MURRUMBIDGEE LANDCARE INC

CROSS-PROPERTY PLANNING BIODIVERSITY PROJECT

FLORA AND FAUNA SURVEYS

SEPTEMBER 2013

FINAL REPORT

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SUMMARY OF PROJECT BRIEF

As part of the Cross-Property Biodiversity Planning Project within Murrumbidgee Landcare Inc. (ML inc), 30 Flora and Fauna surveys were conducted throughout September 2013 on 24 separate farms across three broad Landcare Precincts of the NSW SW Slopes.

Alison Elvin was engaged to undertake the flora and fauna (excepting bird) surveys during the first two weeks of September 2013 (2-20 September) and the first week of October (20 September – 4 October).

Dr. Fiona Christie was engaged to undertake the formal bird surveys during two weeks in September 2013 (9-20 September) in the early morning and later afternoon.

The aim of the project was multi-purpose:

- to provide a snapshot of species diversity 'on farm' throughout the region;
- to provide farmers with information about the species found on their site, and the implications that may have for their on-going management of that site;
- to encourage continuing farmer participation in conserving biodiversity on their farm and across the broader landscape whilst not impacting on their farm productivity;
- to provide baseline flora and fauna information to the Office of Environment and Heritage (OEH) database, adding to the data available for scientific analysis;
- to help guide ML Inc's future Landscape Connectivity programs.

The Landcare / Cross-Property Planning Groups involved in the project are:

1. JUNEE AREA LANDCARE GROUP – divided geographically into Junee East/Bethungra, Junee West /Illabo, and Junee / Wantabadgery
2. KYEAMBA LANDCARE GROUP – includes Ladysmith, Book Book and Big Springs
3. HUMULA LANDCARE GROUP – includes Humula and Westbrook Rd.

A 'Night-stalk' information exchange was held for each of the three landcare groups in their local area during an evening during the survey period to explain the type of data being collected, and the various scientific methods for discovering arboreal fauna that may be living on their farm. Post surveys, another information exchange was held, one in each landcare area, to discuss and explain the survey results. Each participating farmer received a copy of the results for their farm, complete with photographs. The post-survey meetings also discussed the way forward into the future, prioritizing recommended strategies for continuing to increase on-farm bio-diversity.

OVERALL CONCLUSIONS

The findings overall are positive, especially in an intensively farmed landscape with recent catastrophic natural disasters – the millennium drought, intense storms and floods, and catastrophic wildfire. Since European settlement, many species once living in this region have become extinct, and today many other species are known to be declining; threatened with extinction; or critically endangered.

Despite such impacts, the surveys of 30 sites recorded
2 Threatened Ecological Communities with varying levels of disturbance
- Inland Grey Box tall grassy woodland communities – 3 farms
- Box-Gum Grassy Woodland communities, especially White &Yellow Box -9 farms

7 species of Threatened birds
- Superb Parrots, Varied Sittella, Flame Robin, Scarlet Robin, Brown Treecreeper, Grey Crowned Babblers, Diamond Firetail

90+ total species of birds (including 3 species of exotic birds)
154 species of native plants. (& 34 species of exotic plants, incl. noxious woody weeds).

Overall, 5 major vegetation communities were recorded –
Grey Box Grassy Woodlands, Box Gum Grassy Woodlands (BGGW), Dry Sclerophyll forests (usually dominated by Red Stringybark and Mugga Ironbark), River Red Gum Forests (along waterways), and re-vegetation areas. Although White Cypress Pines grew strongly in some sites, they were an integrated part of a BGGW.

For such a rapid, 'snapshot' survey, these are excellent findings within intensive farming landscapes.

The most striking correlation from the data is the strong relationship between the size of a vegetation remnant with high floristic and structural diversity, and the total number of declining bird species and Threatened bird species living there.
The larger and more ecologically intact the remnant, and the closer its' proximity to similar remnants, the higher the number of the smaller, insectivorous and nectarivorous woodland bird species. These birds are currently declining in the south-west slopes and tablelands, and it is most heartening to find them dominating these remnants. This finding is consistent with in-depth scientific research conducted throughout the region over recent decades.

Most of these large remnant sites are broadly classified as Dry Sclerophyll Forests (mostly Red StringyBark / Red Box / Mugga Ironbark Woodlands) growing on less fertile soils on the ridges and slopes, and merging into Box Gum Grassy Woodlands (BGGW) on the more fertile lower slopes. As the more fertile BGGW country has generally been cleared for farming, most remaining remnant BGGW's have less floristic and structural complexity, and are dominated by exotic grass and weed species. Such sites often recorded a high number of bird species overall, BUT few of these species were the declining insectivorous woodland birds. Instead, opportunistic and 'generalist' bird species dominated. These birds adapt well to the agricultural matrix surrounding them, and their numbers are not declining.

Another strong correlation was the relationship between mature River Red Gum Forest remnants along watercourses and the presence of numerous native bird species including the **Threatened Superb Parrot**, providing sufficient tree hollows and flowering eucalypts were available, irrespective of the overall diversity of flora and structure. Most of

these sites were dominated on the ground by exotic grasses and weeds. The declining woodland bird species were rarely observed in these sites.
These correlations are made clear in Dr. Christies' Bird Survey Findings, (pg. 17) and in the Table of Survey Findings on pg. 6.

The shape, age and connectivity of re-vegetation areas also affected the suite of bird species living there, with long, linear sites not inter-connected with larger remnants recording the most common birds, some exotic species, and many Noisy Miners (an aggressive native bird that out-competes woodland birds for territory).

Most vegetation communities with the least floristic diversity and medium to low structural complexity had plentiful **Noisy Miners** and exotic birds such as Starlings and Sparrows, as well as the opportunistic and generalist native birds. Such bird species tend to prevent the declining, and often threatened, species of woodland birds from establishing their territories in these sites.

Significant efforts have, and are, being made by farmers to link-up remnant and re-vegetation areas with other remnants and mature paddock trees, both throughout their own farm and across into neighboring farms, increasing the overall landscape connectivity without adversely impacting on their productivity.

Another encouraging finding were the number of farmers conserving their tree hollows, their dead standing trees, and the litter of woody debris and large fallen timber, providing critical habitat for local animal species

The enthusiasm and vision of the participants of this project is very heartening, and bodes well for the continued conservation of the flora and flora living on and around their farms.

SURVEY FINDINGS - Patch size, Vegetation type, No's of native Flora sp., Structural complexity

SITE	Fire	Veg Type	Complex structure	Patch Size Ha	Threatened Bird species /Other	Native Veg Species	Total Bird Sp + Miners	Exotic G' cover
TE 1	No	Dry Sclero	High	19	1sp	20sp	21sp	
RD 1	No	Dry Sclero	High	42.3	3 sp	29sp	20sp	
MP1	No	River Red	Medium	13	1sp	6sp	20sp	H
OW 1	No	WBox/Cypress	High	40	1sp	30sp	14sp	
DT 1	No	Dry sclero	High	18	2 sp	14sp	19sp	
BS 1	No	Dry Sclero	High	70	1 sp	30sp	21sp	
PL1	No	RRG/reveg	High	4.3	1sp	14sp	22sp	M
ACH 1	No	River Red Gum	High	30	1 sp plus Superb P	5sp	19sp 6M	M
TJ1	Yes	Grey Box	High	40	1 sp	26sp	10sp17M	M
CJG 1	No	Dry Sclero	High	14	ApostleBird	25sp	17sp	
RD 2	No	Dry Sclero /Box-Gum	High	26.2	0	18sp	18sp	
XC1	Yes	River Red	High	15	Superb P	3sp	21sp	H
TM 1	No	BoxGum	Low	9	Superb P 2 Raptors	21sp	18sp	H
TK 1	No	Old reveg	High	5	0	12sp	19sp	H
TK2		Box-Gum	Medium	13	0	17sp	10sp	M
LM 1	No	Box-Gum	High	4.3	Superb P	15sp	17sp	
ACH2	No	Box-Gum	Medium	10	4 waterbirds	8sp	17sp 5M	M
SK 1	Yes	Reveg -BoxGum	Medium	2.6	0	13sp	16sp 4M	M
PD1	No	BoxGum	Medium	8	Superb P	23sp	17sp 4M	M
ARH1	Yes	Reveg	Low	4.2	Superb P	6sp	10sp	H
ARH2	Yes	Saline Reveg	Medium	2.1	0	5sp	10sp	
PMD 1	?	Reveg	Medium	2	Superb P	15sp	13sp 5M	M
JH 1	Yes	GrBG / RRedG	Medium	3.3	Superb P	9sp	14sp 6M	H
JH2.	Yes	BoxGum /reveg	Medium	1.2	Superb P	15sp	20	H
GR 1	No	GrBox/Cypress	Low	5	Superb P	2sp	11sp10M	M
FLR 1	No	BoxGum	Medium	2.9	Superb P	21sp	12sp 1M	M
BM1	Yes	RRed Gum	Medium	2.9	2Raptors Superb P	3sp	17sp 5M	H
BM2	Yes	BoxGum	Medium	3.6	Superb P	9sp	10sp 2M	H
SB 1	No	Reveg	Low	1	0	6sp	13sp 1M	H
KPC 1	No	Reveg BoxGum	Low	1	2 waterbirds	9sp	11sp	H

NOTE

- **The remnant patch sizes** are derived from maps of the area, not on-ground truthing – some of the patches may be larger than the area reported here
- **In the column for % of Exotics, H** represents greater than 80%, **M**edium is 40%-80%, **L**ow is 20%-40%. **No mark in the column indicates <20% of exotics**
- **'Complex Structure'** refers to a number of overall features on-site – a mixture of tree and shrub ages; the presence of mature trees; woody debris; fallen logs; ground cover diversity and ground 'roughness'.
- **'Fire'** refers to the Junee firestorm of 2006**.**
- **'M' (**in the Total Number of Birds column) refers to **Noisy Miners** at each site.

EXPLANATION OF TERMS USED IN THIS REPORT

FORBS – these are the plants that grow (usually) in amongst grasses, sedges and rushes, that do not have woody stems.

GROUND-COVER SPECIES – refers to all grasses, sedges, rushes and forbs that create the lowest –growing canopy over the ground except for the Cryptogams.

CRYPTOGAMS – These are a large group of organisms that live on the surface of soils in drier areas, forming a living 'crust'. Some of these organisms are microscopic – the cyanobacteria, green algae and a large suite of fungi species – while many others are readily seen, including lichens, mosses and liverworts. These live together in a complex web of inter-connection and inter-dependence that also binds them to the soil surface.

Regular trampling by humans and hard-hoofed domestic animals breaks the crust, and can ultimately destroy it, as can land-clearing, chemical pollution from fertilizers and herbicides.

While living soil crusts are not found in wetter environments where there is a relatively deep leaf litter and a dense over-story, many of the drier areas of the SW slopes have extensive soil cryptogams in their grasslands and grassy woodlands.

WHY ARE CRYPTOGAMS IMPORTANT?

- **REDUCE WATER AND SOIL EROSION** by providing a barrier between the particles of soil, and water droplets and wind. These living organisms, although generally very small, create a 'rough' micro-surface on the soil that slows-down the flow of surface water

- **PROVIDE PATHWAYS FOR WATER TO ENTER THE SOIL –** By slowing down the flow of surface water, Cryptogams assist with its' percolation into the soil, providing pathways for the water to enter the soil beneath.

- **Cryptogams PROVIDE ESSENTIAL NUTRIENTS** for the soil, especially organic carbon, critical in helping bind particles of soil together. Cryptogams in the form of cyanobacteria are one of the largest sources of available soil nitrogen, as they can 'fix' atmospheric nitrogen, ultimately making this nitrogen available for larger plants.

- By reducing the erosive power of wind and water, retaining a film of moisture, and providing the soil with valuable nutrients, the cryptogams **CREATE A MICROCLIMATE ON THE SOIL SURFACE** in which seeds can germinate and seedlings can flourish. This in turn provides food, shelter and habitat for invertebrate animals, allowing a more complex food chain to become established**.**

This information has been adapted from an excellent book on the subject -

"A Practical Guide to Soil Lichens and Bryophytes of Australia's Dry Country"
David Eldridge and Merrin E. Tozer, 1997, Published by DLWC (NSW Govt Department)

FORMAL BIRD SURVEY - the survey undertaken by bird expert Dr. Fiona Christie early in the morning or late in the afternoon, using the standard 20minute survey procedure.

QUADRAT - the designated area (50m x 20m in these surveys) that is intensively surveyed for flora and fauna species within the overall survey site.

TRANSECT – in these surveys, this was a cross-section of 50m length, whereby the flora, litter layer, cryptogams, rocks, woody debris and anything else of significance was recorded every 50cm along the 50m length.

REMNANT – any area of native vegetation - usually but not always this refers to areas never fully cleared, although they may have been significantly altered. However, some areas that have been previously cleared and have regenerated can also be considered as viable remnants.

THREATENED SPECIES – This is a ranking given by the scientific community to flora and fauna species that are considered to be at risk of extinction within the next 25 years, if habitat degradation continues unabated. Within the umbrella term "threatened", there are two sub-categories –

- species who are **Critically Endangered** – this means they are at risk of immediate extinction
- species who are **Vulnerable** – this means that, if the processes threatening their survival are not constructively addressed, they could be extinct within 25 years.

NOTE – Every bird species recorded as Threatened in these surveys is currently listed as Vulnerable.

Each State has legislation to protect every species listed as Threatened – in NSW, this is the *Threatened Species Conservation Act 1995.* Additionally, the Commonwealth EPBC Act - *Environmental Protection and Biodiversity Conservation Act 1999* provides an overarching framework to protect and conserve threatened species and vegetation communities.

THREATENED ECOLOGICAL COMMUNITIES
These are entire vegetation communities considered to be so threatened by human activities that their very existence is now under threat of extinction. They are protected by both State and Federal laws, and the most appropriate description comes from the Department Of Environment and Heritage website - www.environment.nsw.gov.au/threatenedspecies. It is quoted in part below:

Threatened ecological communities

www.environment.nsw.gov.au/threatenedspecies

"Ecological communities are groups of plants and animals that occur together in a particular area. Any given ecological community may be distinguished from others by its set of characteristic species and the area in which it occurs. Ecological communities are complex, so correct diagnosis often requires specialist advice. The places they occur are typically characterized by a set of environmental conditions that define their suitable habitats. For example, the soil types, landforms and climatic conditions of a particular area.

What is a threatened ecological community?

The NSW Threatened Species Conservation Act 1995 (TSC Act) defines an ecological community as 'an assemblage of species occupying a particular area'. Ecological communities can be listed under the TSC Act as critically endangered, endangered or

vulnerable, depending on their risk of extinction.
An ecological community may be considered threatened under the Threatened Species Conservation Regulation 2010 for one of three main reasons

its distribution has been significantly reduced
its distribution is so restricted the whole community is susceptible to significant threats
the ecological function of the community is undergoing a significant decline

Reductions in distribution are typically related to historical and/or current clearing for development.

Distribution may also be restricted through naturally rare environmental conditions that are essential to the community.
Declines in the ecological function of a community may result from change in community structure, change in species composition, disruption of ecological processes, invasion and establishment of exotic species, habitat degradation or fragmentation.
Consequently, many ecological communities have been cleared or degraded to such an extent that only a small amount of their original area resembles or functions in its natural state.

Why identify and manage threatened ecological communities?

By listing an ecological community as threatened, all component species of that community are also protected. This approach enables a more efficient use of limited resources than the single-species approach. It also overcomes bias towards charismatic species, protects both undiscovered species and the biological processes critical to maintaining a healthy environment.

What about degraded sites?

Human activities, fire, and invading weeds and pests have modified much of the natural environment in NSW. Threatened ecological communities are often highly fragmented and most remnants show evidence of disturbance and degradation to varying degrees.
The degree can be influenced by

the size of the remnant
invasion by pest animals and weeds
fire frequency and intensity
chemical disturbances of the soil surface by water and nutrients from urban run-off, and
physical disturbance from infrastructure construction and recreational use

However, the retained values of such remnants are often highly context-dependent. For example, smaller remnants may be in better condition and display greater resilience to future threats compared to some larger remnants.

A remnant can be part of a threatened ecological community with or without trees. Trees may be present as a canopy with little visible native ground-layer, or characteristic tree species may have been removed, leaving only the ground-layer component of the ecological community.

Degraded areas of native vegetation may still retain considerable conservation value. They may provide habitat critical to the survival of native plants and animals including threatened species. Such areas can often be rehabilitated and contribute to the recovery of the threatened ecological community.

Individual trees may provide an important resource to threatened animals, which are part of the ecological community. For example, large older trees may support a diverse and abundant array of insects and the animals that feed on them. They often have numerous hollows, cracks or fissures that provide shelter and nesting sites. Or they might act as 'stepping-stones' for fauna moving between larger, more complex remnants across an otherwise cleared landscape. Standing dead trees also provide critical shelter for fauna. In many landscapes, these important habitat resources are now more common in the form of isolated trees rather than in patches of vegetation."

NOTE - There are two Threatened Ecological Communities surviving in these survey regions – the White Box Yellow Box Blakely's Red Gum Woodland, and the Inland Grey Box Woodland.

THREATENING PROCESSES These are activities and events that threaten the conservation, and indeed in some case the very existence, of a species or ecological community. These processes are listed from the OEH website in Appendix 4 of the Flora and Fauna report

PROJECT METHODOLOGY

HOW WERE SURVEY SITES SELECTED?

Members of the three Landcare groups who had participated in previous cross-property planning activities were contacted about becoming involved in this survey project, and there was an enthusiastic response.

Survey sites were chosen on the basis of the farmers' nomination of a 2ha+ site on their farm they believed had the best bio-diversity values, whether it is a remnant, re-vegetation corridors, or both.

This approach values local knowledge, the farmers being best placed to know which part of their property was most appropriate for these time-limited surveys.

A number of farmers had difficulty choosing just one site, so in the spirit of scientific curiosity and furthering partnerships, two sites on 6 farms were surveyed, resulting in a total of 30 site surveys on 24 separate farms.

SEASONAL CONDITIONS

Early spring, when the surveys were conducted, often includes observations of migratory birds, as well as the nesting activities of many species. Similarly in the plant world, many species are appearing after their winter dormancy, especially the grassland and woodland forbs. Thus springtime provides the opportunity to potentially identify the greatest range of flora and fauna in the area.

However, weather conditions in September 2013 were unusual; ranging from well-above average temperatures with gale force winds, to well below average temperatures, heavy rain at times, and cold southerly winds, and only one week of average weather conditions. Such weather could have influenced the emergence of winter-dormant native forbs (such as orchids and lilies), the emergence of reptile species, and the flowering of the Eucalypts and Wattles, which are major food sources for many bird and mammal species.

The rapid flora and fauna assessments of each site, together with the variability of the weather throughout the survey period, influenced the data collected, ensuring this baseline data simply provides a snapshot of each site in this particular season in this point in time.

SIZE AND SHAPE OF SITE

2ha of native vegetation, either remnant or planted, was the minimum size required for the survey. Although the shape as well as the size of a remnant is a well-known predictor of biodiversity, it was decided prior to undertaking the surveys that site shape would not be a priority, as it may prevent participation by farmers with 'undesirable' site shapes.

LIMITATIONS OF METHODOLOGY

The final analysis of the data is affected by variables such as inconsistent site shapes (rectangular, square, round, narrow, wide, etc.); 5 different vegetation communities across the survey areas; differing farming practices; variable connectivity; and differing soil types, altitude and aspect.

Due to time constraints, no formal nocturnal faunal surveys were undertaken on any sites, nor small mammal trapping carried out.

Further, a 2ha bird survey for 20 minutes captures many bird species living in and near the site in that season, but not all species. Similarly, an intensive Flora and Fauna survey over a small 50m x 20m quadrat and 50m transect details only the species found within that small patch, on that day, in that season, not all possible species living there year-round.

Nonetheless all current research concludes that the bird species present on the day are reliable indicators of the ecological health of the site, and its' structural and biodiverse integrity.

BIRD SURVEYS – DR FIONA CHRISTIE

Bird Surveys of 20-minute bird duration in the early morning and late afternoon were conducted across each nominated 2ha. Site. Dr. Christie recorded all birds heard and/or sighted, and noted any nests or other relevant information. Weather conditions for these surveys varied from hot to very cold, very wet to dry with gale force winds.

FLORA AND OTHER FAUNA SURVEYS – ALISON ELVIN

Within the 2ha site chosen for bird surveys, a smaller quadrat of 50m x 20m was chosen within which all visible flora and fauna were identified and assessments of groundcover, structural complexity and land-use impact made. A further, more intensive assessment of ground-cover condition was made by recording litter layer, bare ground, cryptogams (includes mosses and lichens), native and exotic plant species, fallen timber and twigs every 50cm of a 50m transect that bisected the 50m x 20m quadrat.

GPS recordings were made within each 2ha site, within each quadrat, and at the beginning of each transect, and all species observed on the day, at the time, were recorded and identified. Records were also made of the presence of hollow-bearing trees and logs, the approximate girth of the trees (providing an estimate of tree age), general soil type, aspect of the site, rocky outcrops or boulders, and current and present land-use activities.

Cryptogams including Moss colonising bare ground in an older revegetation site

Lichens colonising granite boulders

Large fallen hollow bearing logs in a River Red Gum / Blakely's Red Gum Forest

Smaller hollow-bearing logs in a BGGW remnant

Patches of bare gorund, fungi, Sundews, grass seedlings and scattered twigs

Bare ground being colonised by Australian Stonecrop

The spreading native groundcover, Kidneyweed, found on numerous sites

Scattered Leaf litter covers some of the bare ground

Climbing saltbush thrives with the protection of leaf litter mulch and a fallen branch

A smaller tree hollow in a Box Gum Grassy Woodland remnant that was previously burnt.

Any other characteristic features of the site and its surrounding landscape were also noted, together with relevant information provided by the farmer.

To further engage the community, and promote on-farm bio-diversity conservation, each of the three landcare groups were invited to a 'Nightstalk' event in their local precinct area. At each event, Fiona Christie instructed interested farmers into the setting-up and recording operations of a night camera and video, together with how to set-up specific traps to capture, record and release small mammals. Each group will then be provided access to a camera from Murrumbidgee Landcare Inc, and be encouraged to set them up and record the nocturnal creatures on their farm.

Mason Crane from ANU spoke about his long-standing research throughout the area, monitoring arboreal mammals, reptiles and birds, including monitoring the nesting boxes he has setup in specific sites across the region.

Alison Elvin spoke about the project overall, the range of data being recorded at each survey site and why such data helped gain further insights into the ecological processes taking place across the landscape. The 'snapshot' characteristic of the survey methods and timing was emphasized, together with its' general value in adding to an already existing body of knowledge about the flora and fauna of the NSW SW Slopes.

Analysis of the data collected during these surveys will contribute to the on-going knowledge base driving the funding decisions to assist the farmers in the cross-property planning groups to continue with their efforts to re-connect their landscapes.

SUMMARY OF PROJECT FINDINGS

1. Bird Survey Results – Dr. Fiona Christie

Murrumbidgee Landcare Preliminary Bird Report – Dr. Fiona Christie

General Findings

Thirty diurnal bird surveys were carried out on 24 different properties in the Murrumbidgee Landcare area (Junee/Humula/Kyeamba). A total 1099 individuals and 90 species of bird were detected during surveys at 30 locations in the (Appendix 1). On average of 15 species were detected during each 20 minute survey (range 8-21 species) with a range of 8-21 species.

The five most abundant species were the White-plumed Honeyeater (*Lichenostomus penicillatus,* 7.1% of observations), Noisy Miner (*Manorina melanocephala,* 6.3%), Australian Magpie (*Cracticus tibicen*, 5.4%), Galah (*Cacatua roseicapillus*, 4.7%) and White-winged Chough (*Corcorax melanorhamphos* 3.8%). Thirteen species were only detected once, including the Apostlebird (*Struthidea cinerea*), Black-shouldered Kite (*Elanus axillaris*), Brown Songlark (*Cincloramphus cruralis*), Collared Sparrowhawk (*Accipiter cirrocephalus*), Dollarbird (*Eurystomus orientalis*), Horsefield's Bronze-Cuckoo (*Chrysococcyx basalis*), Peregrine Falcon (*Falco peregrines*), Red-kneed Dotterel (*Erythrogonys cinctus*), Restless Flycatcher (*Myiagra inquieta*), Sacred Kingfisher (*Todiramphus sanctus*), Spotted Dove (*Streptopelia chinensis*), White-necked Heron (*Ardea pacifica*) and White-winged Triller (*Lalage sueurii*).

Parrots accounted for the greatest number of detections with Waterbirds (e.g. Grey Teal (*Anas gracilis*) and White-necked Heron (*Ardea pacifica*)) and Raptors accounting for the fewest (Figure 1).

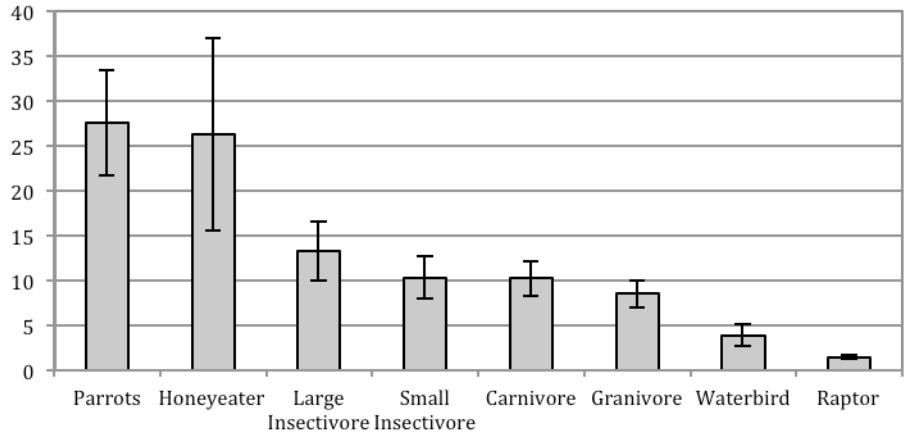


Figure 1: Mean abundance of the primary bird groups detected during surveys. Error bars represent the standard error of the mean.

Signs of Nesting

A number of species were observed nesting, including White-faced Heron(*Egretta novaehollandiae*), White-winged Chough, Grey Shrike-thrush (*Colluricincla harmonica*), Galah(*Cacatua roseicapillus)*, Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), Little Corella (*Cacatua sanguine*) and the Striated Pardalote (*Pardalotus striatus*). Common Starlings and Little Corellas were observed nesting in a number of

isolated paddock trees or mature stags on the edge of remnants. House sparrows were also observed nesting in hollows of large stags. White-faced Herons were observed in mature Red Gum spp. White-winged Choughs built their mud nests in a number of tree species, including White Box (*Eucalyptus albens*), Red Gum (spp.) and White Cypress Pine (*Callitris glaucophylla*). While Striated Pardalotes often nest in tree hollows, they were nested in an excavated tunnel in the eastern side of a dry creek bed (John Hopkins site)

Nocturnal Species

Only two nocturnal bird species were detected (Barn Owl, *Tyto alba* and Southern Boobook, *Ninox novaeseelandiae*). Both species was observed at night as an incidental observation. The scarcity of nocturnal species detected is not surprising as no nocturnal surveys were carried out.

Exotic species

Three introduced species were also detected. These were the Common Starling (1.6%), House Sparrow (0.4%), and Spotted Dove (0.01%).

Threatened Species

Seven threatened species were detected including the Grey-crowned Babbler, eastern subspecies (*Pomatostomus temporalis temporalis*), Scarlet Robin (*Petroica boodang*), Flame Robin (*Petroica phoenicea*), Superb Parrot (*Polytelis swainsonii*), Brown Treecreeper, eastern subspecies (*Climacteris picumnus victoriae*), Varied Sittella (*Daphoenositta chrysoptera*) and Diamond Firetail (*Stagonopleura guttata*). All of these species are listed as *Vulnerable* in NSW under the Threatened Species Conservation Act (1995) (Figure 2). The Crested Shrike-tit (*Falcunculus frontatus*) was also detected. This species is listed as Secure for NSW however subspecies elsewhere in Australia are listed as Endangered and Near Threatened.

Superb parrots were the most abundant threatened species accounting for 3% of all observations and they were detected in 30% of all surveys. They were commonly observed in sites with mature hollow bearing trees, typically box-gum woodlands and river red gum habitats.

The least commonly observed threatened species were the Flame Robin, Scarlet Robin, Diamond Firetail and Varied Sittella. The Flame Robin (Red Stringybark) and Varied Sittellas (River Red Gum) were detected in one survey only. The Scarlet Robin and Diamond Firetail were each detected during two surveys.

Noisy Miners

Noisy Miners (*Manorina melanocephala*) although a native species have become recognised as species which threatens the persistence of other species. Research has suggested that the presence of this species has a negative effect on the richness and abundance of other woodland bird species. Sixty seven individuals were observed during 12 surveys.

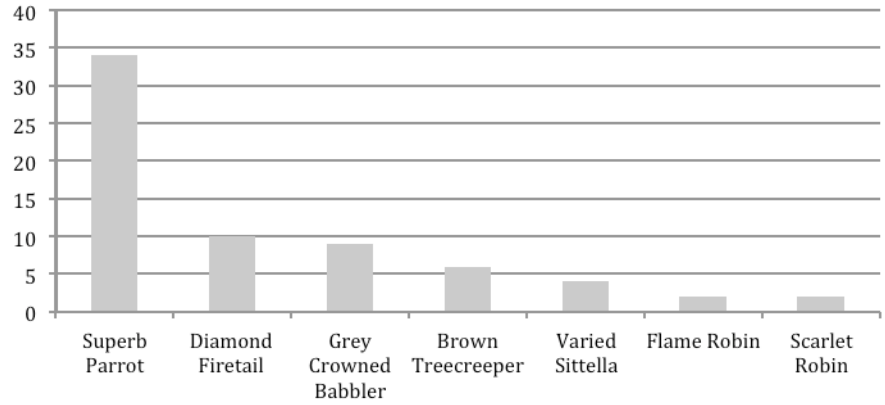


Figure 2: Total abundance of threatened species detected during surveys

Hollow Nesting Species

Fifteen hollow nesting species were detected (Figure 3) and represented 25% of all observations. While most of these species are exclusive hollow nesters, others such as the House Sparrow, Australian Wood Duck (*Chenonetta jubata*) and Striated Pardalote (*Pardalotus striatus*) often use alternative nesting sites. For example Striated Pardalotes were observed during surveys nesting in tunnels in the eastern bank of a creek. Two threatened hollow nesting species were observed, Superb Parrots and Brown Treecreepers.

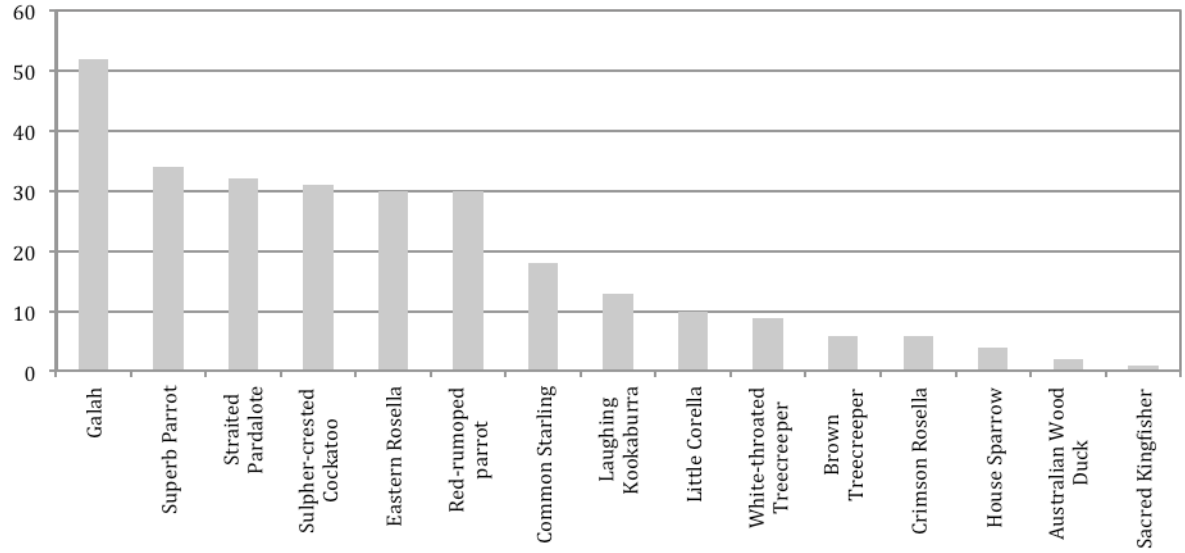


Figure 3: Total abundance of hollow nesting species detected during surveys.

Relationships with vegetation type

Although nine vegetation types were surveyed a lack of replication of vegetation types prohibited the use of many statistical analyses. However in general the fewest species were detected in Western Grey Box-Tall Grassy Woodlands, Blakleys Red Gum and Yellow Box woodland and Revegetation sites. The greatest number of species was detected in Mugga Ironbark sites (Figure 4) with 21 species being recorded at one site. The lowest number of species (8) was recorded at Red Stringybark-Red Box site, although the adverse weather conditions at the time of the survey may have contributed to this low value. Abundance also varied across vegetation types with the lowest abundance recorded in White- Box/White Cypress and the greatest abundance in River Red Gum sites and also Mugga Ironbark sites although with much greater variance (Figure 5).

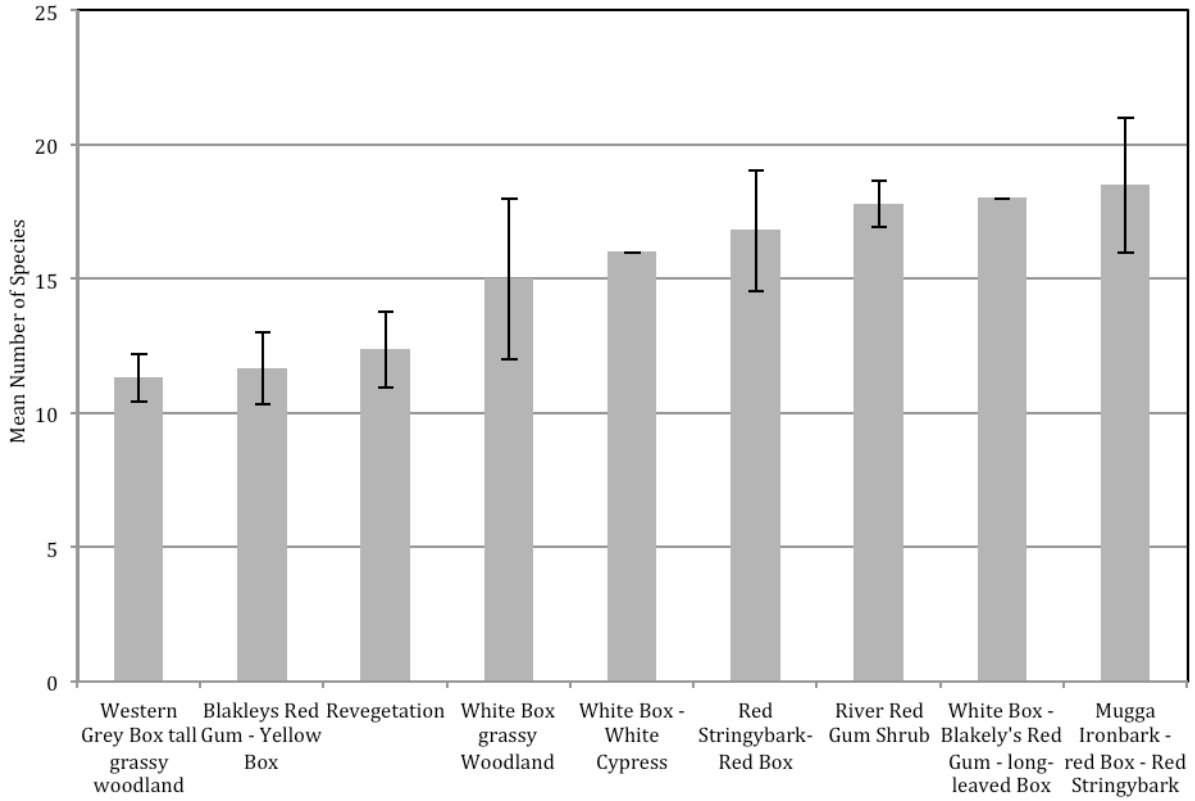


Figure 4: Mean number of species detected within each vegetation type. Error bars represent the standard error of the mean.

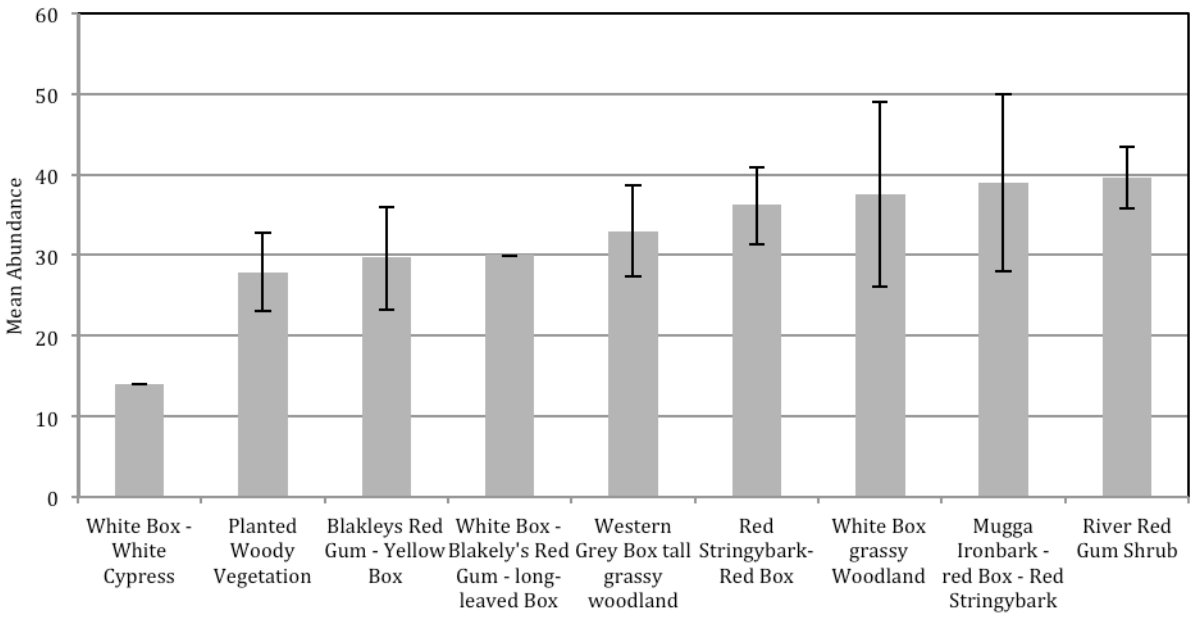
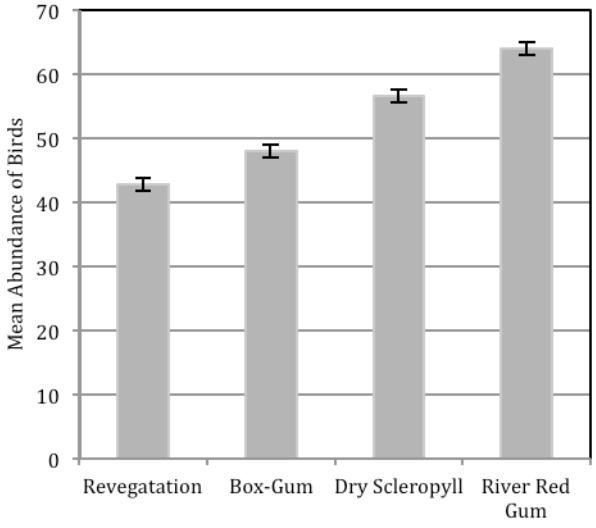


Figure 5: Mean abundance of species detected within each vegetation type. Error bars represent the standard error of the mean.

For more rigorous analysis vegetation types were grouped into broader vegetation communities to investigate responses of birds, more details further below. Each site was assigned to one of four broad vegetation groups for analysis of avian community composition. The four broad veg types were:

- Dry Sclerophyll – rocky ridges and slopes
- River Red Gum – riparian zones
- Box-Gum – Box and Gum woodlands
- Revegetation - any revegetation irrespective of new or enhancement plantings.

These new vegetation groups were used to investigate the differences in bird species richness, bird abundance and assemblages of the bird communities in relation to vegetation type. Waterbirds and nocturnal birds were removed from the dataset for this analysis. Within these vegetation groupings there were significant differences in the abundance of birds. Revegetation areas had significantly fewer birds than both Dry Sclerophyll forests and River Red Gum. There was no difference in abundance of birds between Revegetation areas and Box-Gum vegetation types (Figure 6a & b). Species Richness also differed between vegetation types. Revegetation sites and Box-Gum sites had very similar species richness however Dry Sclerophyll and River Red Gum sites had a significantly greater number of species than the Revegetation and Box-Gum sites. Although the abundance and species richness of birds in Dry Sclerophyll and River Red Gum forests were similar the composition of these assemblages were different (detailed below).



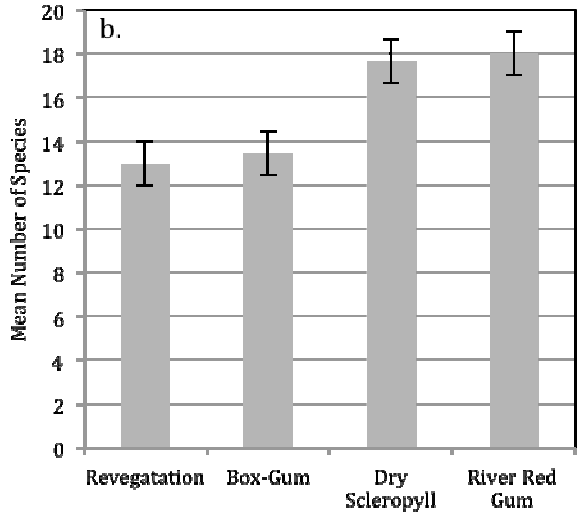


Figure 6: Mean abundance of birds detected in each vegetation type (a.); Mean number of species detected in each vegetation type (b.). Error bars represent the standard error of the mean.

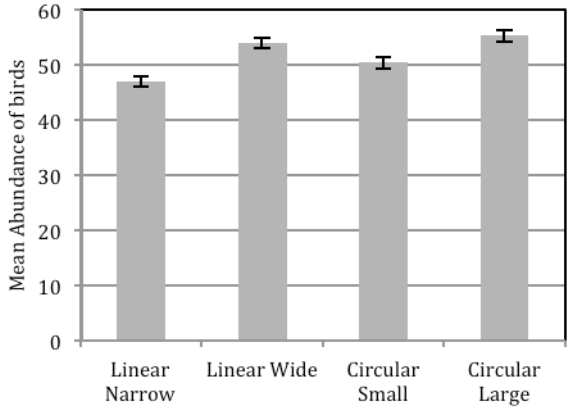
Relationships with vegetation configuration

To try and determine how remnant configuration may have influenced patterns in bird species richness and abundance, each remnant was assigned to one of the following configuration classes:

1. Linear Narrow – less than 150m wide at widest point
2. Linear Wide – wider than 150m at narrowest point
3. Circular Small – less than 15 ha
4. Circular Large – greater than 15ha

There were significant differences in the abundance of birds between the remnants of differing configurations. Large circular shaped remnants and wider linear remnants had a significantly greater abundance of birds than small and narrow remnants (Figure 7a & b).

7a.



7b.

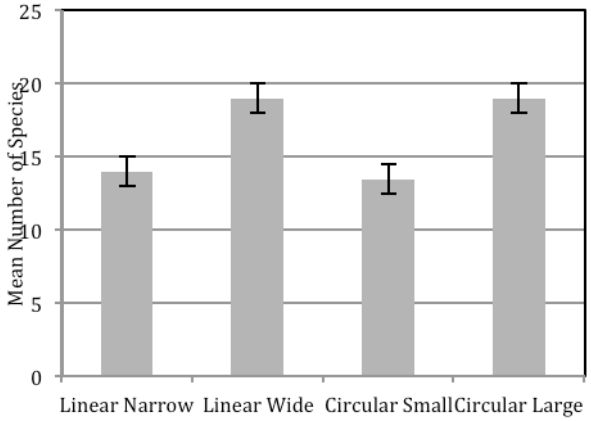


Figure 7: The mean abundance of birds detected in each remnant configuration (a.); Mean number of species detected in each remnant configuration (b.). Error bars represent the standard error of the mean.

Relationships with Remnant Area

Using ArcGIS software and digital vegetation layers, the area (in hectares) of each remnant surveyed was estimated. This data was used to investigate the relationship between the area of the remnant and the number of bird species. There was a positive relationship between remnant area and the number of species, with 55% of the variance in the species data explained by the independent variable (remnant area). Remnants of less than 20 ha typically supported fewer species than larger remnants (Figure 8). The large number of smaller sized revegetation areas and the large remnants being dominated by dry sclerophyll vegetation types are driving much of this relationship.

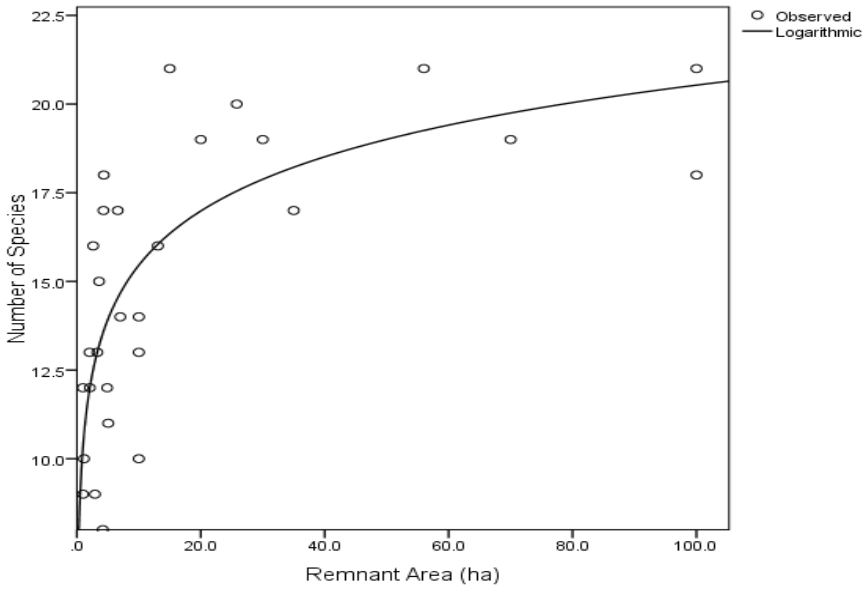


Figure 8: Relationship between remnant area and bird species richness

Effects of remnant attributes of bird community composition

Bird Communities and Vegetation Type

There were significant differences in the species of birds that were found in the different vegetation types (Figure 9). On this figure each site is represented by a coloured dot. The closer in space the sites are to one another the more similar their bird communities are. The further away the sites are from one another the more dissimilar the sites are. Most significantly, Dry Sclerophyll bird communities were very different from bird communities in all other vegetation types. Sites that had undergone revegetation were also different from all other vegetation types.

Dry Sclerophyll sites were more likely to support a diverse suite of smaller insectivorous and nectarivorous species such the White-throated Treecreeper, Brown-headed honeyeater, Grey Fantail, Buff-rumped Thornbill, Rufous Whistler, Weebill, Western Gerygone, Eastern Yellow Robin and Striated Thornbill. These are typical of the species that have been undergoing decline in parts of Australia.

Sites where revegetation works had been conducted at some stage were dominated by bird species that regularly utilize the surrounding agricultural matrix. For example, Rufous Songlark, Pied Butcherbird, Grey Butcherbird, Willie Wagtail, Common Starling, Grey Butcherbird, Australian Magpie and Australian Raven. While these species were often present in other remnant types they were observed in greater numbers in revegetation areas. This composition of species is likely due to the configuration of most revegetation works (linear) and their proximity to agricultural land. Many smaller insectivorous species such as Weebills and Robins were generally absent from these vegetation types.

River Red Gum and Box-Gum sites did not support a distinct assemblage of birds from one another.

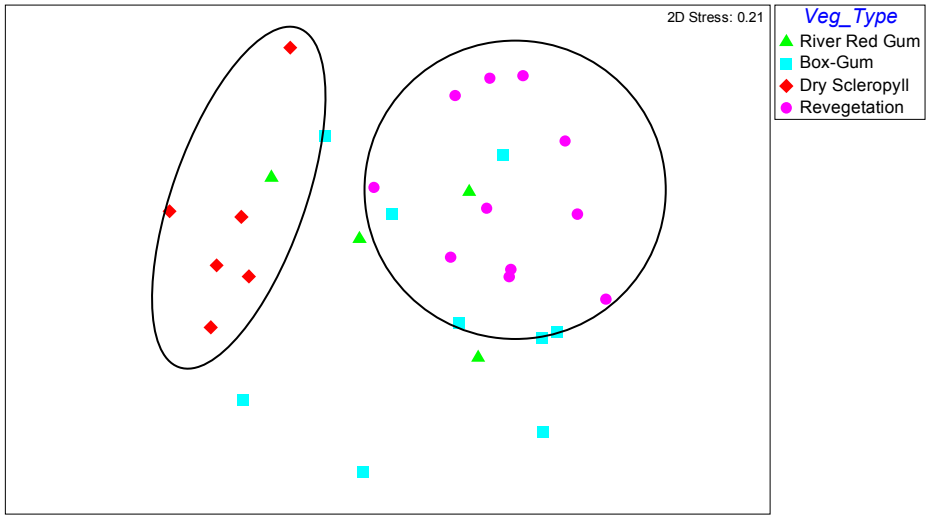


Figure 9: Spatial representation of sites which were surveyed in each vegetation type. Sites in circles represent those with bird communities which are significantly different from other communities.

Bird Communities and Remnant Configuration

As mentioned above sites were categorized very simplistically based on their configuration. Large remnants, which were more circular than long, supported a significantly different bird community compared to small circular and narrow linear remnants (Figure 10). The bird communities were not different between narrow wide and circular large remnants, however there were only two sites that were classified as narrow wide. Larger, circular remnants supported a greater abundance of a number of species than both smaller circular and linear narrow remnants. These included: White-throated Treecreeper, Grey Fantail, Grey Shrike-thrush, Rufous Whistler, Weebill, Buff-rumped Thornbill, Western Gerygone and Brow-headed Honeyeater. Small and linear narrow remnants tended to support a greater number of Galahs, Rufous Songlarks, Sulphur-crested Cockatoos and Noisy Miners.

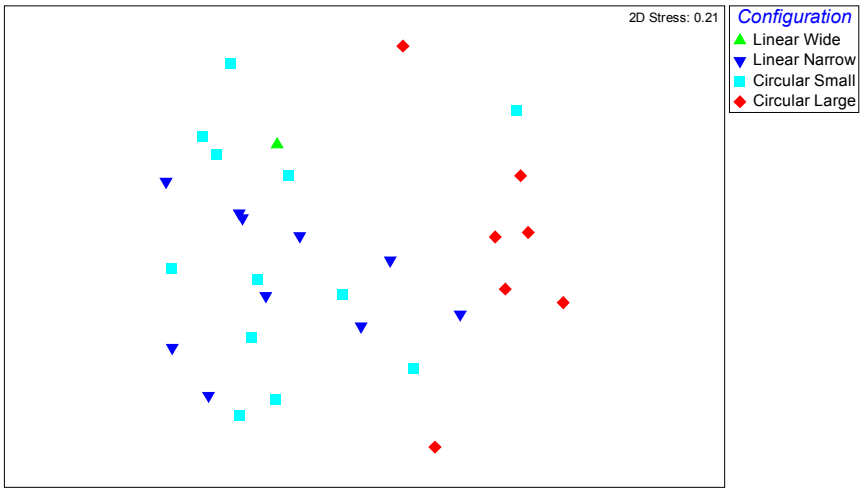


Figure10: Spatial representation of sites which were surveyed in each remnant configuration. Large Circular remnants supported a significantly different bird community to other remnant configurations.

Bird Communities and Remnant Area

Each site surveyed was categorized based on the area of the remnant into one of three categories; Small (0.9 – 9 ha), Medium (10 – 29 ha) and Large (30-100 ha). These size

classes were used to investigate potential effects of remnant size on bird community composition. These analyses revealed that remnants of small area had a significantly different composition of birds than both medium and larger sized remnants (Figure 11). Not surprisingly small remnants tended to be dominated by species that were more tolerant of the surrounding agricultural matrix and the opportunistic species this supports. These species tend to be larger bodied (Parrots, Magpies, Ravens) with the exception of the Willie Wagtail and the Striated Pardalote which did not show a preference for larger remnants. The Spotted Pardalote, however was not observed in smaller remnants.

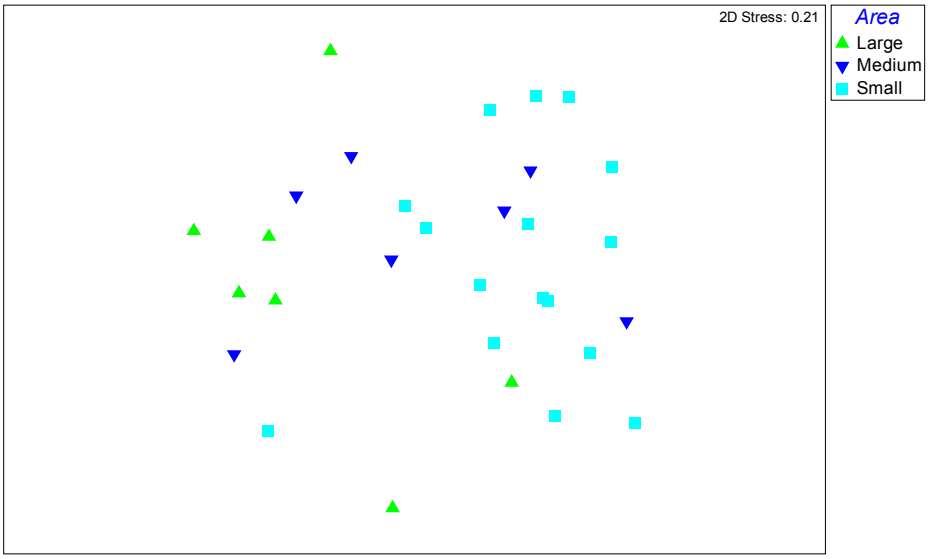


Figure 11: Spatial representation of sites which were surveyed in each remnant area. Small remnants supported a significantly different bird community to other remnant configurations.

In Summary

- Diverse suites of woodland birds, with a number of threatened species, were detected.
- Smaller remnants supported fewer woodland dependent species and supported a greater number of opportunistic species and those that are tolerant of the agricultural matrix.
- There is a strong positive relationship between remnant area and species richness.

NOTE –

The complete list of bird species recorded during the formal bird surveys can be found in APPENDIX 2 of this report.

SUMMARY OF PROJECT FINDINGS

2. Flora and Fauna findings.

VEGETATION COMMUNITIES

The following vegetation communities were identified across the survey region– Threatened Box-Gum Grassy Woodlands, (BGGW and includes White-Box woodlands); River Red Gum Forests; Dry Sclerophyll Forests; the Threatened Grey Box Grassy Woodlands; and Re-vegetation areas. Each community has experienced varying degrees of disturbance since European settlement, and each farmer is managing their remnants and re-vegetation areas differently.

In the re-vegetation areas surveyed, species common to the Box-Gum Grassy Woodlands once growing in the region have generally been re-planted in the re-vegetation areas. All the re-vegetation sites are linear, of varying lengths, and all but one are connected to other re-vegetation rows across the farm and into the broader landscape.

The stepping-stones of connectivity provided by both isolated and scattered mature Paddock Trees (mostly Box-Gum Eucalypt species, with occasional White Cypress Pines) were found to be within a few 100m of every re-vegetation site surveyed. These paddock trees were generally noted to contain hollows, a positive feature potentially increasing the fauna species diversity.

At the time of the surveys, the mature Yellow Box and Mugga Ironbark trees were also beginning to flower, a sure attractant to nectar-foraging birds, mammals and invertebrates.

AVAILABILITY OF WATER WITHIN 200M OF SURVEY SITE

It was noted that all 30 survey sites had a relatively permanent body of water (mostly a dam, and sometimes a creek or small spring / soak) within 100m-200m of the site. Accessing this water without being predated would be an issue for some smaller species, and creating protective 'stepping-stones' from the bush to the water could become part of future works.

HOLLOW-BEARING TREES and LARGE, HOLLOW-BEARING FALLEN LOGS

Every site had mature Eucalypts with hollows either within the quadrat itself, or within the 2ha, or alongside the site in the nearby paddocks and roadsides.

30% of sites did not have large fallen logs with hollows, although such logs were often noted nearby the site.

It appears all farmers who participated in the survey are careful to not collect all fallen timber for firewood, nor to 'make the farm tidy' so the habitat values of this timber is both recognized and conserved.

LITTER LAYER, WOODY DEBRIS, CRYPTOGRAMS, BARE GROUND

The extent of leaf litter, small woody debris, cryptogams and bare ground varied considerably from site to site. There appeared to be no common factor that indicated the % of these important ecological drivers on a site. Land-use, vegetation type, recent fires all play a part, but at this stage no suite of factors could be consistently derived from the data collected.

EXTENT OF EXOTIC PLANT SPECIES ON SITE

All River Red Gum sites had at least 80% of the under-canopy and ground area dominated by exotic plants, including annual and perennial grasses and forbs, and woody weeds.

These plants at listed the end of the full vegetation species list in Appendix 1.

Sites that had been badly burnt in the 2006 Junee fires also had a heavier burden of exotic annual plants and woody weeds, as did sites that continue to be heavily grazed.
There were 16 sites with between 5 and 50% of exotic species, a finding that was unexpected and very heartening. The two sites in the following photos had less than 2% of exotic species.

White Cypress / White Box grassy woodland

Mugga Ironbark / Red Stringybark Dry Sclerophyll Forest and native grassland

PROXIMITY OF LANDUSE ACTIVITIES TO SITE

Only 2 sites out of the 30 are no longer grazed. The remaining sites are all grazed to varying extents. Those rested for the longest periods of time had the greatest floristic diversity (albeit this was sometimes a diversity of flowering exotic species). Sites heavily grazed in a short rotation system with high stocking rates and short rest periods had an absence of native forbs and higher amounts of bare ground with stock tracks criss-crossing the site.

On farms where paddocks are sown to crops, the plowing activities have come very close to the fence-line that is excluding the native vegetation. Fertilizers and herbicides were used with the sowing and management of the crop, although the specific rates were not recorded. Simple visual observations suggested the native vegetation alongside these paddocks had not been severely compromised by these activities, although local invertebrate populations could well be affected, having repercussions up the food-chain.

NATIVE FAUNA RECORDED ACROSS THE SURVEY SITES

BIRDS

The complete list is included in Dr. Fiona Christies' bird list in Appendix 2.

A Superb Kingfisher was recorded during the flora survey on one site, and there are anecdotal reports of a flock of red-tailed Black Cockatoos living on Cooba Mt.

A Wedge-tailed eagle Nest in River Red Gum Forest

A White winged Chough on her nest

AN UNWANTED NATIVE BIRD – THE NOISY MINER

The NOISY MINER information below has been downloaded from the website of the NSW Department of Environment for your information. Anecdotally there are many reports that Noisy Miners are less frequent in larger-sized remnants that have a complex structure, including available nesting hollows, and a diverse range of plant species.

Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala* - profile

Scientific name: *Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners Manorina melanocephala*
Conservation status in NSW: Key Threatening Process
Commonwealth status: Not listed
Gazetted date: 27 Sep 2013
Profile last updated: 14 Nov 2013

Description

Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala* (Latham 1802) was listed as a KEY THREATENING PROCESS on Schedule 3 of the *Threatened Species Conservation Act 1995* [27 September 2013].

The Noisy Miner is a large (24-28 cm, 70-80 g), sedentary, highly aggressive honeyeater (family Meliphagidae) endemic to eastern Australia. In NSW the Noisy Miner is found throughout the coastal plains, foothills, ranges and tablelands (up to 1200 m), as well as on the inland slopes and plains of the semi-arid zone, favoring open, lightly timbered areas and habitat edges and so has benefitted from the large-scale vegetation changes that accompanied the European settlement of Australia. This includes forest and woodland clearance and fragmentation, a reduction in understory vegetation by livestock grazing, invasion of exotic grasses & altered fire regimes.

A range of threatened woodland and forest bird species listed under the *Threatened Species Conservation Act 1995* are adversely affected by aggressive exclusion by abundant Noisy Miners including Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Speckled Warbler (*Chthonicola sagittata*), Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Varied Sittella (*Daphoenositta chrysoptera*), Little Lorikeet (*Glossopsitta pusilla*), Painted Honeyeater (*Grantiella picta*), Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*), Turquoise Parrot (*Neophema pulchella*), Gilbert's Whistler (*Pachycephala inornata*), Scarlet Robin (*Petroica boodang*), Flame Robin (*P. phoenicea*), Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), and Diamond Firetail (*Stagonopleura guttata*). These and other bird species are primarily impacted by their active exclusion from areas of otherwise suitable habitat, which limits feeding, breeding and dispersal opportunities and ultimately population size and persistence.

A White-Faced Heron's nest in one site

Hollows in creek banks (LHS of photo) offer excellent nest sites

MAMMALS

Eastern Grey Kangaroos were noted on most farms, either observed grazing, or through their scats. In places the kangaroo numbers are rising, but overall they were not as prolific as they appear to be in the southern tablelands.

Red-necked Wallabies were observed on only two farms, moving through areas of relatively dense native vegetation with a rich diversity of forbs and smaller shrubs. Their scats were also recorded.

Farmers with large areas of well-vegetated gully lines anecdotally reported Swamp Wallabies, although they were recorded on only one farm, in a Dry Sclerophyll remnant.

Many farmers reported sighting, or unintentionally capturing, native mice such as the Yellow Footed Antechinus and the Common Dunnart, and this would be consistent with the interconnected native vegetation across the landscape, albeit often only in tree/shrub rows. No evidence (burrows, scratchings, scats, fur etc.) was observed during the daytime field surveys, but longitudinal surveys of the areas and the use of night cameras and various trapping (and releasing) techniques would undoubtedly verify their presence.

Whilst there are reports of Spotted Quolls, Brush and Ring-tailed Possums, and Bandicoots living in the vegetated hills surrounding the farming land, no evidence of these animals was found during the surveys. Such evidence may come from the footage taken by farmers via the night-camera provided by ML.

One Echidna was noted at the base of a small termite mound in a Dry Sclerophyll remnant.

ABOREAL MAMMALS
Signs of arboreal mammals (scratchings, scats, fur) were not evident during the surveys, which was somewhat surprising.

Bats – as the surveys were undertaken only during the daytime, no bats were officially recorded. However, all farmers spoke of bats being visible about their farm at night, especially wherever there were patches of native vegetation containing older Eucalypt trees. Mason Crane recorded species of Micro-bats flying above the Box trees during the 'Nightstalk' activities at the Eurongilly TSR.
Farms with large and relatively undisturbed remnants could have a suite of arboreal and nocturnal mammals, including a range of Bat species, Gliders, Possums, and even Koalas.

REPTILES
Possibly due to the unseasonal heat during the first week of the surveys, a great number of Bearded Dragons were observed on most of the farms that had River Red Gum riparian remnants, Box-Gum Woodland remnants, and Grey Box grassy Woodlands.

Bearded Dragons Basking in the spring sunshine.

Copper-tail Skinks and Tree Skinks were also noted on most sites.

Red-Bellied Black Snakes were observed chasing frogs alongside dams and creeks, and an **Eastern Brown Snake** watched proceedings from the grass in a re-vegetation site.

A large **Goanna** poked its head out from a hollow high in a majestic old River Red Gum along Mitta Creek to utter a few warning growls before withdrawing into the hollow. Although it was probably a Lace Monitor, a positive identification wasn't made – the element of surprise momentarily precluded successful camera recording.

Farmers with Box-Gum and River Red Gum remnants containing trees with large hollows also anecdotally report the presence of large Lace Monitors cruising the area.

FROGS and TORTOISES

Two common species of frog were recorded wherever there was even a small puddle of water, namely the Common Eastern Froglet (*Crinia signifera)* and the Eastern Banjo Frog, or Pobblebonk (*Limnodynastes dumerelli.)*

Frogspawn was found wherever a dam or water-course occurred in the survey site

Algal covered Long-necked Tortoises (*Chelodina longicollis)* were noted in the dam within one survey site, and alongside a second survey site with a dam.

CRUSTACEANS

Every survey site containing a water body (including drying-out drainage lines) had numerous native yabbie burrows along their damp edges.

Crustacean exoskeletons were observed along Mitta Creek (see photo). Crayfish?

INVERTEBRATES

Although not positively identified into genus and species, each site had an array of –

Ants - often in large colonies, as in the huge colony seen below

Spiders – They were found beneath the bark of Eucalypt trees; with dense webs across the surface of ground burrows (photo below) and with a variety of web designs across the vegetation, from those living in the grasses to those spinning webs across higher shrubs /saplings. (second photo)

Termites – active beneath fallen timber in less-disturbed sites

Moths – 5 species of small moths were observed across the survey areas

Flies – numerous swarms of very small fly-like creatures appeared above water bodies and crops – one site had up to 20 Willy Wagtails chasing swarms of tiny 'flies' above a canola crop alongside a revegetation area.

Bees – both native and exotic honeybees were observed at many sites

Beetles – dung beetles were observed in cow manure in various sites

EXOTIC / FERAL SPECIES – for scientific names, see Appendix 2.

Cats - throughout area. Cat below pictured at the Eurongilly 'Nightstalk'

Rabbits – extensive and endemic across the survey sites
Pigs - only anecdotal evidence on a few farms
Starlings - found on a few survey sites
Sparrows - endemic around buildings, not so much in high-quality remnants
Spotted Dove – found in 1 site
Deer- clear evidence on farms with large woodland/forest remnants – note antler impacts On Red Stringybarks in photo below.

EXOTIC PLANTS – for complete species list and botanical names, refer to Appendix 1.
Thirty-four species of exotic plants were identified overall – the dominant were the annual exotic grasses and forbs such as Barley grass, Capeweed, Ryegrass, Brome Vulpia, and Wild Oats. Pattersons' Curse was widespread. Woody weeds such as St Johns' Wort varied in abundance and distribution.
2 exotic Tree species were identified - African Blackthorn, found on 2 sites,
and the Peppercorn tree growing on 1 site.

THREATENED PLANT SPECIES AND COMMUNITIES. For details, see Appendix 4.

One threatened individual plant species was recorded during the surveys, growing nearby the survey site, the rare and threatened Woolly Ragwort. (*Senecio garlandii)*.
It has been previously documented and recorded by OEH personnel. Photo below.

Eleven sites have the Threatened Ecological Community - White Box / Yellow Box Blakely's Red Gum Grassy Woodland (BGGW) in varying states of degradation.
Three sites have the Threatened Ecological Community Grey Box tall grassy woodlands in varying states of degradation.
One site contains a large biodiverse White Cypress/White Box grassy woodland remnant. (BGGW).These communities are listed as Threatened under the Federal EPBC Act.

A Grey Box grassy Woodland regenerating after the Junee fires of 2006

There were a number of uncommon species recorded, including the Yam Daisy on 8 sites (photo above) and the Slender Violet in 1 site, (photo below) persisting among granite boulders in a grazing paddock otherwise over-run with exotic grasses and weeds .

THREATENED BIRD SPECIES AND VEGETATION TYPES

Eight farms were recorded as having Threatened bird species on their sites (this does not include the Threatened Superb Parrot). Of these 8 sites, 6 are on ridges and hillsides, and 2 are riparian. All six sites on hills and ridges are predominantly Dry Sclerophyll Forest, verging into BGGW. One of the riparian sites is a re-vegetation area, planted in the early 1980s, with pre-existing older riparian and BGGW Eucalypts nearby the survey site.

It was found that with all these seven sites, there is a strong correlation between the largest vegetation remnants, their richness of floristic species and structural diversity, their connectivity and minimal farming impacts, and the farms that host most of the declining insectivorous woodland birds. These farms also have the highest number of Threatened Woodland Bird species.

The stand-out exception is the eighth site, a River Red Gum riparian Forest. This site had unusually low floristic diversity,(6 species) but a long riparian corridor excluded from general grazing and with all ages of River Red Box flourishing. Canola paddocks surround much of this area and there are some grazing paddocks. Yet there was a high diversity of woodland birds, including the Threatened Varied Sitella.

This finding, of low floristic diversity but high total number of bird species including regular observations of the Threatened Superb Parrot, was consistent with River Red Gum forests along riparian areas across the entire survey area.

Mature, hollow-bearing River Red Gums along the creek systems of the SW Slopes.
Note that farming practices have left no understorey, and exotic groundcover species.

Superb Parrots were also recorded in BGGW communities where there were tree hollows, and higher floristic diversity, but they were not noted in Dry Sclerophyll Forests with tree hollows.

Many older re-vegetation sites that were not regularly grazed, and 'mess' was allowed to build-up, also had higher total numbers of bird species, as in the photo below.

To date, the dominant bird species in re-vegetation sites are known as 'generalist' and 'opportunistic' species. The declining woodland bird species don't appear to have yet located to these sites.

RESULTS FOR EACH CROSS-PROPERTY PLANNING GROUP

For the purposes of this report, and for focusing on the outcomes on continuing landscape repair works, each cross-property planning area will be treated separately.

1. JUNEE CROSS-PROPERTY PLANNING GROUP. 20 sites surveyed.

The farmers in this group cover a large geographical area, comprising three distinct precincts - Junee / Wantabadgery (5 sites) Eurongilly / Bethungra (11 sites), and West Junee /Illabo. (4 sites)

The common feature of all three areas here is both the fragmentation of the native vegetation, and the intensity of farming practices, both grazing and cropping. The landscape is criss-crossed with rivers, creeks and ephemeral drainage lines, with few excluded from grazing. The landscape contains flat alluvial floodplains, undulating grazing country, and steep mountains with large granite outcrops. Virtually every part of this landscape has been impacted by European settlement and farming activities, leaving few intact remnants of the original vegetation. Today mostly scattered fragments remain.

Three properties contain remnant areas of Grey-Box Grassy Woodlands (a threatened vegetation community under the EPBC Act). There are 4 River Red Gum vegetation communities, 1 White cypress /White Box Grassy Woodland, and the remainder are BGGW / Revegetation sites.
Each of the River Red Gum communities had low Floristic diversity, numerous River Red Gum seedlings and saplings, numerous hollows in mature trees, numerous fallen logs with hollows, no shrub layer and more than 80% of exotic groundcover of grasses, woody weeds and forbs. Revegetation corridors, riparian corridors, and isolated paddock trees link these riparian remnants. Recent research suggests the role of these mature hollow-bearing paddock trees is critically important to the survival of numerous native faunal species, and their ongoing protection is an important part of the cross-property planning and connectivity project.
Another dominating feature of this area, both in the physical landscape, and in the minds of its inhabitants, is the impact of the ferocious wildfires (colloquially known as the Junee Fires) that swept across these farms in early January 2006 – after 5 years of severe drought. The landscape continues to bear the scars of this savage fire, with many magnificent old trees including River Red Gums (possibly 400+ years old, and full of hollows) burnt to the ground, and the hollow-bearing logs that littered the ground.

Then the drought continued for another three years, broken by flooding rains and storms. Fire, flood and storm damage remain visible throughout the landscape.
The three years of drought-breaking, above-average rains (2009 – 2011) helped to replenish the ground and surface water supplies, encouraging a flush of both exotic and native plant growth across the landscape. This in turn theoretically led to sufficient feed and habitat sites for the surviving native fauna to breed successfully again. However, the bared-out ground grew mostly exotic plants, persisting to this day - exotic annual grasses and forbs, together with exotic perennial weeds such as St John's Wort, Thistles, Mallows and Blackberry. Many of the survey sites had bare ground when the rains came, and today remain almost exclusively covered with exotic grasses, forbs and woody herbs.

Dominance of Exotic species -A common ground-cover on many sites.

The rains also impacted on River Red Gum regrowth, adapted as it is to cycles of drought and flood inundation. Farms with this vegetation community have countless sapling River Red Gums within their conservation areas. (see photos below)

The flooding rains also created many other changes, including washing large logs and fallen trees downstream until such point that they became lodged across the watercourse. Today, all creeks and flow lines surveyed have fallen-log debris cluttering their waterway, adding invaluable habitat value. (see following photo)

Of the 7 Threatened Bird species (listed under the NSW Threatened Species Conservation Act) and 1 potentially Vulnerable species (the Crested Shrike Tit is listed as endangered – to Vulnerable in other states) identified overall, 4 Threatened species are found in this Landcare group – 1 Brown Tree Creeper, 1 Grey Browed Babbler, Diamond Firetails, and numerous Superb Parrots.

All sites with mature, hollow-bearing Eucalypts in this Landcare area were found to have Superb Parrots, regardless of any other vegetation diversity or structural complexity. Re-vegetation sites without hollow-bearing trees had no Superb Parrots recorded on the day, but had quite high numbers of bird species generally, especially if the sites also had structural 'mess'.

The Brown Tree Creeper was identified in a large (40ha) and structurally complex River Red Gum/Blakely's Red Gum wetland area surrounded by Box-Gum Grassy woodland. This area is crash-grazed, then allowed to rest for long periods.

Grey-crowned Babblers were observed in a large (100ac) Grey Box Grassy Woodland remnant immediately adjacent to, and continuous with, a bio-diverse roadside woodland community. This area was badly burnt in the Junee fires, has much fallen and standing dead timber, and is rarely grazed. It has a floristically diverse grassland cover, with few shrubs.

The Diamond Firetails were identified in a large remnant of structurally complex and floristically rich White-Box / White Cypress Pine grassy woodland. Rotational grazing with long rest periods is practiced here.

Humula Cross-Property Planning Group.

Three farms participated in the surveys, and all three have extensive areas of native vegetation cover, from native grass pastures to BGGWoodlands and Dry Sclerophyll forests.

Much of this area is very hilly and historically has not been as extensively cleared as the Junee/Bethungra /Wantabadgery areas. There is a predominance of grazing, with cropping only on the fertile alluvial flats. The area is criss-crossed with creeks of varying sizes, and the Tarcutta River.

All three farms are currently grazed, with the extent of rotation dependent on the pasture growth each season, and stock numbers and stock health monitored accordingly. Each farm has low to no inputs of fertilizers and herbicide.

One BGGW vegetation communities was surveyed, the other two surveys were at the interface between BGGW and the Dry Sclerophyll forests on the higher slopes.

3 of the 7 Threatened bird species were recorded on two sites (see photos below) surveyed on slopes at the intersection of the BBGW and Dry Sclerophyll communities – the Brown Treecreeper and Flame Robin on one site, the Scarlet Robin on the other. Each had a high floristic diversity, including forbs and small shrubs, a high number of total bird species recorded (19+species), and few exotic grasses, forbs and woody weeds.

No Superb Parrots were recorded on either site, but were observed in the BGGW site.

Large dry-sclerophyll remnants with high floristic diversity and Threatened Bird species

The third site (see photo below) surveyed was a BGGW encompassing a saturated drainage line with gentle slopes on either side. A cyclonic storm in 2011 had flattened many of the old hollow bearing Eucalypts (Yellow Box, White Box, Red Stringybark, Red Box) across the paddocks in and around this site, and for the most part these fallen trees remained on the ground as habitat.
There are many hollow bearing trees still standing, numerous sapling recruits, and a ground-cover rich in native grass species, some native forbs. There are very few exotic grasses, woody weeds or exotic forbs.
The paddock is set-stocked with a small mob of Merino sheep, with the grazing pressure carefully monitored and the sheep moved if the cover begins to be depleted.
While no threatened woodland bird species were recorded here, Superb Parrots were identified on site, together with a higher number of overall bird and floristic species.

BBGW – Humula area – a dense cover of native pasture grasses; all ages Box-Gum trees.

KYEAMBA CROSS-PROPERTY PLANNING GROUP
Seven farms from this group participated in the surveys – three along Big Springs Road, two near Ladysmith along Tumbarumba road, and one higher-up along Keajura Road.

Each of these properties has either large areas of intact remnant communities, or older revegetation corridors alongside old-growth Eucalypts. Every site has permanent water nearby, and is connected across the farm to other sites or mature paddock trees.

5 of the 7 Threatened woodland bird species were recorded at five of the seven sites – the Brown Tree Creeper, Scarlet Robin, Crested Shrike Tit, Varied Sitella and the Grey Crowned Babbler. Six of these sites were either Dry Sclerophyll Forests merging with BGGW, or BGGW. All these large remnant sites had a high number of bird species overall, a high number of small woodland birds currently in decline, and a relatively high to very high floristic diversity. (see following photos)

Dry Sclerophyll remnant - Native forbs - A Greenhood Orchid, above

Dry Sclerophyll remnant - Twining Glycine.

Dry Sclerophyll remnant - *Grevillea lanigera* in flower (above)

Dry Sclerophyll Remnant - Tiger Orchid flowering

BGGW & Dry Sclerophyll - Native ‘Egg and Bacon’ pea plant

BBGW & Dry Sclerophyll - Nodding Blue Lily

One site has a Threatened plant species, already recorded on YETI database, nearby the survey site – Woolly Ragwort. Seed has been taken from last years’ flowering of this plant, the germinated seedlings cared for, and 50 of them planted-out nearby the parent plant. The farmer is currently monitoring their success rate. Photographs of this plant occur on page 20 of this report.

Superb Parrots, another Threatened bird species, were recorded in a sixth site dominated by River Red Gums in and along a watercourse. After the last major floods, the owners noticed seedling Bottlebrush (*Callistemon pallidus*) near the creek crossing, so they have carefully placed an exclusion fence around them and hope they grow, reproduce and eventually spread. Regrowth River Red Gums are also growing within the fence-line.

This farm has excluded an extensive length of creek and riparian edge dominated by mixed-age stands of River Red Gums, with an almost total cover of exotic grasses, woody weeds and forbs. Despite the lack of floristic diversity, the Varied Sitella (a Threatened bird species) together with Superb Parrots was identified on site, together with a total of 18 other bird species. This finding, of low floristic diversity with extensive exotic groundcover yet high bird diversity, was consistent across all River-Red Gum sites surveyed throughout the project.

RECOMMENDATIONS FOR FUTURE WORKS AND ASSISTANCE

Control exotic annual and perennial grasses, annual and woody weeds with grazing strategies, while not impacting on the existing native species and allowing the native species to set seed periodically. How?
Grazing management over the years is the simplest and most cost-effective tool to use to achieve this – that is, to ensure the perennial native species have sufficient rest periods from grazing pressure to set viable seed, and that grazing is undertaken in such a manner as to ensure there is no bare ground, thus further reducing the ability of exotic species, and weed species, to invade. To reduce the impact of annual grasses, graze them heavily early in the season, then remove grazing once the native species begin to grow.

Incorporating these grazing systems may require more fencing in the years ahead.
NB If grazing rotations aren't possible, **slashing** exotic annuals before they seed is a viable option.

Control weeds from scattered and isolated patches first, steadily working towards areas of dense infestations. Keep 'clean areas clean – of weeds'!

Add the seed of desired native species onto conservation areas bared-out from weed death as without any other competition, the weeds will simply grow again next year!!

Maintain year-round ground cover with cryptogams, living plants; dense leaf litter

Monitor and release appropriate BioControl agents (see simple list Pg 54) for Pattersons Curse, St John's Wort, Thistles and Blackberry in remnant and revegetation areas

Prioritize the highest – value conservation areas and keep them weed-free over time.

Record your management control of your remnant and/or re-vegetation site each year if possible, with maybe a few photos and basic written info. Keep it simple!

Ensure fallen hollow logs remain on the ground and dead trees with hollows also remain. In areas with few hollows, continue **adding nesting boxes** in the trees. Monitor if possible. **In Re-vegetation sites especially, add more fallen timber and/or rock piles.**
NOTE- Potentially a Fire Fuel Load issue. Strike a sensible balance between human safety and animal shelter. Determine appropriate loads of woody debris and fallen logs with RFS.

Consider adding connecting 'perch poles' with indents / hollows, or other rock/fallen log debris clumps, for birds and small mammals to move from site to site with less risk of predation – these are especially important in the absence of paddock trees sufficiently close to the remnant / re-vegetation site.

Consider connecting conservation sites to the nearest dams /water-points with appropriate vegetation, and possibly include the dam itself into the conservation area. NB – Conservation does not exclude judicious grazing!

Continue with feral animal control wherever and whenever possible as a community – Rabbits, Foxes, Deer, Pigs Wild Dogs, and Cats especially.

Keep the ridge-lines well vegetated, then connect to the valley floor – b the importance of ridge-line vegetation is critical.

Further protect riparian areas, especially those with BGGW /River Red Gum Forests It is recommended to these areas very carefully, as many are badly eroded – it is a fine balance to always maintain ground-cover (currently mostly exotics) while gradually replacing the annuals with perennial natives. (Graze in early spring, then remove livestock). Consider planting patches of native grasses, reeds, rushes, forbs and small shrubs, both at the waters' edge, and above high water mark, to slowly increase the biodiversity. Early records suggest these areas were once teeming with biodiversity.

Continue to increase connectivity across the farm and broader landscape with plantings, perch poles and log/rock piles for safe harbor. Where possible, increase the depth/width of plantings to reduce the 'edge effect'.

Protect old, often dying paddock trees and encourage recruits to grow around them – this may require assistance with protective fencing too. These trees are critical to both conservation and productivity. Where possible, connect them to larger areas nearby.

Encourage and conserve areas of thick regrowth on-farm, where appropriate and where only insignificant productivity can be forgone, in order to provide continued stepping stones for fauna to shelter, breed and maintain their territory.

Graze areas like this in the early spring, to reduce the seeding and spread of the annual exotics, and promote the growth of native grasses, and reduce fire fuel load in late summer.

Resist removing fallen timber – it provides critical habitat

Manage grazing in the riparian areas carefully. Control the weeds steadily over time, and revegetate with patches of more native, shrub and ground-cover species over time.

Effective BIOCONTROL AGENTS for some common WEEDS -

Patterson's Curse and Vipers Bugloss

Crown weevil
Leaf Mining Moth
Root Weevil
Flea Beetle
Stem Borer

Horehound

Plume Moth
Clearwing Moth

St John's Wort

Mite
Chrysolina Beetle

Thistles (most species)

Seed-Head Weevil
Rosette Moth
Stem-borer Weevil

Blackberry

Rust fungus

Blue Heliotrope

Leaf-feeding beetle

APPENDIX 1 - VEGETATION SPECIES LIST

COMMON NAME	GENUS	SPECIES
Yellow Box	*Eucalyptus*	*melliodora*
Red Box	*Eucalyptus*	*polyanthemous*
River Red Gum	*Eucalyptus*	*camaldulensis*
Blakely's Red Gum	*Eucalyptus*	*blakelyi*
Tumbledown Gum	*Eucalyptus*	*dealbata*
Mugga Red Ironbark	*Eucalyptus*	*sideroxylon*
Scribbly Gum	*Eucalyptus*	*rossi*
Red Stringybark	*Eucalyptus*	*macrorhynca*
White Box	*Eucalyptus*	*albens*
Grey Box	*Eucalyptus*	*microcarpa*
Apple Box	*Eucalyptus*	*bridgesiana*
Mistletoe	*Amyema sp*	
Kurrajong	*Brachychiton*	*populneus*
White Cypress pine	*Callitris*	*glaucophylla*
Black Cypress pine	*Callitris*	*endlicheri*
She-oak	*Casuarina*	*cunninghamiana*
Hill Oak	*Allocasuarina*	*luehmannii*
Drooping She-oak	*Allocasuarina*	*Verticillata syn stricta*
SHRUBS - WATTLES		
Golden wattle	*Acacia*	*pycnantha*
Cootamundra wattle	*Acacia*	*baileyana*
Silver wattle	*Acacia*	*dealbata*
Currawang	*Acacia*	*doratoxylon*
Hickory wattle	*Acacia*	*implexa*
Varnish wattle	*Acacia*	*verniciflua*
Golden Dust Wattle	*Acacia*	*acinacea*
Early Wattle	*Acacia*	*genistifolia*
Kangaroo Thorn	*Acacia*	*paradoxa*
Box-leaf Wattle	*Acacia*	*buxifolia*
Western Silver Wattle	*Acacia*	*decora*
Western Black Wattle	*Acacia*	*hakeoides*
SHRUBS - OTHER		
Sifton bush	*Cassinia*	*arcuata*
Dolly Bush	*Cassinia*	*aculeata*
Violet Kunzea	*Kunzea*	*parvifolia*
Common Fringe Myrtle	*Calytrix*	*tetragona*
Native Blackthorn	*Bursaria*	*spinosa*
Tea-Tree	*Leptospermum*	*continentale*
Hop Bush	*Dodonea*	*viscosa*
Woolly Grevillea	*Grevillea*	*lanigera*
Prickly Paperbark	*Melaleuca*	*stypheloides*

Bracelet Honey Myrtle	*Melalueca*	*amarillis*
SMALL SHRUBS		
Hoary Guinea Flower	*Hibbertia*	*obtusifolia*
Guinea Flower	*Hibbertia*	*sericea*
Daphne Heath	*Brachyloma*	*daphnoides*
Peach Heath	*Lissanthe*	*strigosa*
Urn Heath	*Melichrus*	*urceolata*
Small-leaf Bush Pea	*Pultanea*	*foliolosa*
Old Man Saltbush	*Atriplex*	*mummularia*
Slender Bitter Pea	*Daviesia*	*leptophylla*
Showy Parrot Pea	*Dillwynia*	*sericea*
Austral Indigo	*Indigophera*	*australis*
Bush Pea	*Pultanea*	*procumbens*
Pretty Cryptandra	*Cryptandra*	*amara*
Grass Tree	*Xanthorrhoea*	*glauca*
Fringe Myrtle	*Calytrix*	*tetragona*
Woolly Ragwort (off-site)	*Senecio*	*garlandii*
FORBS		
Native Soya	*Glycine*	*tabacina*
Slender Violet	*Hybanthus*	*monopetalus*
Curved Rice Flower	*Pimelea*	*curviflora*
Slender Rice Flower	*Pimelea*	*linifolia*
Mulga Fern	*Cheilanthes*	*seiberi*
Rock Fern	*Cheilanthes*	*austrotenuifolia*
Chocolate Lily	*Dichopogon*	*strictus*
Vanilla Lily	*Arthropodium*	*milleflorum*
Small Vanilla Lily	*Arthropodium*	*minus*
Yellow Rush Lily	*Tricoryne*	*elatior*
Bulbine Lily	*Bulbine*	*bulbosa*
Early Nancy	*Wurmbea*	*dioica*
Flax Lily	*Dianella*	*revoluta*
Smooth Flax Lily	*Dianella*	*longifolia*
Nodding Blue Lily	*Stypandra*	*glauca*
Wattle Mat-rush	*Lomandra*	*filiformis*
Many-flowered Mat-rush	*Lomandra*	*multiflora*
Twining Fringe Lily	*Thysanotus*	*tuberosus*
Milkmaids	*Burchardia*	*umbellata*
Golden Weather-grass	*Hypoxis*	*hygrometrica*
Swan Greenhood Orchid	*Pterostylis*	*cycncephala*
Blue Finger Orchid	*Caladenia*	*caerulea*
Pink/white Finger Orchid	*Caladenia*	*carnea*
Waxlip Orchid	*Glossodia*	*major*
Common Onion Orchid	*Microtis*	*unifolia*
Slender Sun Orchid	*Thelymitra*	*pauciflora*
Tiger Orchid	*Diuris*	*sulphurea*
Ivy Goodenia	*Goodenia*	*hederacea*
Scrambled Eggs	*Goodenia*	*pinnatifida*
Common Buttercup	*Ranunculus*	*lappaceus*
Common Everlasting	*Chrysocephalum*	*apiculatum*

Common Woodruff	*Asperula*	*conferta*
Pale Sundew	*Drosera*	*peltata*
Austral bears-ear	*Cymbonotus*	*pressianus*
New Holland daisy	*Vittadinia*	*muelleri*
Native Bluebell	*Wahlenbergia*	*stricta*
False Sarsaparilla	*Hardenbergia*	*violacae*
Blue Storks' Bill	*Erodium*	*crinitum*
Yellow Wood Sorrel	*Oxalis*	*perennans*
Corrugated Sida	*Sida*	*corrugata*
Native Geranium	*Geranium*	*solanderi*
Native Cranesbill	*Geranium*	*retrorsum*
Willowherb	*Epilobium*	*billardierianum*
Grass trigger Plant	*Stylidium*	*graminifolium*
Common Raspwort	*Gonocarpus*	*tetragynus*
Hill Raspwort	*Gonocarpus*	*elatus*
Native Swamp Dock	*Rumex*	*brownii*
Variable Plantain	*Plantago*	*varia*
Twin-flowered Knawel	*Scleranthus*	*biflorus*
Kidneyweed	*Dichondra*	*repens*
Stinking Pennywort	*Hydrocotyle*	*laxiflora*
Sheep's Burr	*Acaena*	*ovina*
Native Carrot	*Daucus*	*glochidiatus*
Twining Glycine	*Glycine*	*clandestina*
Climbing Saltbush	*Einadia*	*nutans*
Australian Bindweed	*Convovulus*	*erubescens*
Showy Isotome	*Isotoma*	*axillaris*
Creamy candles	*Stackhousia*	*monogyna*
Cotton Fireweed	*Senecio*	*quadridentatus*
Sticky Everlasting Daisy	*Bracteantha*	*viscosa*
Australian Stone crop	*Crassula*	*sieberiana*
Cudweed	*Gnaphalium*	*sp.*
Twin-flowered Knawel	*Scleranthus*	*biflorus*
Yellow Burr Daisy	*Calotis*	*lappulacea*
NATIVE GRASSES, REEDS RUSHES & SEDGES		
Kangaroo Grass	*Themeda*	*australis*
Corkscrew grass	*Austrostipa*	*scabra*
Brushtail Speargrass	*Austrostipa*	*densiflora*
Wallaby Grass	*Rytidosperma*	*sp.*
Weeping Grass	*Microleana*	*stipoides*
Red-leg Grass	*Bothriochloa*	*macra*
Hairy Panic	*Panicum*	*effusum*
Snow Grass	*Poa*	*sieberiana*
Common Sedge	*Carex*	*appressor*
Pin-Rush	*Juncus*	*filicaulis*
Common Rush	*Juncus*	*urstitus*
Curly Windmill grass	*Enteropogon*	*acicularis*
Umbrella Grass	*Chloris*	*truncata*

Bottlewashers	*Enneapogon*	*nigricans*
Common Wheat Grass	*Elymus*	*scaber*
Short-haired Plume Grass	*Dichelachne*	*micrantha*
Wiregrass	*Aristida*	*ramosa*
EXOTIC FORBS/WEEDS		
Onion Grass	*Romulea*	*rosea*
Capeweed	*Arctotheca*	*calendula*
Common StorksBill	*Erodium*	*cicutarium*
Vipers Bugloss	*Echium*	*vulgare*
Pattersons Curse	*Echium*	*plantagineum*
Wild Sage	*Salvia*	*verbenaca*
Clovers and Trefoils	*Trifolium sp.*	*many species*
Soursob	*Oxalis*	*pes-caprae*
Proliferous Pink	*Petrorhagia*	*nanteuilli*
Common Centaury	*Centaurium*	*erythraea*
Ribwort Plantain	*Plantago*	*lanceolata*
Catsear / Flatweed	*Hypochaeris*	*radicata*
Smooth Catsear	*Hypochaeris*	*glabra*
St John's Wort	*Hypericum*	*perforatum*
Thistle	*Carduus*	*sp*
Black Thistle	*Circium*	*vulgare*
Scotch Thistle	*Onopordum*	*acanthium*
Variegated Thistle	*Silybum*	*marianum*
Saffron Thistle	*Carthamus*	*lanatus*
Storksbill	*Erodium*	*cicutarium*
Sow thistle	*Sonchus*	*sp*
Wild lettuce	*Lactuca*	*sativa*
Prickly lettuce	*Lactuca*	*serriola*
Jersey Cudweed	*Pseudonapthalium*	*luteoalbum*
Bartsia	*Bartsia*	*trixago*
Wild Mustards	*Brassica*	*sp*
Fleabane	*Conyza*	*bonariensis*
Horehound	*Marrubium*	*vulgare*
Shepherds Purse	*Capsella*	*bursa-pastoris*
Exotic Dockweed	*Rumex*	*crispus*
Blackberry	*Rubus*	*fruticosus*
African Boxthorn	*Lycium*	*ferocissimum*
Monterey Pine	*Pinus*	*Radiata*
Stinging Nettle -	*Urtica*	*sp*
Fumitory	*Fumaria*	*sp*
EXOTIC GRASSES		
Phalaris / Canary grass	*Phalaris*	*aquatica*
Cocksfoot	*Dactylis*	*glomerata*
Couch Grass	*Cynodon*	*dactylon*
Ryegrass	*Lolium*	*perenne*
Bulbous Bluegrass	*Poa*	*bulbosa*
Barley Grass	*Hordeum*	*sp*
Rat's Tail Fescue	*Vulpia*	*sp*
Quaking Grass	*Briza*	*sp*

Brome Grass	*Bromus*	*sp*
Wild Oats	*Avena*	*fatua*

APPENDIX 2
FAUNA SPECIES RECORDED DURING FLORA SURVEYS

COMMON NAME	**SPECIES NAME**	
Eastern Grey Kangaroo	*Macropus giganteus*	
Black Swamp Wallaby	*Wallabia bicolour*	
Red-necked Wallaby	*Macropus rufogriseus*	
Echidna	*Tachyglossus aculeatus*	
Red-Bellied Black Snake	*Pseudechis porphyriacus*	
Bearded Dragon Lizard	*Pogona barbatus*	
Brown Snake	*Psuedonaja textilis*	
Lace Monitor	*Varanus varius*	
Common Eastern Froglet	*Crinia signifera*	
Pobblebonk (Eastern Banjo Frog)	*Limmnodynastes dumerilii*	
Long-necked Tortoise	*Chelodina longicollis*	
Copper-Tailed Skink		
Rabbits	*Oryctolagus cuniculus*	
Deer (Red)	*Cervus elaphus*	
Pigs	*Sus scrofa*	
Cat	*Felis catus*	
Hare	*Lepus europaeus*	
Spitfire Caterpillars	*Perga sp*	
Bardi Grub (of Rain Moth)	*Trictena atripalpis*	
Spiders		
Ants		
Native bees		
Honey bees		
OTHER BIRDS NOT RECORDED IN BIRD SURVEY		
Sacred Kingfisher	*Halcyon sancta*	

SPECIES LIST OF BIRDS RECORDED BY DR. CHRISTIE DURING THE BIRD SURVEYS.

Bird species and total abundance observed both during formal surveys and incidental sightings. * indicates birds observed outside of surveys.

Common Name	Scientific Name	Total Abundance
Apostlebird	*Struthidea cinerea*	1
Australian Magpie	*Cracticus tibicen*	60
Australian Raven	*Corvus coronoides*	13
Australian Reed Warbler	*Acrocephalus australis*	2
Australian Wood Duck	*Chenonetta jubata*	2
Barn Owl*	*Tyto alba*	1
Black Falcon	*Falco subniger*	2
Black Fronted Dotterel	*Elseyornis melanops*	4
Black shouldered Kite*	*Elanus axillaris*	1
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*	19
Blue-faced Honeyeater*	*Entomyzon cyanotis*	3
Brown Falcon	*Falco berigora*	2
Brown Songlark	*Cincloramphus cruralis*	1
Brown Thornbill	*Acanthiza pusilla*	3
Brown Treecreeper	*Climacteris picumnus*	6
Brown-headed Honeyeater	*Melithreptus brevirostris*	13
Buff-rumped Thornbill	*Acanthiza reguloides*	39
Collared Sparrowhawk	*Accipiter cirrocephalus*	1
Common Bronzewing	*Phaps chalcoptera*	7
Common Starling	*Sturnus vulgaris*	18
Crested Pigeon	*Ocyphaps lophotes*	17
Crested Shrike-tit	*Falcunculus frontatus*	2
Crimson Rosella	*Platycercus elegans*	6
Diamond Firetail	*Stagonopleura guttata*	10
Dollarbird*	*Eurystomus orientalis*	1
Double-barred Finch	*Taeniopygia bichenovii*	8
Dusky Woodswallow	*Artamus cyanopterus*	8
Eastern Rosella	*Platycercus eximius*	30
Eastern Yellow Robin	*Eopsaltria australis*	4
Fairy Martin*	*Petrochelidon ariel*	3
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	2
Flame Robin	*Petroica phoenicea*	2
Galah	*Cacatua roseicapillus*	52
Golden Whistler	*Pachycephala pectoralis*	2
Grey Butcherbird	*Cracticus torquatus*	11
Grey-crowned Babbler	*Pomatostomus temporalis*	9
Grey Fantail	*Rhipidura albiscapa*	20
Grey Shrike-thrush	*Colluricincla harmonica*	16
Grey Teal	*Anas gracilis*	6
Horsefield's Bronze-Cuckoo	*Chrysococcyx basalis*	1
House Sparrow	*Passer domesticus*	4
Jacky Winter	*Microeca fascinans*	3
Laughing Kookaburra	*Dacelo novaeguineae*	13
Little Corella	*Cacatua sanguinea*	10
Little Friarbird	*Philemon citreogularis*	26
Little Raven*	*Corvus mellori*	4
Magpie-lark	*Grallina cyanoleuca*	20
Mistletoebird	*Dicaeum hirundinaceum*	2
Noisy Miner	*Manorina melanocephala*	70
Olive-backed Oriole	*Oriolus sagittatus*	3

Pacific Black Duck	*Anas superciliosa*	9
Peaceful Dove	*Geopelia striata*	7
Peregrine Falcon	*Falco peregrinus*	1
Common Name	**Scientific Name**	**Total Abundance**
Pied Butcherbird	*Cracticus nigrogularis*	11
Pied Currawong	*Strepera graculina*	9
Rainbow Bee-eater	*Merops ornatus*	3
Red Wattlebird	*Anthochaera carunculata*	11
Red-browed Finch	*Neochmia temporalis*	15
Red-capped Robin	*Petroica goodenovii*	5
Red-kneed Dotterel	*Erythrogonys cinctus*	1
Red-rumped Parrot	*Psephotus haematonotus*	30
Restless Flycatcher	*Myiagra inquieta*	1
Rufous Song-lark	*Cincloramphus mathewsi*	28
Rufous Whistler	*Pachycephala rufiventris*	21
Sacred Kingfisher	*Todiramphus sanctus*	1
Scarlet Robin	*Petroica boodang*	2
Silvereye	*Zosterops lateralis*	8
Southern Boobook*	*Ninox novaeseelandiae*	1
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	2
Spotted Dove	*Streptopelia chinensis*	1
Spotted Pardalote	*Pardalotus punctatus*	7
Striated Pardalote	*Pardalotus striatus*	32
Striated Thornbill	*Acanthiza lineata*	12
Sulphur-crested Cockatoo	*Cacatua galerita*	31
Superb Fairy-wren	*Malurus cyaneus*	34
Superb Parrot	*Polytelis swainsonii*	34
Varied Sittella	*Daphoenositta chrysoptera*	4
Wedge-tailed Eagle*	*Aquila audax*	2
Weebill	*Smicrornis brevirostris*	16
Welcome Swallow	*Hirundo neoxena*	4
Western Gerygone	*Gerygone fusca*	12
White-browed Scrubwren	*Sericornis frontalis*	2
White-faced Heron	*Egretta novaehollandiae*	3
White-necked Heron	*Ardea pacifica*	1
White-plumed Honeyeater	*Lichenostomus penicillatus*	78
White-throated Treecreeper	*Corombates leucophaea*	9
White-winged Chough	*Corcorax melanorhamphos*	42
White-winged Triller*	*Lalage sueurii*	1
Willie Wagtail	*Phipidura leucaphrys*	36
Yellow-faced Honeyeater	*Lichenostomus chrysops*	3
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	7
Yellow-tufted Honeyeater	*Lichenostomus melanops*	7

APPENDIX 4 Threatened Species found in the Upper Slopes CMA sub-region, Office of Environment & Heritage (NSW Government)

NB Vegetation Communities, Flora and Fauna listed in RED were recorded in some of the Cross Property Planning surveys.

Scientific name	Common name	NSW status	Occurrence
ECOLOGICAL COMMUNITIES			
White Box Yellow Box Blakely's Red Gum Woodland	White Box Yellow Box Blakely's Red Gum Woodland	Endangered Ecological Community	Known
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Endangered Ecological Community	Known
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	Endangered Ecological Community	Known
PLANTS			
Ammobium craspedioides	Yass Daisy	Vulnerable	Known
Brachyscome muelleroides	Claypan Daisy	Vulnerable	Known
Carex raleighii	Raleigh Sedge	Endangered	Known
Caladenia concolor	Crimson Spider Orchid	Endangered	Known
Caladenia arenaria	Sand-hill Spider Orchid	Endangered	Known
Caesia parviflora var. minor	Small Pale Grass-lily	Endangered	Known
Cullen parvum	Small Scurf-pea	Endangered	Known
Diuris tricolor	Pine Donkey Orchid	Vulnerable	Known
Euphrasia collina subsp. muelleri	Mueller's Eyebright	Endangered	Known
Grevillea wilkinsonii	Tumut Grevillea	Endangered	Known
Pultenaea humilis	Dwarf Bush-pea	Vulnerable	Known
Prasophyllum petilum	Tarengo Leek Orchid	Endangered	Predicted
Pomaderris cotoneaster	Cotoneaster Pomaderris	Endangered	Predicted
Pilularia novae-hollandiae	Austral Pillwort	Endangered	Predicted
Swainsona sericea	Silky Swainson-pea	Vulnerable	Known
Swainsona recta	Small Purple-pea	Endangered	Known

Senecio garlandii	Woolly Ragwort	Vulnerable	Known
ANIMALS - BIRDS			
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable	Known
Polytelis swainsonii	Superb Parrot	Vulnerable	Known
Petroica phoenicea	Flame Robin	Vulnerable	Known
Petroica boodang	Scarlet Robin	Vulnerable	Known
Stagonopleura guttata	Diamond Firetail	Vulnerable	Known
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Known
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	Known
Chthonicola sagittata	Speckled Warbler	Vulnerable	Known
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Known
Burhinus grallarius	Bush Stone-curlew	Endangered	Known
Pachycephala inornata	Gilbert's Whistler	Vulnerable	Known
Oxyura australis	Blue-billed Duck	Vulnerable	Known
Ninox connivens	Barking Owl	Vulnerable	Known
Neophema pulchella	Turquoise Parrot	Vulnerable	Known
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	Known
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable	Known
Lophoictinia isura	Square-tailed Kite	Vulnerable	Known
Lathamus discolor	Swift Parrot	Endangered	Known
Stictonetta naevosa	Freckled Duck	Vulnerable	Known
Hieraaetus morphnoides	Little Eagle	Vulnerable	Known
Hamirostra melanosternon	Black-breasted Buzzard	Vulnerable	Known
Grus rubicunda	Brolga	Vulnerable	Known
Grantiella picta	Painted Honeyeater	Vulnerable	Known
Glossopsitta pusilla	Little Lorikeet	Vulnerable	Known
Epthianura albifrons	White-fronted Chat	Vulnerable	Known
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Known
Falco subniger	Black Falcon	Vulnerable	Known
Circus assimilis	Spotted Harrier	Vulnerable	Known
Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Known
Calidris ferruginea	Curlew Sandpiper	Endangered	Known
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Known
ANIMALS - MAMMALS			
Petaurus norfolcensis - endangered population	Squirrel Glider in the Wagga Wagga Local Government Area	Endangered Population	Known
Petaurus norfolcensis	Squirrel Glider	Vulnerable	Known
Petaurus australis	Yellow-bellied Glider	Vulnerable	Known
Phascolarctos cinereus	Koala	Vulnerable	Known
Phascogale tapoatafa	Brush-tailed Phascogale	Vulnerable	Known
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Known
Myotis macropus	Southern Myotis	Vulnerable	Known

Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Vulnerable	Known
Macrotis lagotis	Bilby	Extinct	Known
Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Known
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	Known
Chalinolobus picatus	Little Pied Bat	Vulnerable	Known
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Known
ANIMALS - FROGS			
Litoria raniformis	Southern Bell Frog	Endangered	Known
Litoria booroolongensis	Booroolong Frog	Endangered	Known
Crinia sloanei	Sloane's Froglet	Vulnerable	Known
ANIMALS - REPTILES			
Varanus rosenbergi	Rosenberg's Goanna	Vulnerable	Predicted
Delma impar	Striped Legless Lizard	Vulnerable	Known
Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Predicted
ANIMAL - INVERTEBRATES			
Synemon plana	Golden Sun Moth	Endangered	Known

THREATS TO BIODIVERSITY			
Removal of dead wood and dead trees	Removal of **dead wood and dead trees**	Key Threatening Process	Predicted
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	**Alteration to the natural flow regimes** of rivers, streams, floodplains & wetlands.	Key Threatening Process	Predicted
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners (Manorina melanocephala)	Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala*.	Key Threatening Process	Predicted
Anthropogenic Climate Change	Human-caused **Climate Change**	Key Threatening Process	Predicted
Bushrock removal	**Bushrock Removal**	Key Threatening Process	Predicted
Competition from feral honey bees, Apis mellifera L.	Competition from **feral honeybees**	Key Threatening Process	Predicted
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	Key Threatening Process	Predicted
			Predicted

Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	Competition and grazing by the **feral European rabbit**	Key Threatening Process	
Clearing of native vegetation	**Clearing of native vegetation**	Key Threatening Process	Predicted
Herbivory and environmental degradation caused by feral deer	Herbivory and environmental degradation caused by **feral deer**	Key Threatening Process	Predicted
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	Key Threatening Process	Predicted
Loss or degradation (or both) of sites used for hill-topping by butterflies	Loss and/or degradation of **sites used for hill-topping by butterflies**	Key Threatening Process	Predicted
Loss of Hollow-bearing Trees	Loss of Hollow-bearing Trees	Key Threatening Process	Predicted
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Key Threatening Process	Predicted
Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	Predation, habitat degradation, competition and disease transmission by **Feral Pigs** (*Sus scrofa*)	Key Threatening Process	Predicted
Predation by the Feral Cat Felis catus (Linnaeus, 1758)	Predation by **feral cats**	Key Threatening Process	Predicted
Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	Predation by the **European Red Fox**	Key Threatening Process	Predicted
Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	Predation by the **Plague Minnow** (*Gambusia holbrooki*)	Key Threatening Process	Predicted
Predation and hybridisation by Feral Dogs, Canis lupus familiaris	Predation and hybridisation by **Feral Dogs**, Canis lupus familiaris	Key Threatening Process	Predicted
Infection of native plants by Phytophthora cinnamomi	Infection of native plants by ***Phytophthora cinnamomi***	Key Threatening Process	Predicted
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Key Threatening Process	Predicted

Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	Infection by **Psittacine circoviral (beak and feather) disease** affecting endangered psittacine species	Key Threatening Process	Predicted
Importation of Red Imported Fire Ants Solenopsis invicta	Importation of **red imported fire ants** into NSW	Key Threatening Process	Predicted
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	Ecological consequences of **high frequency fires**	Key Threatening Process	Predicted
Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)	Invasion, establishment and spread of Lantana (*Lantana camara* L. *sens. lat*)	Key Threatening Process	Predicted
Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	Invasion of the **yellow crazy ant** (*Anoplolepis gracilipes*) into NSW	Key Threatening Process	Predicted
Invasion of native plant communities by exotic perennial grasses	Invasion of native plant communities by **exotic perennial grasses**	Key Threatening Process	Predicted
Invasion of native plant communities by Chrysanthemoides monilifera	Invasion of native plant communities by **bitou bush & boneseed**	Key Threatening Process	Predicted
Invasion of native plant communities by African Olive Olea europaea L. subsp. cuspidata (Wall ex G. Don Cirferri)	Invasion of native plant communities by African Olive Olea europaea L. subsp. cuspidata (Wall ex G. Don Cirferri)	Key Threatening Process	Predicted
Invasion and establishment of the Cane Toad (Bufo marinus)	Invasion and establishment of the **Cane Toad**	Key Threatening Process	Predicted
Invasion and establishment of Scotch Broom (Cytisus scoparius)	Invasion and establishment of Scotch Broom (*Cytisus scoparius*)	Key Threatening Process	Predicted
Invasion and establishment of exotic vines and scramblers	Invasion and establishment of **exotic vines and scramblers**	Key Threatening Process	Predicted
Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	Introduction of the **large earth bumblebee** (*Bombus terrestris*)	Key Threatening Process	Predicted

APPENDIX 5 – REFERENCES

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