W
Hope 4	0.07338	0.05835	0	0	0	W
Hope 5	0.07417	0.04624	0	0	0	W
Hope 6	0.13315	0.36797	0	0	0	W
Hope 7	0.0473	0.06035	0	0	0	W
Hope 8	0.10527	0.0943	0	0	0	W
Hope 9	0.09319	0.12312	0	0	0	W
Hope 10	0.03166	0.06759	0	0	0	W
Hope 11	0.02911	0.0227	0	0	0	W
Hope 12	0.03691	0.02278	0	0	0	W
Hope 13	0.0274	0.01807	0	0	0	W
Hope 14	0.04397	0.02857	0	0	0	W
Hope 15	0.02385	0.02858	0	0	0	W
Kila 1	0.56361	0.42283	0	0	0	R
Kila 2	0.10489	0.10135	0	0	0	W
Kila 3	0.30477	0.27494	0	0	0	W
Kila 4	0.03341	0.08646	0	0	0	W
Kila 5	0.08646	0.11611	0	0	0	W
Kila 6	0.46969	0.17522	0	0	0	W
Kila 7	0.36684	0.44449	0	0	0	W
Kila 8	0.29217	0.34392	0	0	0	W
Kila 9	0.43686	0.43271	0	0	0	W
Kila 10	0.13574	0.07527	0	0	0	W
Kila 11	0.09072	0.06628	0	0	0	W
Kila 12	0.12006	0.1594	0	0	0	W
Kila 13	1.4608	1.0719	0	0	0	W
Kila 14	0.13177	0.09674	0	0	0	W
Kila 15	0.09169	0.08951	0	0	0	W
						W = Wetting
						VSR = Very slightly repellant
						SR=Slightly repellent
						R=Repellent

6.8 Appendix 8 - Vegetation transitions