A preliminary overview of what is reserved in the Inverell and Yallaroi Shires, North Western Slopes, NSW

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A brief assessment is made of the adequacy of the formal conservation reserve network within the Inverell and Yallaroi Shires, around Inverell and Warialda, northern New South Wales. The current reserve network consists of two National Parks (Kings Plains & Kwiambal) and three Nature Reserves (Arakoola, Planchonella & Severn River), sampling 2% of the area of the two shires. 62% of the known vascular plant taxa (746 native, 144 exotic) have been recorded within the five reserves, including 27 of the 48 taxa listed as rare or threatened within the shires. Of 30 vegetation communities found within the five reserves, only 13 were considered adequate in terms of extent or condition. Of 18 communities found on basalt, limestone or alluvial soils, only 12% of their area was considered to be good quality stands. 26 communities were only represented in one reserve. Nine Endangered Ecological Communities are listed for the two shires, only four of which are within the formal reserves. The capture and status of assemblages and flora within the five reserves in the Inverell and Yallaroi Shires is inadequate and many of the species and communities contained warrant additional conservation within the formal conservation network.

Introduction

The Inverell and Yallaroi Shires in northern New South Wales cover an area of almost 1.4 million hectares, based on the towns of Inverell and Warialda, north to the Queensland border. The area is part of the New England Tablelands Bioregion in the east, the Nandewar Bioregion in the centre and in the Brigalow Belt South and Darling Riverine Plains Bioregions in the west. The area covers part of the North Western Slopes and North Western Plains Botanical Regions.

Within the Inverell and Yallaroi Shires, there are five formal conservation reserves under the management of the New South Wales National Parks and Wildlife Service, two National Parks — Kings Plains (8519 ha) and Kwiambal (3487 ha), and three Nature Reserves — Arakoola (3189 ha), Planchonella (450 ha) and Severn River (4308 ha) (Figure 1). These reserves incorporate 19 639 ha, approximately 2% of the area of the two shires (though only 716 ha or 0.01% of the Yallaroi Shire). With little exception these reserves are located within the most rugged country with the least agricultural potential.

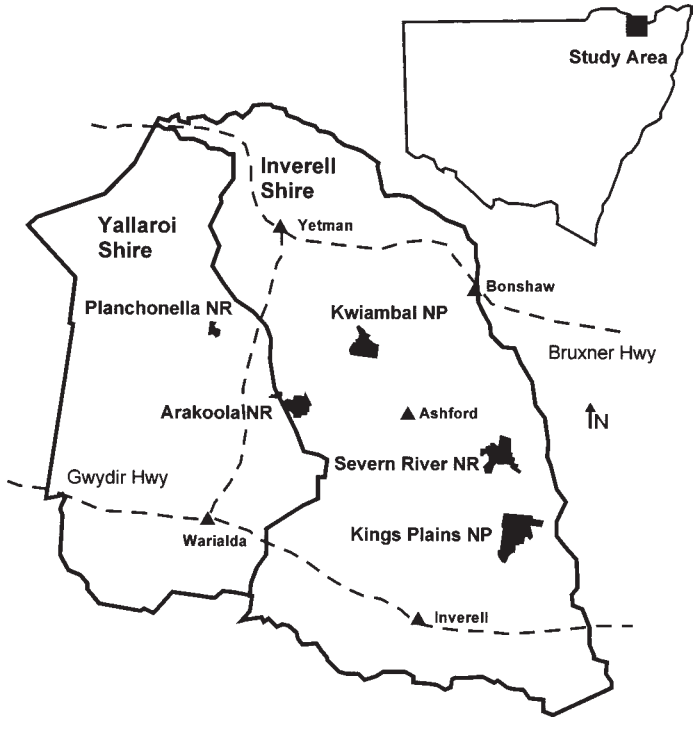

Fig. 1. Location of study area showing the Inverell and Yallaroi Shires and the five conservation reserves.

Attempts to assess how representative the capture of communities within a reserve network is usually rely on occurrence, i.e. how many reserves the community has been found within (Specht et al. 1995). Such criteria do not take into account representativeness across the range of the community, or the quality and condition of stands. Just because an assemblage is represented within a reserve is no indication that it is adequate, in terms of extent or condition (viability).

Comprehensive flora and vegetation surveys based on stratified plot sampling, statistical analyses and API mapping have been done for all reserves within the Inverell and Yallaroi Shires, except Planchonella NR, though Planchonella NR has been qualitatively surveyed and does have a flora checklist and mapped vegetation classes. This paper provides a brief summary of the vegetation communities and flora within the reserves and their status, and discusses some of the implications for conservation adequacy within the Inverell and Yallaroi Shires.

Arakoola Nature Reserve

Arakoola NR (3189 ha) is located 2 km south of Coolatai on the North Western Slopes. The landscape is of low relief but straddles the western fall of the Mastermans Range. Rock types include Late Jurassic Pilliga Sandstone, Tertiary basalts, Tertiary sediments and some Quaternary alluvium.

Formerly part of the freehold properties of Sylvan and Arakoola, land incorporated in Arakoola NR was purchased in 1998 under Natural Heritage Trust Funding and gazetted in 1999. Survey data available includes formal stratified random sampling of the flora (Hunter 2000a) and a number of informal investigations and flora records since the reserve was gazetted and subsequent flora records based on targeted searches for threatened species and general collection.

Planchonella Nature Reserve

Planchonella NR (450 ha) is located 14 km north west of Coolatai in the Shire of Yallaroi on the North Western Slopes. Freehold land currently used for cropping with some grazing surrounds the reserve. The landscape is of gently undulating low basalt hills, which are often moderately stony.

Planchonella NR, formerly freehold property 'Bim Bimble', was gazetted in 1996 for the high conservation value of the Semi-evergreen Vine Thickets (SEVT), this being considered the largest and most intact remnant of its type on the NSW North Western Slopes. The vegetation and flora has been described by Henderson (1997) and Williams (1994). The reserve was visited by the author and assessed on foot and by aerial photograph interpretation prior to this review.

Kings Plains National Park

Kings Plains NP (8519 ha) is approximately 50 km north-west of Glen Innes in the Inverell Shire on the North Western Slopes. The Park contains what was formerly Crown Reserve with some newer purchases of private holdings that are yet to be gazetted. The landscape is heavily dissected with numerous steep ridges that fall away to the west but also with some low plateau areas in the north-west of the Park. Rock types within the Park are primarily acid volcanics and include Permian volcanics and Tertiary volcanics with Tertiary and Quaternary weathered products such as laterite.

The Park was gazetted in 1988 for the conservation of woodlands within the North Western Slopes. Roberts (1977) investigated the flora and communities and John Williams (1994) provided a checklist of the flora. Sampling by Nadolny et al. (1998), Gunninah Environmental Consultants (1998) and Hunter (1999) also occurred. Hunter and Clarke (1998) described the vegetation and flora of rock outcrops within the Park. Formal and informal records by other workers have been incorporated within the formal survey and review of the Park (Hunter 2000b). Subsequent additional records have been incorporated into this review.

Kwiambal National Park

Kwiambal NP (3487 ha, some yet to be gazetted) is approximately 30 km north west of Ashford on the Macintyre River in the Shire of Inverell on the North Western Slopes. The landscape is generally rugged, with low rocky ridges interspersed with areas of deeper soils in gullies or on plateaus. The dominant rock types include metabasalt, limestone, greywacke and granite.

Kwiambal incorporates former freehold land and some Crown Reserves. Part was gazetted in 1998 to conserve some of the largest areas of remnant woodlands on the North Western Slopes. The flora and vegetation of the reserve area has been surveyed by Roberts (1982; 1983), Le Brocque and Benson (1995), Nadolny et al. (1998), Hunter (1998), Hunter and Clarke (1998), Hunter (1999) and Hunter et al. (1999). The reserve has been visited for additional collections by the author several times since these formal reports and subsequent observations have been incorporated into this review.

Severn River Nature Reserve

Severn River NR (4308 ha) is approximately 60 km north-west of Glen Innes and 4 km upstream from the Pindari Dam wall on the North Western Slopes. The landscape is undulating to hilly with the Severn River forming a major gorge through the Reserve. The rock types contained include Permian and Tertiary Volcanics with a minor intrusion of basalt and some Tertiary and Quaternary weathered products such as laterite.

Severn River NR, incorporating Crown Reserve and recently purchased freehold properties, was gazetted in 1968 with additions in 1998. Surveys of the vegetation and species are given in Department of Water Resources (1991), Bowlay (1992), Le Brocque and Benson (1995), Nadolny et al. (1998), Hunter and Clarke (1998), Hunter (1999). A comprehensive review and survey of the flora and vegetation of Reserve is in Hunter (2000c). Subsequent visits have been made to the reserve since the comprehensive survey and additional records have been incorporated in this review.

Methods

A checklist of vascular plant flora taxa was generated for the Inverell and Yallaroi Shires based on information from flora surveys conducted within these shires. Primary sources included Department of Water Resources (1990), Harden (1991–1993), Bowlay (1992), Le Brocque and Benson (1995), Henderson (1997), Gunninah Environmental Consultants (1998), and Hunter (1998; 1999; 2000a,b,c). These sources were also used to collate information on taxa and communities found in the five conservation reserves. No comprehensive surveys of the regions outside of the conservation areas within the shires have been finalised at the time of writing this paper. Thus the sources used are likely to be incomplete in terms of the total flora within the two shires, though the majority of species are likely to have been taken into account in this treatment.

Vegetation communities within the five reserves were qualitatively grouped based on the author's field experience. The condition and area covered by each community were summarised from information contained within the reserve reports (Henderson 1997; Hunter 1998; Hunter 2000a,b,c), subsequent visits on foot, and by aerial photograph interpretation of all the reserves. Assessment of condition was based on plot based sampling, traverses through each reserve beyond plot based sampling areas, and aerial photograph interpretation.

The condition of each community was based on a subjective three-point scale. Communities in good condition had little or no visible disturbance and consisted primarily of old growth; those in poor condition were visibly disturbed by factors such as clearing or logging, were substantially of regrowth, or had significant weed invasion. Communities considered in very poor condition were extremely modified and likely to be of a completely derived nature with no natural counterparts; for example had an introduced overstorey or no overstorey where one should have been, or had greater than 50% introduced flora cover. Areas that fell into the very poor condition category included cultivation paddocks. Assessments of condition have been based on overall vegetation quality based on disturbance history even in remote areas and is not biased by accessibility.

The intensity of sampling was considered adequate for these preliminary purposes, as all reserves had been visited on more than one occasion over several years and a total of 311 full floristic 20 × 20 m formal survey plots had been placed within them. Targeted searches for threatened flora were carried out in conjunction with the formal stratified surveys, and on many occasions since. All regions of the reserves have been visited on foot by the author either during formal vegetation surveys (Hunter 2000a,b,c) or since. The algorithm of Incidence-Based Coverage Estimator of species richness was used (ICE) to generate predictive rarefactoin curves (Lee & Chao 1994) that estimate the potential total species richness, this algorithm is contained within EstimateS 5 (Colwell 1999). The predicted total richness based on ICE estimation was compared with the total richness found for each formally surveyed reserve to test adequacy of sampling. During the ICE simulations 200 random samplings were used.

Results

Floristics

For the Inverell and Yallaroi Shires 1415 vascular plant taxa were collated from published and unpublished sources — 1152 native (81%), 263 exotic (19%). Of these 890 or 62% were found within the five conservation reserves — 746 native (84%) and 144 (16%) exotic. ICE predicted that Arakoola NR would contain 514 taxa (432 recorded), Kings Plains 467 (439 recorded), Kwiambal 459 (409 recorded) and Severn River 520 (463 recorded).

Rare or threatened taxa

48 vascular plant species within the two shires are listed on either the NSW *Threatened Species Conservation Act 1995 (TSC Act)* or ROTAP (Briggs & Leigh 1996) (Table 1). Of those on the *TSC Act*, one is listed as Presumed Extinct, 16 as Endangered and 18 as Vulnerable. Under the ROTAP (Briggs & Leigh 1996) criteria four taxa are listed as Endangered, 19 as Vulnerable, 23 as Rare and two as Poorly Known. 27 of these rare or threatened listed flora were recorded within the five conservation reserves, 17 of these in more than one reserve.

Table 1. Rare or threatened vascular plant species known from the Inverell and Yallaroi Shires.

Taxon	TSC Act	ROTAP	Reserve
Acacia acrionastes	Endangered	3RC-	
Acacia atrox	Endangered		
Acacia burbidgeae		3RC-	
Acacia granitica		3RC-	
Acacia macnuttiana	Endangered	2VCi	
Acacia pubifolia	Endangered	2VC-	
Acacia torringtonensis		2RC-	Kings Plains, Severn River
Acacia williamsiana		2RCa	Kings Plains, Kwiambal, Severn River
Allocasuarina brachystachya		2RCa	Kings Plains, Severn River
Astrotricha roddii	Endangered	3VCa	Kings Plains, Kwiambal, Severn River
Babingtonia odontocalyx		2VC-	
Boronia granitica	Endangered	3VCa	Kings Plains, Severn River
Bothriochloa biloba	Vulnerable	3V	Arakoola, Kings Plains
Cadellia pentastylis	Vulnerable	3RCa	
Callistemon pungens		3RCa	Kings Plains, Severn River
Cryptandra lanosiflora		3RCa	
Derwentia arenaria		3RCa	Kings Plains
Desmodium campylocaulon	Endangered		Arakoola
Dichantheum setosum	Vulnerable		Arakoola
Digitaria porrecta	Vulnerable		
Discaria pubescens		3RCa	
Dodonaea hirsuta		3RC-	Kings Plains, Severn River
Dodonaea stenophylla	Extinct	3V-	
Eucalyptus caleyi subsp. *ovendenii*	Vulnerable	2V-	
Eucalyptus rubida subsp. *barbigerorum*	Vulnerable		
Eucalyptus malacoxylon		2R-	
Eucalyptus mckieana	Vulnerable	2VC-	Kings Plains, Severn River
Eucalyptus nichollii	Vulnerable	3V-	
Eucalyptus youmanii		3R-	
Euphorbia sarcostemmoides	Endangered	3KCa	Kwiambal
Euphrasia collina subsp. *muelleri*	Endangered	2EC-	
Goodenia macbarronii	Vulnerable	3VC-	Arakoola, Severn River
Hibbertia kaputarensis		2RC-	
Hibbertia sp. *B*		3RCa	Kings Plains, Severn River
Homopholis belsonii		3R-	
Homoranthus biflorus	Vulnerable	2VC-	Kings Plains, Severn River
Homoranthus prolixus	Vulnerable	2V-	
Leionema rotundifolia		3RCa	Kings Plains, Severn River
Lepidium hyssopifolium	Endangered	3ECi	
Micromyrtus grandis	Endangered	2EC	Severn River
Monotaxis macrophylla	Endangered		
Olearia gravis		3KCa	Arakoola, Kings Plains, Kwiambal, Severn River
Persoonia terminalis subsp. *recurva*		2RC-	Arakoola, Kings Plains, Severn River

Taxon	TSC Act	ROTAP	Reserve
Persoonia terminalis subsp. *terminalis*		2RC-	Arakoola, Severn River
Phebalium glandulosum subsp. *eglandulosum*	Endangered	2VCi	
Picris evae	Vulnerable	3V	
Platyzoma microphyllum	Endangered		
Polygala linariifolia	Endangered		Kwiambal
Pomaderris queenslandica	Endangered		Arakoola, Severn River
Prostanthera cryptandroides	Vulnerable	2RC-	
Pultenaea stuartiana	Vulnerable	3VC-	Severn River
Rutidosus heterogama	Vulnerable	2VCa	
Swainsona murrayana	Vulnerable	3VCi	
Thelionema grande		3RCa	
Thesium australe	Vulnerable	3VCi	Arakoola, Kings Plains, Kwiambal
Tylophora linearis	Vulnerable	3E	
Zieria odorifera		3RCi	Kings Plains

Table 2. Reservation status and condition of communities within the Inverell and Yallaroi Shires.

Assemblage	Reserve	Condition	Area
1 Communities associated with wetlands	**1 Reserve**		**8 ha**
1 Herbfield/Sedgeland *Rorippa eustylis–Eleocharis plana*	Arakoola	Very poor	8 ha
2 Communities associated with riparian zones	**5 Reserves**	**Poor–v. poor**	**975 ha**
2.1 Rough Barked Apple River Flats *Angophora floribunda*	Severn River	Very poor	147 ha
2.2 Rough Barked Apple – River Oak Open Woodlands *Angophora floribunda – Eucalyptus banksii – Casuarina cunninghamiana*	Kings Plains	Poor	120 ha
2.3 Rough Barked Apple – Weeping Bottlebrush *Angophora floribunda – Callistemon viminalis*	Arakoola	Poor	162 ha
2.4 Red Gum – Rough-barked Apple Woodlands *Eucalyptus blakelyi – Angophora floribunda – E. camaldulensis*	Kwiambal	Poor	523 ha
2.5 River Oak *Casuarina cunninghamiana*	Severn River	Poor	3 ha
2.6 Wilga – Weeping Myall *Geijera parvifolia – Acacia pendula*	Planchonella	Poor	20 ha
3 Communities associated with alluvial areas, basalt or limestone soil	**5 Reserves**	**Usually poor**	**2860 ha**
3.1 Yellow Box – Red Gum – Rough-barked Apple Woodlands *Eucalyptus melliodora – Angophora floribunda – E. blakelyi*	Arakoola Kings Plains Kwiambal Severn River	Poor Good Poor Poor	24 ha 268 ha 200 ha 21 ha
3.2 Grassy White Box Woodlands *Eucalyptus albens*	Kings Plains	Good	24 ha
3.3 White Box – Silver-leaved Ironbark Woodlands *Eucalyptus albens – E. melanophloia – E. crebra*	Arakoola	Poor	1180 ha
3.4 White Cypress Pine – Silver-leaved Ironbark – White Box Woodlands *Callitris glaucophylla – Eucalyptus melanophloia – E. albens*	Kwiambal	Poor	523 ha
3.5 Silver-leaved Ironbark – Wilga Woodlands *Eucalyptus melanophloia – Geijera parvifolia*	Planchonella	Poor	50 ha

Assemblage	Reserve	Condition	Area
3.6 Belah – Brigalow Woodlands *Casuarina cristata – Acacia harpophylla*	Planchonella	Poor	20 ha
3.7 White Cypress Pine – Rough-barked Apple – Kurrajong Woodlands *Callitris glaucophylla – Angophora floribunda – Brachychiton populneus*	Kwiambal	Poor	200 ha
3.8 White Cypress Pine – Silver-leaved Ironbark Woodlands *Callitris glaucophylla – Eucalyptus melanophloia*	Kwiambal	Good	340 ha
4 Communities associated with sandstone	**1 Reserve**	**Good**	**1383 ha**
4.1 Smooth-barked Apple – Long-fruited Bloodwood Woodlands *Angophora leiocarpa – Corymbia dolichocarpa*	Arakoola	Good	602 ha
4.2 Smooth-barked Apple – Red Stringybark Woodland *Angophora leiocarpa – Eucalyptus macrorhyncha*	Arakoola	Good	781 ha
5 Communities associated with acid substrates with deep soils	**3 Reserves**	**Generally good**	**2957 ha**
5.1 White Cypress – Tumbledown Gum Woodlands *Callitris glaucophylla – Eucalyptus dealbata*	Kwiambal	Good	1744 ha
5.2 Tumbledown Gum – Narrow-leaved Ironbark Woodlands *Eucalyptus dealbata – E. crebra*	Severn River	Good	432 ha
5.3 Narrow-leaved Ironbark – Orange Gum Shrubby Woodlands *Eucalyptus crebra – E. prava – E. andrewsii*	Severn River	Good	112 ha
5.4 McKie's Stringybark – Blackbutt Open Forest *Eucalyptus mckieana – E. andrewsii – Callitris endlicheri*	Kings Plains	Poor	31 ha
5.5 Red Stringybark – Ironbark Woodlands *Eucalyptus macrorhyncha – E. crebra – E. dealbata*	Kings Plains	Good	638 ha
6 Communities associated with the margins of rock outcrops	**2 Reserves**	**Good**	**8374 ha**
6.1 Tumbledown Gum – Caley's Ironbark – Orange Gum	Kings Plains	Good	4970 ha
Woodlands *Callitris endlicheri – Eucalyptus dealbata – E. caleyi – E. prava*	Severn River	Good	2732 ha
6.2 Orange Gum – Ironbark Shrubby Open Woodlands *Eucalyptus prava – E. caleyi – E. macrorhyncha*	Kings Plains	Good	672 ha
7 Communities associated with rock outcrops	**3 Reserves**	**Good**	**876 ha**
7.1 Severn Shrublands Eastern: *Calytrix tetragona – Leptospermum novae-angliae – Leucopogon neoanglicus* Western: *Melichrus urceolatus – Leucopogon melaleucoides – Cryptandra amara*			
	Kings Plains	Good	250 ha
	Severn River	Good	426 ha
7.2 Cypress Pine – Tumbledown Gum Woodlands *Callitris endlicheri – Callitris glaucophylla – Eucalyptus dealbata*	Kwiambal	Good	200 ha
8 Dry rainforest influenced	**2 Reserves**	**Good**	**723 ha**
8.1 Mixed Stands *Alphitona excelsa – Corymbia dolichocarpa*	Kwiambal	Good	523 ha
8.2 Semi-evergreen Vine Thicket *Ehretia membranifolium – Elaeodendron australe*	Planchonella	Good	200 ha
9 Other communities mainly of a derived nature	**3 Reserves**	**Very Poor**	**1466 ha**
9.1 Tea-tree Shrublands and Grasslands *Leptospermum brevipes – L. neo-anglica*	Severn River	Very Poor	782 ha
9.2 Windmill Grass Grasslands	Arakoola	Very Poor	534 ha
Chloris truncata – Sporobolus elongatus	Planchonella	Very Poor	150 ha

Communities

Nine communities have been formally listed as Endangered within the Inverell and Yallaroi Shires. Seven are listed under the NSW *Threatened Species Conservation* Act 1995: Brigalow, *Cadellia pentastylis* (Ooline) community, McKies Stringybark/Blackbutt Open Forests, the Howell Shrublands, White Box–Yellow Box–Red Gum Woodlands, Carbeen (*Corymbia tessellaris*) Open Forests and Semi-evergreen Vine Thickets. Two are listed on the Federal *Environmental Protection and Biodiversity Act* 2000, Bluegrass (*Dichantheum* spp.) dominant Grasslands and Grassy White Box Woodlands. Four of these, McKies Stringybark/Blackbutt Open-forests, Grassy White Box Woodlands, White Box – Yellow Box – Red Gum Woodlands and Semi-evergreen Vine Thickets have been captured within the five reserves.

30 vegetation communities were found within the five reserves (Table 2). Of these 16 were in poor or very poor condition and accounted for 5517 ha (28%) of the reserved area. 18 communities occurred on basalt, limestone or alluvial soil types, 15 of these accounted for 93% of all communities in poor or very poor condition. Of the 12 communities found on granite or sandstone soils only one was thought to be in poor condition. 26 communities were only captured within one reserve, with four being captured in only two reserves.

Discussion

Although the five National Parks & Wildlife Service reserves make up only 2% of the land area in the Inverell and Yallaroi Shires, they capture 62% of the total vascular flora, 56% of the listed rare or threatened vascular flora species, and four of the nine listed Endangered Ecological Communities. The 38% of species not captured within the reserve network were from all districts within the two shires but incorporated a larger proportion of species more common in the North Western Plains.

Occurrence however does not equate with adequacy, and many of the 30 communities are not sufficiently sampled or representative. Nine communities each cover an area of 50 ha or less, two of these cover less than 10 ha each and as such are unlikely to be self-sustainable in the long term. In terms of condition, 24% of the reserved land area and 60% (16) of all communities are poor or very poor. Thus, only 13 (43%) communities captured within reserves could be considered adequate in terms of area (more than 50 ha) and condition. In terms of duplication, only four (12%) communities were captured in two different reserves.

The condition of the communities within reservation is heavily biased in favour of assemblages occurring on poor soils such as acid volcanics or granite. Communities on these soil types accounted for 72% (9437 ha) of the reserve area but only 40% or 12 of the communities, with only one in poor condition. This is in contrast to the 18 communities (60%) found on basalt, limestone or alluvial soils which accounted for 5517 ha of the area (28%) of which only 632 ha (12%) was considered to be in good condition. Therefore, although communities on basalt, limestone and alluvial soils are found within the reserve network in the Inverell and Yallaroi Shires, their occurrence is not an indication of adequacy.

As sampling outside conservation reserves in the two shires is currently limited, this compilation could not compare the extent of communities outside the reserves to the extent within. Nor could quantitative comment be made on the number and type of communities that exist outside the reserve network. Thus, this discussion has a number of limitations, particularly in commenting on the comprehensiveness of community representation. It can be inferred, however, that the capture of communities in the current five reserves is inadequate. For example, the Ashford 1: 100 000 Map Sheet incorporates the Severn River NR and part of Kwiambal NP. Here Le Brocque and Benson (1995) describe 13 communities. Of these only seven are potentially synonymous with those listed here. As such, on a map sheet that includes much of the reserve network within the two shires, only about half of communities described have been captured. It is likely that within the Yallaroi Shire, where only 0.01% of the land area is within reserves, a far greater number of communities are not represented. The listing of Endangered Ecological Communities for the study area provides further evidence as only four out nine are within these formal reserves.

Conclusion

This compilation of information provides a preliminary picture — whether each community type or species is truly adequately represented needs more intensive investigations. However, this type of investigation does provide an insight into the overall formal reservation adequacy of the vegetation communities within the shires and shows the bias and potential inadequacy of current land acquisition. In particular, the information indicates that even if a community type is known to have its distribution within a conservation reserve, it may not be in good condition. The reservation status of assemblages and species within the two shires is likely to be inadequate. Measures are needed not only to provide a comprehensive sampling of assemblages and taxa, but also additional sampling of good quality representatives of many assemblages already represented.

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