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INSIDE THIS ISSUE!

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Front Cover Photo: Juvenile Giant Barred Frog (*Mixophyes iteratus*)

Courtesy of Grant Mclean

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The ECA postal address has changed to

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Message from the President

Dear Members,

My first task as the ECA President for 2017/2018 is to thank the organisers of the 2017 ECA conference, Mia Dalby-Ball, who convened the conference and our Administrative Assistant Amy Rowles who yet again found a great venue and organised an excellent dinner and Trivia night. The conference covered a broad spectrum of topics including an important talk by John Seidel addressing the new Biodiversity Act and some very interesting talks by recipients of the ECA Student grants.

As the new President of the ECA I will be working hard to encourage our Practicing members to become Certified Practicing Ecological Consultants (CPEC) should they meet the stringent requirements to become accredited.

Since its formation ECA Council members have worked to develop an accreditation scheme that would provide a mechanism to support and encourage reputable assessments for industry, government the community, and result in better outcomes for biodiversity. One over-riding point was that the scheme needed to be linked to the overall product rather than to specific assessment tasks, skills or, government Acts, policies or regulations. The ECA CPEC scheme achieves this while removing the complexity required to be accredited for specific skills or task.

Throughout the development of the CPEC scheme OEH, and its various previous forms, have intermittently shown some interest in the scheme but without full commitment. Most interest from OEH was shown when the Government of the day was under pressure from the Greens to implement an accreditation scheme. After investing funds into our scheme, the Government was able to assure the Senate that an accreditation scheme would soon be implemented by industry. The problem went away and so did Government interest in fostering our CPEC scheme.

The introduction of BioBanking assessor accreditation was to ensure that BioBanking assessors had the skills to operate the BioBanking scheme. The new Biodiversity Assessment Method (BAM) accreditation is for the same purpose, ensuring that operators of the BAM have the skills to do so. Accredited BioBanking assessors must now retrain to become BAM assessors.

Accreditation by our industry on the other hand is about more than just being certified to implement an assessment method or satisfy a political end, it is about ensuring quality of work and scientific rigour across all tasks, having the experience in the industry to understand what is a quality product, being aware of the need to remain up to date with new approaches to assessment, keeping abreast of and interpreting changes to legislation, species and community listings, and giving the best outcomes for client and the environment.

CPEC is not for everyone but it is for those in our industry who have the experience, understand the ethics and want to provide the community with a certainty that they will be giving them the best services from our profession. It is not about one scheme or another it is about providing a guarantee that whatever the method, act, policy or regulation clients, community, colleagues can be assured that a CPEC is able to interpret and implement at a high standard.

I look forward to seeing many of our members supporting this intuitive by applying for accreditation as a CPEC.

Belinda Pellow

2018 Membership
Renew On-line Now
www.ecansw.org.au

PHOTO COMPETITION

Congratulations! to ***Grant Mclean*** for winning the last photo competition with his photograph featured on the front cover of a juvenile Giant Barred Frog *Mixophyes iteratus*.

Thank you to everyone who entered our photo competition. All entries have been included in the ECA Photo Gallery on the back cover

Email your favourite flora or fauna photo to admin@ecansw.org.au to enter a competition and have your photo on the cover of the next ECA newsletter. Win your choice of one year free membership or free entry into the next ECA annual conference. The winner will be selected by the ECA council. Runners up will be printed in the photo gallery

Photos entered in the competition may also be used on the ECA website

ECA COUNCIL MEETINGS

The ECA Council meet every three months to discuss and deal with any current business of the association. The last meeting took place on the 18th September and the next meeting will take place on the 4th December. Any member who wishes to view the minutes from any of the ECA council meetings may do so by contacting the Administration Assistant Amy Rowles admin@ecansw.org.au

ECA RESEARCH GRANT WINNERS 2017

Terrestrial Ecology Grant:

Annabel Ellis—The Role of Introduced Rats in Restoring Island Rainforest Communities ($2000).

Thomas Taylor—Quantifying the effectiveness of thermal weeders as an ecological tool for native plant regeneration ($350).

Ray Williams Mammal Research Grant:

Cassie Thompson—Reducing fragmentation and barrier effects for Eastern Pygmy Possums and other small mammals in the peri-urban environment ($2000).

ECA Conservation Grant:

Jane Williamson—Fire interval guidelines aimed at sustaining flora diversity: are they also sustaining fauna diversity? ($2000).

FOR SALE / WANTED

If you have 2nd hand ecological equipment that you would like to sell or would like to purchase you can place an ad in this newsletter. Free for members or $40 for non-members. Contact admin@ecansw.org.au.

EUROKY

Euroky***: ability of an organism to adapt to changes in the environment***

If you have any interesting observations or useful hints and information that you would like to share in the euroky column, please forward them to the newsletter editor or administration assistant to be included in the next edition.

OBSERVATIONS ON A POWERFUL HAIL STORM IN THE FOREST

Brian Wilson

I recently observed for the first time, the aftermath of a powerful hail storm in open forest habitat with some rainforest elements (wet sclerophyll forest) and have been pondering the effects of such severe weather events on wildlife.

I was not present during the hail storm but I have obtained some photos from soon after the storm and I have taken some photos myself ten days after the event and three months after the event.

Without knowing that a hail storm had occurred, my first impressions of the near total leaf fall from large trees and shrubs and deep leaf litter on the ground, was that prolonged high temperatures and lack of decent rainfall had caused the leaf drop. The dam water was black and putrid from decaying leaves. The appearance of the forest was like a fire had been through, but without any blackness. I could see further through the forest than ever before in 30 years. I then started to notice other signs such as displaced objects, some broken glass, broken plastic rain gauge and flattened blady grass - and then the penny dropped.
I noticed that the rough-barked trees were scruffy on one side and the smooth-barked trees were pock-marked on one side (see photo) strongly suggesting big hail. The damaged forest extended over at least several square kilometres.

What of the vertebrate fauna that we knew occurred in this part of the forest such as possums, koalas, gliders, micro-bats, bandicoots, wallabies, owls and diurnal birds?

- Birds and mammals rely on leaf cover for shelter, so they could have been killed or injured from the hail itself or subsequently from exposure or predation due to lack of concealment. Of course the predators may have been similarly killed or injured.
- Nocturnal mammals and birds including those that are hollow dependent could have been caught out in the open and struck by the hail if the storm occurred between dusk and dawn.
- All fleshy fruit eating fauna would be severely impacted by the immediate loss of these food items from shrubs and vines and seed eaters would be severely impacted by most eucalypts and she-oaks losing their fruit. Most of these food sources were knocked off the trees, shrubs and vines by the hail stones.
- All leaf eating fauna could be severely impacted by the immediate loss of leaves and also by the subsequent loss of damaged leaves on trees and shrubs.
- Could the large trees cope with having very few leaves to carry out photosynthesis especially since the weather was otherwise very hot and dry? Would decades old trees die?
- Was there any potable water available in creeks and dams for fauna.

Some weeks later and the trees started adopting strategies normally part of their bushfire management plan, with epicormic growth making them very furry and unusually light green in colour.

Amy Rowles did some harp trapping and found depleted bat species diversity in the area by comparison with previous harp trapping, but we can only observe gross changes. Wouldn't it have been good to do a thorough before and after habitat assessment and fauna survey if we had known this was going to happen?

Now nearly ten months later, some trees are still showing advanced epicormic growth. Recovery may be slower than normal due to extremely low rainfall over this period.

I can only conclude that the likely effects of a powerful hail storm would be similar to those from a wildfire, with trees recovering through epicormic growth, some direct deaths of fauna, some subsequent deaths due to lack of forage and cover and a relatively long time period for the whole forest ecosystem to get back to normal. As with a bushfire, the intensity of damage was patchy, there being small patches where leaf and fruit loss was not so severe.

The frequency of large hail storms in any forested area is also likely to be similar to that for forest fires but may be increasing with the effects of climate change.

Above: Gravel forest road, hours after the storm showing dense leaf layer and melting hail.

Above: Stripped trees and dense dead leaf layer ten days after the storm. Below: Stripped trees and putrid black water (from rotting foliage in the water) in dam 10 days after the hail storm

Right: Pock-marked bark of Grey Gum ten days after the hail storm. Marks are about 10 – 15 mm in diameter.

Below: Lots of light green epicormic growth on trees 3 months after hail storm.

TAXONOMY AND BIOSYSTEMATICS DECADAL PLAN—WHAT THE HELL IS THAT?

Martin Denny
ECA Vice President

Decadal plans for science are being developed by the Australian Academy of Science as 10-year strategic plans for science disciplines. The purpose of a plan is to:

- assess the current state of knowledge in a specific science discipline
- identify and set priorities for the most important scientific questions for the next decade
- outline strategies to achieve these priorities and goals.

The diversity of each discipline makes the production of decadal plans exciting and unique projects. Decadal plans are produced by the research community, but the audiences for the documents are, to a large extent, policy makers and funding bodies. To date there are decadal plans for space science, agricultural science, mathematical science, chemistry, marine science, astronomy, ecosystem science and physics. These plans can be accessed at https://www.science.org.au/support/analysis/decadal-plans-science.

Taxonomy and biosystematics are the twin disciplines that literally name the living world. We share our planet with many millions of other species; taxonomists and biosystematists discover, resolve, name and classify these species for the benefit of science and society. Many plants, animals, fungi and microorganisms provide us with food, shelter, pharmaceuticals and ecosystem services. Some threaten our health and prosperity through disease and threats to agriculture and the environment. All are inherently important. The first step in understanding all species, both for their potential benefits or threats, and as a key scientific endeavour, is to document them. Taxonomy and systematics are the foundational sciences that document the living world.

The biosystematics and taxonomy communities in Australia and New Zealand, and their key stakeholders, in partnership with the Australian Academy of Science, the Royal Society Te Apārangi, and the Ian Potter Foundation, have joined together to develop a 10-year (decadal) plan for the sector. Taxonomy and biosystematics in Australasia is globally important; we live in a biologically mega-diverse region, but with increasing threats to our biodiversity. New technologies, from big digital data systems to genomics and metagenomics, are revolutionising our discipline, providing opportunities to build on the solid foundation already achieved. The aim of the decadal plan is to develop a strategic vision for the discipline for the next 10 years.

A working group has been established, comprising leaders in the fields of biosystematics and taxonomy in Australia and New Zealand including representatives from peak bodies and sector societies. Supported and guided by an advisory committee, the Academy and the Royal Society, the working group will draft the decadal plan during 2017, leading to the release of an exposure draft in late 2017 and of the plan in early 2018.

Wide engagement with the community and stakeholders is taking place through sector and stakeholder meetings in all capital cities, along with social media and regular sector newsletter posts, notifications, feedback and surveys. A very interesting dedicated community blog noto|biotica has been established for discussion papers, commentary and to expose ideas and drafts of sections – watch out, once you have tuned in it is hard to leave.

At present, one person (Kevin Thiele, Program Manager) is contracted to undertaken stakeholder and other meetings and to draw all the input together. I attended a Sector/Stakeholder meeting at the Royal Botanical Gardens where about 30 interested persons attended. Most were associated with institutions that employed taxonomists e.g. museums, herbariums (practitioners) with a small proportion of 'outsiders' (stakeholders). These were consultants and those involved with determining identification of plants and animals e.g. quarantine and biosecurity. Of the 30 there about five were stakeholders with only two classed as ecological consultants. Interestingly, there were a number of practitioners associated with animals so the meeting was not swamped by botanists.

The morning session consisted of a number of round-table conversations with a mix of stakeholders (end-users of taxonomy and systematics) and practitioners (taxonomists and systematists). The aim was for each group to discuss and contribute to an online whiteboard one or more specific visions for taxonomy and systematics for the next decade – what should be achieved, what milestones could be passed, what infrastructure should be established/supported. Discussions focused on stakeholder perspectives, and how taxonomy and systematics can facilitate their work, but sector ideas also contributed. As one of a few stake-holders I was fully questioned about the role of ecological consultants and was surprised to find that few of the practitioners had any idea what we did, so it was quite a profitable exercise.

Once all the ideas were summarised and tabulated we then repeated the exercise with an emphasis on the practitioners. I stayed on for this as the whole day was quite interesting and provided many insights into the workings of that strange group called taxonomists. The aim of this session was to determine, as practitioners of taxonomy and systematics, what our impressions from the stakeholders were, and how do their needs and expectations match with ours. Again all of the ideas from this session were summarised and documented.

There has been some feedback from the Working Group which I will provide some extracts. During the meetings, we workshopped and prioritised around two questions: “What should be the key outcomes/ milestones/achievements of taxonomy and biosystematics in the next decade?” and “By 2028 we will have…”. For the first question, we prioritised ideas first from a stakeholder and secondly from a sector perspective.

An initial summary of outcomes has been provided as long spreadsheets (I can supply these to you). All the ideas expressed have been grouped into common themes and sorted by the aggregate prioritisation for each theme, then within themes by prioritisation scores from the meetings. The themes used are resources, people, media and outreach, education, strategy, collections, molecular tools, funding, governance, taxonomy and accreditation.

The next step for the project Working Group will be to distil these ideas into a number of key strategic goals and activities for incorporation into the vision section of the decadal plan. We will of course be working at a high level for this – a key audience for the plan is governments, so we need to craft visions that will be understandable and attractive to government. More specific ideas will be incorporated into an implementation plan, which will become a useful guide for our community for the duration of the decadal plan. A draft of the whole decadal plan, including a draft final synthesis from these meetings, will be distributed to all meeting invitees in late November.

For us, the theme of accreditation was relevant. A number of suggested ideas were: an accreditation scheme to have well defined and current data standards; a recognised taxonomic qualification (e.g. a certified practicing taxonomist registered with a national administrative body); by 2028, we will have a quality assurance and accreditation system for taxonomy and systematics across Australia and New Zealand; an accreditation body to be national; there will be licensing for practitioners and an enforcement of good practice.

It was good to see so many people involved with taxonomy and concerned about the lack of this expertise in the scientific community, particularly for ecological consultants. Our day-to-day involvement with plants and animals is fully reliant on a knowledge of what a particular species is, especially when dealing with those that are threatened and covered by regulatory controls. Hopefully the Taxonomy and Biosystematics Decadal Plan will be embraced by the relevant authorities and I look forward to reading the final version.

UPCOMING ECA EVENTS IN 2018

ECA ANNUAL CONFERENCE

Date: Thursday 26—Friday 27 July 2018

Thursday workshop: Vegetation Communities

Friday conference: The Brave New World – New Legislation, new methods, new technologies

Location: Shoal Bay

ECA WORKSHOPS 2018

- **Van Klaphake Botany Workshops: Sedges, Grasses and Eucalypt ID.**

Date: May—August 2018

Location: Sydney

Register your interest: admin@ecansw.org.au

UPCOMING ECA EVENTS IN 2018

- **Orchid Workshop**

Date: August 2018
Location: TBA
Register your interest: admin@ecansw.org.au

NON ECA EVENTS

- **Frog and Bat Survey and Identification**

Date: 12th—14th March 2018

Location: Kiola, South Coast NSW

Details: www.wildlifeschools.com.au

- **Australasian Bat Society Conference**

Date: 3rd—7th April 2018

Location: University Western Sydney, Richmond, NSW.

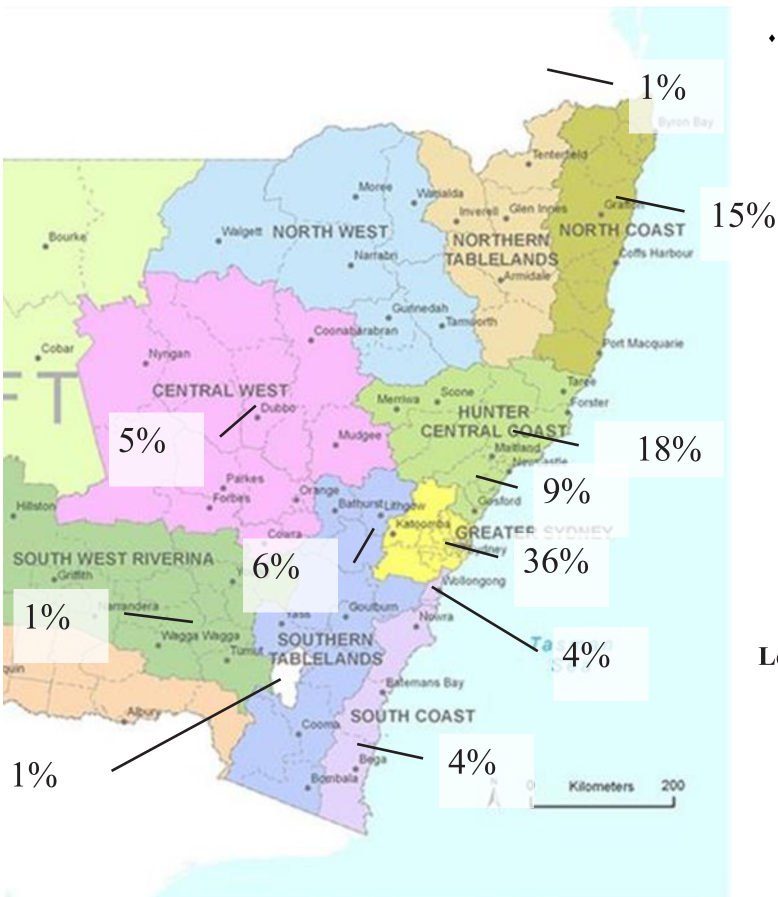
Details: ausbats.org.au

- **Ecoacoustics Congress 2018**

Date: 24-28 June 2018

Location: Brisbane

Details: www.ecoacousticscongress.org



August 2017 ECA Membership Report

Amy Rowles
ECA administrative assistant

In total we have 187 members, comprised of 140 Practising Ecological Consultants, 12 Associate (Consultants), 22 Associate (Government Ecological/ Environment Officer), 6 Associate (Non-practising), 1 Associate (Subscriber) and 6 Students. We have had 17 new members and they are introduced below:

- Mark McKinnon (Associate Ecological Consultant)
- Kate Hammill (Practising Ecological Consultant)
- Ulrike Kloecher (Practising Ecological Consultant)
- Ruby Stephens (Associate Ecological Consultant)
- Stephanie Clark (Practising Ecological Consultant)
- Daniel Watts (Practising Ecological Consultant)
- Janene Devereux (Practising Ecological Consultant)
- Sarah Allison (Associate Ecological Consultant)
- Lauren Eather (Practising Ecological Consultant)
- Nicholas Yu (Non-practising)
- Nicholas Tong (Associate Ecological Consultant)
- Grant Mclean (Practising Ecological Consultant)
- Katherine Howard (Associate Government Environment Officer)
- Mohammad Ameri (Student)
- Lisa Jones (Associate Ecological Consultant)
- Nikki Allen (Associate Ecological Consultant)
- Liam Hogg (Practising Ecological Consultant)

Left: Current distribution of membership

ECA SOILS WORKSHOP

Belinda Pellow

ECA President

At a one-day ECA workshop in August Dr Pam Hazelton instructed 28 attendees in the basic of soil identification and the relevance of soil types as an aid for determining plant community types.

Dr. Hazelton has worked as a soil scientist for over 35 years. Recently retired, she was a lecturer in the Faculty of Engineering and IT at the University of Technology Sydney. In recent years her interests have been in urban and coastal soils with an emphasis on environmental engineering. Dr. Hazelton is well known for her soil landscape series covering most of NSW and she gave the attendees a comprehensive overview of soils and how to determine them in the field.

ECA hopes to run this popular workshop again in the future.

USEFUL SOIL REFERENCES

Pam Hazelton

Young Ann and Young Robert (2001) Soils in the Australian Landscape. Oxford University Press

Hazelton PA and Murphy BW (2011) Understanding Soils in Urban Environments. CSIRO Publishing

Hazelton PA and Murphy (2016) Interpreting Soil Test Results-What do all the Numbers Mean? 3rd Edition, CSIRO Publishing

SOIL LANDSCAPE 1:250 000 reports and maps for the following areas:

- Bathurst
- Goulburn
- Singleton

SOIL LANDSCAPE 1:100 000 reports and maps for the following areas:

- Sydney
- Penrith
- Wollongong-Port Hacking
- Kiama
- Gosford –Lake Macquarie
- Wallerawang
- Michelago
- Cooma
- Katoomba
- Lismore-Ballina
- Curlewis
- Port Stephens
- Newcastle
- Braidwood
- Murwillumbah-Tweed Heads
- Coffs Harbour-Bellingen

ECA ANNUAL CONFERENCE 2017

ECOLOGISTS MAKING A DIFFERENCE ON THE GROUND

A B S T R A C T S

Kevin Gavi Duncan

(Manager – Aborginal Cultural Services, Bara Barang Corporation Ltd))

Welcome to Country and Smoking Ceremony

The Traditional Aboriginal perspective of ecology through traditional practices in a spiritual and physical sense.

This presentation will involve Welcome to Country and Aboriginal Cultural spiritual beliefs customs and traditions on the management of the ecology of the land through Aboriginal eyes.

John Seidel

Office of Environment and Heritage *The Biodiversity Conservation Act: The role of Ecological Consultants*

No abstract provided

Kyla Johnstone

(PhD - The University of Sydney)

Behavioural Types- considering the individual during wildlife management programs.

Animal interactions with wildlife management devices, such traps or bait stations, rely upon a behavioural decision by each individual to interact with the device. Within any population some individuals will choose to interact with devices and will be surveyed, trapped or removed from the population, while others will actively avoid detection. This decision is strongly influenced by an animal's Behavioural Type (consistent behaviour exhibited by individuals over time and context) and a bias often arises when bolder animals are willing to interact with devices but shyer animals avoid detection. This bias is a significant problem in pest control as any residual, un-trapped individuals are capable of rapidly repopulating; negating all control efforts; a costly and time consuming endeavour.

The impacts on a population when they are artificially constrained through behaviour e.g. the removal of all but the extremely shy individuals in a failed pest control programs, is unknown and may affect the outcomes of subsequent control programs. As behavioural traits are partially hereditary, a consequence of this may be that we face entire trap or bait phobic populations. Additionally, they may be capable of overcompensating in response to the constraints; exponentially increasing in population size.

We explored these questions by behaviourally constraining populations of wild caught house mice and examined their behaviour and that of offspring over a nine-week period and examining the behavioural repercussion. We then discuss the implications of programs that inadvertently only target a proportion of the behavioural continuum when monitoring or managing wildlife populations.

Ryan Sims

(Masters – University of New South Wales)

Does Livestock fencing progress woodlands towards desired states?

Livestock exclusion is a common first-management-step for temperate woodland restoration. However, few studies evaluate the outcomes of livestock exclusion on plant and soil chemistry composition. Furthermore, the findings of such studies are equivocal and many sites do not perform as expected (i.e. sites do not reach performance criteria). With so much variability and uncertainty on the effectiveness of livestock fencing we sought answers to two important questions that remain ambiguous in the literature. Firstly, does fencing initiate divergence from continually grazed vegetation and convergence with reference states over time with respect to species composition? Secondly, how does the response to fencing depend on livestock grazing exclusion time and degree of degradation of the initial state? Compositional trajectories based on a 17 year chronosequence of fenced and unfenced woodland plots were assessed relative to reference sites (with no history of grazing) using ordinations of floristic data. Convergence and divergence were modelled as a function of time-since-livestock-exclusions and initial state. Livestock fencing initiated some divergence from unfenced controls and convergence with reference states in species composition, but this was variable among sites and was not explained by time-since-livestock-exclusions. Initial state also did not explain the degree of compositional divergence from unfenced controls or compositional convergence towards reference states. The findings suggest site selection is crucial and reinforces the need to consider supplementary management actions, such as planting, scalping, direct seeding and weed control, in addition to livestock grazing exclusion, to restore woodlands towards desired states.

Amelia Saul

(PhD – The University of Sydney)

Testing the density-benefit relationships for invasive species: does Lantana density influence its role as habitat for natives?

When alien species establish in new environments, they often come to provide positive ecosystem services for native species. However, many alien species can become overabundant, such that these services might break down at high densities. My PhD tests the premise that there should be a density-benefit curve, just as there is a density-damage curve, which wildlife managers use to determine pest control efforts. Combining these two concepts will identify the density of alien species with the lowest negative impact and the highest positive impact.

Alexandra Callen

(PhD - Newcastle University)

Understanding movement patterns of Green and Golden Bell Frog in a closed population can improve survey methods and enhance reintroduction efforts

Understanding the movement ecology of threatened species is a complex task which presents a range of logistic, ethical and resource challenges. As a result, very little is understood about the movement of some threatened species, and this has implications for the impact assessment process and resultant mitigation measures for developments where footprints co-exist with actual and potential habitat. Many threatened amphibians have recently suffered decimating population declines due to the synergistic impacts of habitat modification/removal and the introduction of chytrid disease. There is limited understanding of how species may now respond in the long term to mitigation measures often recommended as part of the development approvals process. We examined the movements of a reintroduced population of the threatened green and golden bell frog in an artificially created habitat within the Hunter Wetlands National Park, north-west of the coastal city of Newcastle. This included describing juvenile movements, of which little is known and determining whether the species exhibited site fidelity within the created habitat. Such behaviours have the potential to limit or enhance ecological survey results and mitigation measures associated with the impact assessment process. Thus, an improved knowledge of movement ecology may improve survey protocols and implementation of mitigation measures.

Kristen Petrov

(PhD - University of Western Sydney)

Recovery of the imperilled Bellinger River Snapping Turtle Myuchelys georgesi

In the past 20 years, disease has played a greater role in species extinctions than they have in the previous 500. Although disease rarely causes species extinction alone, the rate at which infectious diseases are emerging causes reasons for concern. In 2015, a virus severely impacted the Bellinger River Snapping turtle (*Myuchelys georgesi*) population, which is endemic to the Bellinger River, NSW. The *M. georgesi* population declined from approximately 4,000 individuals in 2005, to an estimated 300 individuals in less than 2 months. Adult *M. georgesi* were predominately affected. The surviving *M. georgesi* population is now at an increased risk of extinction with only juveniles remaining in the wild. Reemergence of the virus, competition and hybridization with the non-native short-necked turtle *Emydura macquarii* and habitat degradation all pose a threat to the recovery of *M. georgesi* in the Bellinger River.

Ana Gracinin

(Wollongong University)

Real time camera trapping: an emailing system sending images direct from the field.

Camera trapping is a highly useful and effective method for studying wildlife. Used at both short and long-term scales, camera trapping can detect threatened species or threatening processes, such as invasive species or disease. Real time monitoring of wildlife is particularly promising as a management strategy in general ecology, or conservation research and management. It allows data collection and analysis to occur immediately, with minimal delay between interpretation and management techniques to be implemented. Here we test the applicability of cameras with capabilities of emailing photos as they are taken in real-time. We compared the time delay of emailed photos using extension antennas. We also tested the use of a long-term bait station, and observed behavioural responses over time to the bait. Findings showed that the cameras could provide a long-term record (five months tested) of wildlife by a continuous baiting system drawing in a range of species, particularly possums, bandicoots, wombats, small mammal species (Antechius and Rattus sp.) and foxes. This set-up has proved useful for invasive species management, threatened species monitoring, and as a technique for monitoring requirements during development.

Dr Beth Mott

(Birdlife Australia)

Powerful Owls: findings from the latest tracking study in Sydney and recommendations for sustaining owl populations and the role of citizen science in urban ecology.

Since 2011 the Powerful Owl Project has continued to generate valuable information about urban Powerful Owl ecology in Greater Sydney through the efforts of 350 project volunteers, and with outreach via the media to over 1 million people. The 23% increase in uptake of volunteers to the project in 2017 and the persistence of existing volunteers suggests the success of the Project in actively engaging members of the community to be involved in and to promote conservation will be ongoing. Empowerment of members of the community has led to self-generated projects specifically associated with forest and fauna conservation, including a radio show, primary school education programs and books.

Breeding success in the 81 owl territories monitored in the 2016/17 breeding season was 80%, with an average fledging rate of 1.24 chicks/year, higher than both the previous estimate of success generated by the project in 2015/16 (1.22 chicks/year) and the 0.9 chicks/year typical of less urban Powerful Owls. Radio tracking over the 2016/17 breeding season identified owls in highly urbanised areas travelling five times further in a 24 hour period than those in less urbanised areas, and highlighted the importance of even small green patches within the cityscape as focal stepping stones for owls moving through the urban landscape. Successful urban Powerful Owl territories typically contain 1-3 trees with hollows big enough for owls to use. Whether owls re-use the same hollow in consecutive breeding years was correlated with the level of disturbance around the nest tree. *Angophora costata* remains the most commonly used nest tree species (43%), followed by *Eucalyptus pilularis* (21%), *Syncarpia* *glomulifera* (7%) and dead trees (7%). Average hollow entrance height and widths in breeding owls in 2016/17 were 42.3/44.2centimeters, although owlets fledged successfully from hollows as small as 26 centimetres high and 13 centimetres wide.

The urban owl population continues to experience annual mortality of up to 10% of the population through car strike, with electrocution accounting for a further 5% of the documented mortalities. An increasing number of anecdotal reports of collision suggest glass veranda fences pose a significant and increasing risk to Powerful owls when they back on to green spaces like riparian zones, with four documented mortalities throughout the study area associated with collisions into these fences. Diet in highly urbanised Powerful Owls includes terrestrial fauna like rabbits and semiarboreal fauna like rats. Owls holding territories in less dense urban areas eat fewer rats, but all urban owls in the population sampled eat greater proportions of Brushtailed Possums and Grey-headed Flying Foxes and fewer invertebrates than their forest-dwelling counterparts. This dietary shift has the potential to increase mortality in urban populations through secondary poisoning. Ongoing conservation efforts include advocacy focussed on retaining critical habitat features such as hollow-bearing trees, preferred species of roost trees and roost microhabitats, and mapping and managing mortality hot spots in conjunction with local land managers.

Dr Stephen Ambrose

(Director – Ambrose Ecological Services)

Conflicts between city development and bird populations: are they adequately addressed by our planning and building regulations?

Tall and large buildings in city centres are a double-edged sword for urban bird populations. They benefit a few bird species by providing artificial roosting and nesting habitat, and shelter from inclement weather and predators, but can have adverse impacts on other bird species through habitat displacement and bird collisions with glass windows. Birds that use city buildings as habitat have the potential to become pests if they occur in large numbers, through the accumulation of droppings, mite and lice infestations, contamination of air-cooling systems, physical damage to building structures, excessive noise, and just being a general nuisance. Some architects are attempting to bring native birds back into cities through the construction of roof gardens, but are also incorporating building features that reduce the risk of colonisation by pest birds and reduce the risk of bird strikes. The ECA presentation focuses on the use of city buildings by birds, and describes how ornithologists, architects and construction companies in Sydney are working together to design buildings that are friendly to some native bird species, but unfriendly to potential pest bird species.

Greg Steenbeeke

(Senior Threatened Species Officer, OEH)

Managing Threatened Species in Urban Habitats

There are many factors to consider in managing threatened species in the urban environment, commencing before it becomes such an environment and continuing through in perpetuity. The ability of species and communities to persist, and in some instances, thrive in the urban environment is typically related to the management implemented on site. This can be identified early in the development assessment and approval process, or as changes to management that are implemented on the basis of more information or improved methods. The assessment establishes the baseline information and can be rigorously reviewed to ensure compliance and use of appropriate methods. It is critical to identify the potential changes to the environment that result from the development. These may not have an immediately identifiable impact on the community but can lead to long term impacts that may result in significant changes – especially where onsite offsets are used to ameliorate impacts. Impacts on hydrology, pollination services and propagule movement, fire ecology and woody debris are factors often not taken into account but which are critical to ensure persistence. The post-development environment can be augmented, managed and promoted, and it is often the relationships with the human community that will provide for long-term success.

Tony Cable

(Biosis – Senior Aquatic Ecologist)

Project approval compliance to delivering research outcomes – The Ugly Fish

Biosis was engaged, by Austral Research and Consulting to provide advice regarding an assessment of the functioning of a fishway installed to facilitate fish passage on newly constructed weir on the Hunter River, Singleton. The assessment of the fishway function was a condition of approval within the Instrument of Approval for the Bayswater Power Station Upgrade to Increase Water Extraction Capacity. Multiple options of assessing fishway function were considered, with a small scale acoustic telemetry assessment determined to be the most practical and conclusive.

A total of 50 acoustic transmitters were inserted into the peritoneal cavity of 48 Australian Bass (*Macquaria novemaculeata*) and two Bullrout (*Notesthes robusta*). Thirty acoustic receiving stations were established between the upper reaches of the Hunter River and estuary. The migrations of Australian Bass within freshwater systems is well understood, however the queues for these movements is poorly understood. The two Bullrout captured were unexpected, with little information available on movement patterns, behaviour and life history, with only vague assumptions currently available within literature. The Australian Bass successfully passed downstream and upstream of the fishway, with seasonal peak flows triggering movement of most individuals downstream. The two Bullrout also made similar movements, although at more "casual" rate, with both individuals remaining in an estuarine or brackish environment.

The project conclusively provided evidence of the function of the fishway, contributed to the understanding of migratory queues and seasonal requirements of an important recreational freshwater fish species and provided some insight into the life history of a poorly understood species. Several questions were raised and future research options are currently being investigated to fully understand the "Ugly Fish".

James Dalby-Ball

(Senior Site Supervisor Dragonfly Environmental)

On-ground ecological restoration works – how to get better on-ground outcomes and compliance through improved environmental reporting: practical additions and changes to reporting to assure great on-ground works

So what is needed from a report or plan to get the best ecological outcomes on-ground?

This presentation goes through the steps to maximise how environmental reporting particularly vegetation management plans can be improved to get the best ecological outcomes.

The presentation follows the order of works from: site assessment, writing the plan, detailing works required, approvals of the plan by relevant government agencies, conditioning the whole plan or points of the plan as part of DA or other approval. Implementation of the plan and follow-up monitoring and associated compliance when necessary.

Practical additions including flexibility between time of writing and work implementation, species selection and zonation of works areas. The critical detail needed within the bill of quantities. Designating the technical expertise of those implementing works is key to include. Clarity of recommendations such that approval authorities can implement the plan as part of Development Approvals and staging of conditions such that each activity can occur at the correct time. For example, seed collection and vegetation protection. Plans must include the procedure for managing works post expiration of the plan or report.

Arthur White

(Biosphere Environmental Consultants P/L)

Life beneath your feet – habitat creation and enhancement for the Pink-tailed Worm-lizard Aprasia parapulchella

Pink-tailed Worm-lizards *Aprasia parpulchella* are small, ant-eating lizards that are rarely seen and spend much of their life under rocks or below ground. Due to their subterranean habits, our knowledge of these animals has been limited and our understanding of the range of the worm-lizards totally deficient. Prior to 2000, Pink-tailed Worm-lizards were known almost exclusively from the Murrumbidgee Valley in the ACT but shortly afterwards a few specimens were located in Victoria. In 2001, a Pink-tailed Worm-lizard was found in the Dubbo Local Government Area, at Toongi, about 30 km south of Dubbo. This discovery was significant as the species was totally unknown from areas this far north or west. The discovery of the lizard came as part of a wider fauna survey initiated at the site which was proposed to become the location of a rare-earth mine (The Dubbo Zirconia Project). The challenge for the miners and conservationists was to develop the mine site in such a way that the mine was functional and profitable while still retaining viable populations of these elusive and secretive animals. To do this a series of searches and environmental surveys were undertaken to determine the distribution and habitat requirements for the worm-lizards, where they mainly occurred and what measures could be implemented to conserve them. Trials were conducted using artificial shelter materials to see if the worm-lizard habitat areas could be expanded were also carried out. With this new biological information at hand, a Plan of Management was developed in 2014 that considered the ecological needs of the Worm-lizards and integrated these requirements into the mine site development plans. As a result, core habitat areas have been spared, habitat enrichment areas are proposed and the survival of this inconspicuous reptile is guaranteed at Toongi.

Josie Stokes and **Cassie Thompson**

(Roads and Maritime Services)

Recent innovations in microbat mitigation on road projects in NSW

Roads and Maritime is responsible for maintaining over 18, 000 kilometres of road network in New South Wales (NSW), Australia. Along the east-coast of NSW, roosting and breeding habitat for threatened microbats occurs in in a variety of Roads and Maritime assets. This includes structures such as historic timber truss bridges, concrete pipe and box-cell concrete culverts, and concrete bridges.

When these structures are removed or upgraded for maintenance or safety reasons, impacts on threatened bats such as the Large-footed Myotis and Bent-wing bats can be significant enough to cause the extinction of local populations.

To minimise impacts of road projects on threatened microbats, the agency aims to restore roosting and breeding habitat by providing mitigation measures such as bat boxes which are subsequently monitored for use. However, results from ecological monitoring indicate that wooden or recycled plastic bat boxes should only be considered as temporary construction mitigation measures as most bat boxes deteriorate over time, and are sometimes not utilised by the target species.

For the past five years, Roads and Maritime has investigated and documented the features of known roosting and breeding habitat for threatened microbats in a variety of concrete and wooden structures within the Northern Rivers region of NSW.

Based on these known features, ecologists, bridge designers, biodiversity specialists, environment staff and project managers have worked together to include permanent roosting and breeding habitat in the design and construction of new concrete bridges and box-cell culverts. These designs have also been applied to the retrofitting of existing concrete culverts and recent ecological monitoring has recorded successful uptake and breeding events.

This presentation provides detail on the evolution of microbat mitigation in NSW, and the project that resulted in an Australian first- inclusion of permanent microbat habitat in the design and construction of a new bridge. It also highlights other recent innovations in microbat mitigation for small and large scale road projects, and illustrates how the culture of a road agency is changing to design and incorporate permanent roosting and breeding habitat for threatened microbats into new concrete structures.

John Travers

Travers Bushfire & Ecology

The compromise between bushfire asset protection zones and ecological conservation.

Asset protection zones cause one to think of cleared lands, roads and car parks. Yes that's one and probably the most common theme …. but there are other ways to achieve satisfactory asset protection. By breaking down the components of fuel one can see the available opportunities that arise for *ground dwelling* reptiles, invertebrates, mammals; *flowering plant* specialists such as birds and bees; *tree bark* opportunists such bats and invertebrates; *tree canopy & branch* opportunists such as mammals, birds and microbats. 'It doesn't have to be threatened to be protected'.

This array of wildlife can take advantage of these special asset protection zones when they are adjacent to larger patches that connect to fully structured natural area landscapes as they would be! By applying basic design skills an APZ can be a place that our wildlife can occupy, forage and potentially refuge within. There is no doubt that refugia is the key ingredient here and there is no future in presenting habitat whilst not providing appropriate refugia from the nocturnal hunters (cats) or the day time irritants (dog). Through good design and use of available on-ground resources our diverse wildlife have a chance.

ECA SUBMISSION TO OEH REGARDING BIODIVERSITY CONSERVATION REGULATION 2017 AND ACCREDITATION SCHEME FOR THE APPLICATION OF THE BIODIVERSITY ASSESSMENT METHOD

21 June 2017

Biodiversity Reforms - Have Your Say

PO Box A290
Sydney South

NSW 1232

ECA ECOLOGICAL CONSULTANTS ASSOCIATION of NSW Inc

Dear Sir/Madam,

Re:

- **Biodiversity Conservation Regulation 2017**
- **Accreditation Scheme for the Application of the Biodiversity Assessment Method**

The Ecological Consultants Association of NSW (ECA) formed in 1999 to promote and enhance best practice in ecological assessment, planning and management in accordance with the principles of Ecologically Sustainable Development. It is the leading industry-based organisation for ecological consultants in NSW.

The ECA provides essential professional development services for its members, including young ecologists starting their careers. Along with our mentoring, conferences, publications and annual grants the ECA provides an effective link between environmental and planning law, government agencies and consultants with expert and specialist ecological knowledge.

ECA has already made significant submission to OEH on aspects of the new Act. The ECA provides the following additional comments the Accreditation Scheme for the Application of the Biodiversity Assessment Method and the new Biodiversity Conservation Regulation 2017.

The ECA believes that at the heart of these laws is an apparent philosophy by the NSW Government that some biodiversity just cannot be conserved. The greatest biodiversity losses in NSW currently occur in agricultural regions. The ECA is of the very strong opinion that these losses will be increased and accelerated in agricultural landscapes, where sensitivity maps will classify vast areas of NSW as no longer subject to vegetation clearing controls.

Yours faithfully

Belinda Pellow

Vice President ECA of NSW

SUBMISSION BY THE ECOLOGICAL CONSULTANTS ASSOCIATION ON THE ACCREDITATION SCHEME FOR THE APPLICATION OF THE BIODIVERSITY ASSESSMENT METHOD

The Ecological Consultants Association of NSW (ECA) was initiated to promote and enhance best practice in ecological assessment, planning and management in accordance with the principles of Ecologically Sustainable Development.

The ECA was formed in 1999 and our members include ecologists, regulators and land managers. Ecological consultants in NSW are professionals with a vast amount of experience in biodiversity assessment across a wide range of disciplines.

One of our main aims has been to develop a certification scheme for consultants. The scheme, launched in January 2016, was developed with financial support and peer review from OEH. The scheme and its goals are detailed further below at Appendix 1. A number of members have already been certified as CPEC practitioners.

With the advent of the new Biodiversity Conservation Act (the Act) and the associated Regulations it has now become even more necessary that a workable and reputable accreditation scheme be adopted by ecological consultants. Under the Act, an Accreditation Scheme for the Application of the Biodiversity Assessment Method - Order 2017, is proposed. On inspection of this Order, it is apparent that the procedure for applying for accreditation (Section 7) is similar to that utilised within the certification scheme established by the ECA, as you will see when reviewing the attached documents. This is to be expected as ECA and OEH have, over the years, worked closely on developing a scheme that will provide the government and the community with a high standard in ecological consulting.

To avoid any duplication of time and resources we would like to recommend that the relevant OEH staff involved with the introduction of the accreditation scheme work together with those members that have developed the ECA certification scheme. It would be beneficial for OEH if the ECA could contribute to the BAM accreditation scheme, providing their acquired expertise in establishing protocols and implementing an accreditation scheme. Due to the similarity between the schemes there should be scope for the ECA accreditation scheme to be used as a criterion for accreditation as a BAM assessor. This would reduce the requirement for OEH resource input as some of the assessments required will have been undertaken in the ECA accreditation process.

6.4 Variation rules under biodiversity offsets scheme (section 6.4 (4))

(1) The circumstances in which the ordinary offset rules for the determination of the like-for-like biodiversity credits required as biodiversity offsets may be varied

This variation rule allows a threatened species (plant or animal) in a particular region to be lost as long as another species can be protected. This will not stop the loss of biodiversity in NSW but allow it to continue at a greater rate. How can a woodland in the same formation composed of totally different species substitute for another being lost? How will biodiversity loss be avoided if the removal of a listed orchid can be offset by the protection of listed Eucalypt.

The use of this system relies heavily on the ancillary rules determined by the Environment Agency Head for purposes of biodiversity offset and variation rules (section 6.4).

ECA recommend that OEH develop rigorous rules to ensure that a proponent pursues all possible avenues to locate and protect like for like biodiversity credits before variation rules are applied.

6.5 Ancillary rules of Environment Agency Head for purposes of biodiversity offset and variation rules (section 6.4)

This clause states that:

The Environment Agency Head is to publish ancillary rules for the purposes of the interpretation and application of the offset rules and variation rules.

Ancillary rule (f) - will set out the reasonable steps that a proponent is required to take to obtain requisite like-for-like biodiversity credits before the variation rules can be applied, which may include:

- (i) checking the public register of biodiversity credits, and
- (ii) lodging an entry in the public register of persons seeking biodiversity credits for a minimum specified period, and
- (iii) contacting landholders who are entered on the public register of biodiversity stewardship site expressions of interest, and

(g) define what constitutes hollow bearing trees or artificial hollows, and

(h) include any other provisions that the Environment Agency Head considers necessary or convenient for the purposes of the interpretation or application of the offset rules or variation rules.

ECA recommend that the following step be added as step 1 in the list:

(i) providing evidence that all reasonable steps have been undertaken by the proponent to locate like for like biodiversity credits in the relevant IBRA region.

Appendix 1

CERTIFIED PRACTISING ECOLOGICAL CONSULTANT

The primary objectives of the ECA Certified Practicing Ecological Consultant (CPEC) scheme are:

1. facilitate professional recognition for those involved in ecological assessment;
2. Establish a high standard of practicing ecological assessment in NSW;
3. Provide planning authorities and communities with a high level of confidence in ecological assessments prepared by CPEC; and
4. Promote the development of a viable ecological survey and assessment industry.

A CPEC will be recognised by the industry, government authorities and the community as **ethical, experienced, respected** within the industry, **licenced** and **insured**.

To qualify to become a CPEC the requisite competency criteria need to be met:

- Have at least five years of consulting experience in a relevant ecological field during the past 10 years.
- Commit to ongoing professional development and demonstrate commitment to maintaining an appropriate understanding of current and scientifically robust ecological assessment methodologies.
- Demonstrate that you are respected by peers within the ecological consulting industry by the provision of two recommendations from full members of the ECA NSW, and two from within the applicant's area (s) of particular interest.
- Provide a written statement of 500 words outlining your career achievements and particular ecological interests. (Attendance at a meeting with the review panel may be requested on a case by case basis).
- Provide evidence of appropriate licences and approvals to undertake ecological work in NSW and carry Professional Indemnity Insurance applicable for your area of consulting.
- Be willing to Sign the ECA (NSW) Code of Business Practice, Professional Conduct and Ethics and to uphold the beliefs as set out in these documents.

Guarantee of quality of a CPEC.

1. A CPEC is required to submit documents to an independent committee of experts who will recommend certification. The committee can request interview or further information from the applicant if required.
2. The CPEC committee follows a set of requirements to ensure the applicant is qualified for certification.
3. A CPEC will pay a biannual fee
4. A prospective CPEC will be listed for 30 days on the ECA website to invite community input prior to awarding of the certification.
5. A CPEC will be required to renew their certification every two years supported by a log of professional development activities undertaken in the preceding 2 years.
6. A CPEC can be reported to the ECA for discipline if they do not meet the standard required by the certification.
7. The ECA has Articles that support the disciplining of a CPEC.
8. The ECA has the relevant insurance required.

Recent Literature and New Publications

Recent Journal Articles / Literature

Paper published by Charlotte Mills using funding from the ECA Ray Williams Mammal Research grant

Mills CH, Gordon CE, Letnic M. (2017) **Rewilded mammal assemblages reveal the missing ecological functions of granivores.** *Funct Ecol.* 2017;00:1–11. **https://doi.org/10.1111/1365-2435.12950**

Thea O'Loughlin, Luke S. O'Loughlin, Damian R. Michael, Jeffrey T. Wood, Helen P. Waudby, Phillip Falcke and David B. Lindenmayer (2017). **The importance of travelling stock reserves for maintaining high-quality threatened temperate woodlands.** *Australian Journal of Botany* 65(7) 507-516 **https://doi.org/10.1071/BT17114**

David J. Sharpe and Ross L. Goldingay. (2017) **Demographic parameters of the squirrel glider (*Petaurus norfolcensis*) in an urban forest remnant.** *Australian Journal of Zoology* 65(3) 141-147 **https://doi.org/10.1071/ZO17004**

Grant D. Linley (2016). **The impact of artificial lighting on bats along native coastal vegetation.** *Australian Mammalogy* 39(2) 178-184 **https://doi.org/10.1071/AM15047**

T. M. Newsome E. E. Spencer and C. R. Dickman (2016) **Short-term tracking of three red foxes in the Simpson Desert reveals large home-range sizes.** *Australian Mammalogy* 39(2) 238-242 **https://doi.org/10.1071/AM16037**

Greta J. Frankham, Sean Thompson, Sandy Ingleby, Todd Soderquist and Mark D. B. Eldridge (2016). **Does the 'extinct' eastern quoll (Dasyurus viverrinus) persist in Barrington Tops, New South Wales?** *Australian Mammalogy* 39(2) 243-247 **https://doi.org/10.1071/AM16029**

Kylie Soanes, Briony Mitchell and Rodney van der Ree (2016). **Quantifying predation attempts on arboreal marsupials using wildlife crossing structures above a major road.** *Australian Mammalogy* 39(2) 254-257 **https://doi.org/10.1071/AM16044**

Paul I. Boon (2017). **Are mangroves in Victoria (south-eastern Australia) already responding to climate change?** *Marine and Freshwater Research* 68(12) 2366-2374 **https://doi.org/10.1071/MF17015**

S. J. S. Debus , W. K. Martin and J. M. Lemon (2017). **Changes in woodland bird communities as replanted woodland matures.** Pacific *Conservation Biology* 23(4) 359-371. **https://doi.org/10.1071/PC16028**

Jonathan D. Majer , Harry F. Recher , Christopher Norwood and Brian E. Heterick (2017). **Variation in bird assemblages and their invertebrate prey in eucalypt formations across a rainfall gradient in south-west Australia.** *Pacific Conservation Biology* 23(4) 372-386 https://doi.org/10.1071/PC17024

Hugh C. Finn and Nahiid S. Stephens (2017). **The invisible harm: land clearing is an issue of animal welfare.** *Wildlife Research* 44(5) 377-391 https://doi.org/10.1071/WR17018

Amanda M. Adams and M. Brock Fenton (2017). **Identifying peaks in bat activity: a new application of SaTScan's space–time scan statistic.** *Wildlife Research* 44(5) 392-399 **https://doi.org/10.1071/WR16194**

Recent Book Releases

Information Source: CSIRO Publishing

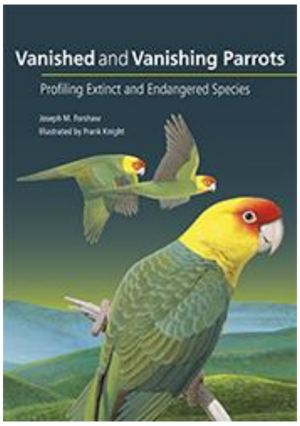
Website http://www.publish.csiro.au

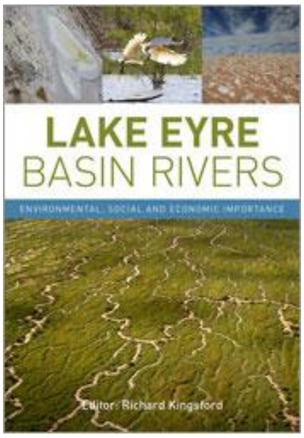
Title: Vanished and Vanishing Parrots
Author: J Forshaw and F Knight
RRP: $150
No. Pages: 352
Publisher: CSIRO Publishing
Date: October 2017

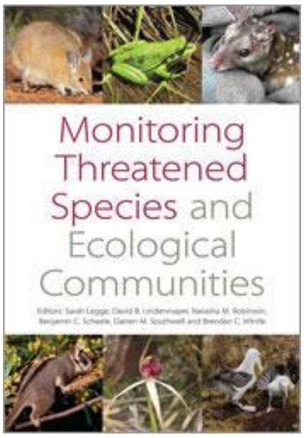
Title: Lake Eyre Basin Rivers
Author: JR Kingsford
RRP: $59.95
No. Pages: 272
Publisher: CSIRO Publishing
Date: October 2017

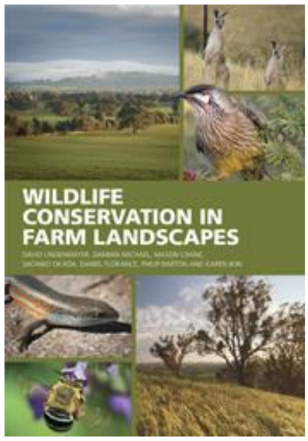
Title: Monitoring Threatened Species and Ecological communities
Author: Legge S. et al.
RRP: $69.95
No. Pages: 480
Publisher: CSIRO Publishing
Date: January 2018

Title: Wildlife Conservation in Farm Landscapes
Author: Lindenmayer D. et al.
RRP: $49.95
No. Pages: 232
Publisher: CSIRO Publishing
Date: August 2016









Advertising Opportunities with the ECA

Website:

- **$200 for a banner**
- **$300 for company name with some detail and a link**
- **$500 for company name within box, logo, details and web link**

All website packages run for one financial year and include a small ad in any newsletter produced during the financial year.

Newsletter:

- **$100 for a third of a page**
- **$250 for a half page**
- **$500 for a full page**
- **$1 / insert / pamphlet**

Advertising is available to service providers of the Ecological Consulting industry. The ECA will not advertise a consultant or their consulting business.

If you wish to advertise, please contact the ECA administrative assistant on admin@ecansw.org.au.

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"Non-ECA promotional material presented in the ECA Newsletter does not necessarily represent the views of the ECA or its members."

PUBLICATION REVIEW

The Australian Bird Guide

Menkhorst, P., Rogers, D., Clarke, R., Davies, J., Marsack, P. and Franklin, K. (2017). 566 pp. (CSIRO Publishing, Clayton South). Softcover, 245 x 170 mm. Wt: c. 1,450 g. AUD$49.95

With several high-quality field guides to Australian birds on the market, why another guide? There is no such thing as the perfect field guide and there is always room to improve on existing ones. There is already strong competition between several field guides to Australian birds in the existing market, so any newcomer would have to raise the standard considerably to have any chance of lasting success. I'm pleased to say that *The Australian Bird Guide* has done this, partly through adopting the best layout features of other field guides, but also adding some of their own.

The field guide covers bird species that have been recorded in Australia and its external territories, including Australian territorial waters, Cocos Keeling Islands, Christmas Island (Indian Ocean), islands of the Torres Strait, Norfolk Island, Lord Howe Island, Macquarie Island, Heard and McDonald Islands and the Australian Antarctic Territory. A map of the geographical region is shown on the inside of the back cover. The guide describes 936 bird species that have been recorded in the region since 1940, 747 of which are breeding residents or regular migrants that occur annually, 29 introduced species, and 160 vagrant species. The authors explain that 30 new vagrant species were recorded in the geographical region for the first time while they were compiling the field guide, so cautioned that additional vagrants are likely to occur after the book is released. While other recent Australian bird field guides have variously covered Australia and its territories, and vagrant species, *The Australian Bird Guide* covers more species because it is the latest field guide and the number of vagrant species recorded in the region continues to increase.

The authors (Peter Menkhorst, Danny Rogers and Rohan Clarke) are widely-respected Australian zoologists and experienced birders. Peter is the author of the *Field Guide to Mammals of Australia* (Oxford University Press, Melbourne) and is editor of two editions of *Graham Pizzey's The Field Guide to Birds of Australia* (Harper Collins, Melbourne). Danny compiled the plumage and morphometrics sections for many of the species in the early volumes of the *Handbook of Australian, New Zealand and Antarctic Birds* (*HANZAB*) (Oxford University Press, Melbourne) and is a shorebird specialist. Rohan is a co-author of *Finding Australian Birds: A Field Guide to Birding Locations* (CSIRO Publishing, Collingwood), has worked professionally as a bird photographer, and is a specialist in seabirds and birds in Australia's external territories.

The illustrators (Jeff Davies, Peter Marsack and Kim Franklin) are highly-acclaimed wildlife artists, all of whom contributed significantly to the artwork of the *HANZAB* volumes, the current definitive source of information on the avifauna of our region. All the illustrators are also among the most experienced birders in Australia.

Most of the authors and illustrators are twitchers and, collectively, would have seen most of the species featured in the field guide, in the wild. Therefore, everyone involved professionally are highly-qualified to put this latest field guide together. They have also been ably-assisted by other senior ornithologists and the "who's who" of Australian birding, all of whom have been named in the *Acknowledgements* section of the field guide.

There are four main introductory chapters in the field guide. The first one explains the construction of the guide: an introduction to the book's contributors, sources of information used, the geographical area and the bird species (including vagrants and rarities) covered, the taxonomy and nomenclature used, an explanation and defence of the book's layout, structure of species accounts, artwork and distribution maps. The second chapter introduces useful information on how to identify birds, includes discussions of bird size, bird topography (external appearance), feathers and moults, plumage sequences and how to age birds, geographical variation and the ageing of subspecies. The third chapter is about birding in Australia, and discusses when to go birding, bird migration, what equipment to use, and how to document your records. The fourth chapter, written by Leo Joseph (Principal Scientist, Australian Wildlife Collection, CSIRO), discusses the evolution and classification of Australian birds. All these chapters demonstrate that the authors are cognizant of the value of the field guide for birding novices, as well as the seasoned birder.

The species accounts, understandably, occupy most of the book (500 pages). Species are categorised into three major habitat types: marine and coastal, freshwater, and land. Pages are colour-coded near the top right corner of each page to denote each type of habitat. The concept of arranging species in a book according to habitat is always problematic, mainly because most bird species live in a range of habitats, and not all taxa within a family are found in the same habitats. The magnitude of this problem was no more obvious than in the various editions and reprints of "*Neville Cayley's What Bird Is That?*" where habitats were defined too finely, and each bird species was categorised under just one habitat. The end result was difficulty in locating bird species within that guide book and for bird novices to mistakenly believe that many bird species were restricted to the habitat under which they were categorised. The authors of *The Australian Bird Guide* have tried to avoid this problem by restricting habitats to three broad categories but, inevitably, anomalies still exist. For example, all shorebird species are categorised in the book as marine and coastal species, but two of these species, the Inland Dotterel (*Charadrius australis*) and Australian Pratincole (*Stiltia isabella*) occur mainly on sparsely-vegetated inland plains, the Oriental Pratincole (*Charadrius veredus*) occurs mainly on grasslands and thinly-vegetated plains of northern Australia and the Bush Stone-curlew (*Burhinus grallarius*) is found in grassy woodlands. Similarly, all egrets are categorised as freshwater species, but the Eastern Reef Egret (*Egretta sacra*) and Western Egret (*E. gularis*) are found mostly in marine tidal areas, on rocky shorelines and on coastal reefs. This is likely to create confusion among users of the guide, and create difficulties for birding novices, in particular, to identify such anomalous species.

Species profiles within each habitat are presented in taxonomic order. A brief family profile precedes the profiles of the species that occur within that family. In families containing high species richness and diversity, there are brief profiles of subfamilies [e.g. Family Laridae (gulls and terns), Subfamily Sternidae (terns)] or genera [e.g. Family Meliphagidae (honeyeaters), Genus *Philemon* (friarbirds)]. This is a valuable aid for honing in on the species that a birder may wish to identify.

Unlike most other bird field guides, this guide has included vagrants and rarities in the main part of the book, rather than as an appendix. The authors explain in the first introductory chapter that they debated this at length and finally decided it was best to include them alongside more common species with which they are most likely to be confused. Vagrants are identified clearly as such in the top right corner of each species' text and, where possible, their images are near the bottom of colour plates. I'm still undecided about the merit of their decision; on the one hand, there is real value in having images of vagrants next to commoner species for comparison, but on the other hand, they could become a distraction and will probably lead to more misidentifications by inexperienced birders.

Between two and six species profiles are written on the left-hand pages of the book and the colour plates of the corresponding species are on the right-hand pages. Corresponding distribution maps are located along the bottom of the left-hand pages that contain the species text. This adds to the user-friendliness because all the available information for a set of species is across a double-page spread.

The accounts of most species are extremely detailed, more detailed than in other Australian bird field guides for most species. Each species account contains the following information: common English name and scientific name; a likelihood of encounter in Australia score (e.g. moderately common/reasonable chance or very rare/very difficult to find); official national conservation status (e.g. Endangered, Vulnerable); body measurements (wing length, bill length, body weight); italicised key identification features; body profiles at rest and in flight; descriptions of adult, breeding, non-breeding, immature and juvenile plumages; descriptions of vocalisations; and additional notes that help in species identification.

There are occasional lapses in editorial quality of the texts. The most notable of these is in the section on ravens and crows (Family Corvidae) where the family description (p. 438) states "*Identification can be challenging and relies on hearing the calls, as well as body size and structure, and the structure of throat hackles (see table on page 410)*." However, no such table exists in the book, and p. 410 is devoted to a discussion of Australian chats. Curiously, though, there is an extremely useful table at the end of the section on corvids (p. 440) that identifies the common corvid species in major Australian cities, which is not referred to in the section's text.

Why the authors chose to record wing length instead of body length for all bird species is a bit of a mystery. It is probably because the body measurements were reproduced from the *HANZAB* volumes which did not record body lengths of species. Wing length is a useful feature for identifying soaring birds (e.g. seabirds; shorebirds; raptors; waterfowl; and swifts, swallows and martins), but most birders would be more comfortable at estimating the body length of perching birds. So I hope that a revised edition includes body length measurements too.

The colour plates are a core part of the field guide and, on many levels, are the best feature of the book. For each species, there are images of adults and juveniles, and other recognisable forms (non-breeding and immature plumages, subspecies and intergrades). The birds are shown in postures that allow quick comparisons of relative size, shape, structure and proportion. Most of the species are shown at rest and in flight and, where space permits, some species are shown displaying diagnostic behaviours in typical habitat (e.g. babblers, p. 419). Some images also come with a brief explanatory note, identifying an important feature (e.g. wing marking) that is unique to the species. Each species is drawn to scale and a scale bar is located near the bottom left-hand corner of each colour plate. In a recent television interview, I heard Peter Menkhorst explain that a major incentive for producing the field guide was to assist birders who used high-quality digital optical equipment, to see and record fine plumage details, to identify their birds. Many of those fine plumage details are depicted in the bird images in the field guide.

Distribution maps range from simple geographical distributions of species to those showing more detail. More detailed maps show the ranges of subspecies, including areas of overlap or irregular occurrence and, for migratory species, regions of intra-continental migration. Distribution maps of seabirds show the ranges of species across the ocean and the locations of known breeding colonies within the region. Symbols on some shorebird distribution maps depict the locations of internationally-significant sites for those species. Collectively, these maps show more information than those found in other Australian bird field guides. Unfortunately, they have been shrunk to such a small size in the book, so that they can fit on the same pages as the corresponding species texts, that the more detailed maps depicting subspecific distributions and internationally-significant sites are difficult to decipher. I also hope this is resolved in a revised edition.

The final part of the book is a checklist of bird species in the region that the birder can use for recording the species they have seen. This is not a unique feature, most Australian bird field guides have a checklist, but its inclusion helps make this field guide the complete package.

The authors have done all they can to assist the birder to find a species in the field guide. On the inside of the front cover there is a double-page visual quick reference (illustrations and corresponding page numbers) to bird groups. A few pages in, immediately before the main contents page, is an alphabetical quick reference to bird groups (e.g. albatrosses, kingfishers, whitefaces) with corresponding page numbers. Finally, there is an alphabetical index of common English and scientific names at the end of the book.

The book has a waterproof plasticised cover, an important consideration if it is to be taken into the field. The pages have a gloss-finish to them to enhance the print quality of the illustrations and text, but this is likely to result in individual pages becoming glued together in moist (high-humidity or light rain) environments, a high risk in some Australian environments, especially on pelagic trips. The book is also bulky, 566 pages in length and *c.* 1,450 g in weight, adding to its difficulty of use in the field. The field guide needs to be developed as an app for mobile electronic devices, because a hardcopy is likely to spend a lot of time in the backpack or the glove box of the car, and consulted less frequently than it should be during birding trips.

The field guide is great value for money, costing only $49.95. This is the lower end of the cost-spectrum for Australian bird field guides, but it contains more and better-quality information.

Despite its minor flaws, this bird field guide has simply blitzed other hardcopy Australian bird field guides currently on the market. It covers more species, their profiles are more detailed, and the colour plates take illustrated guides to a record high standard. It is likely to be the hardcopy field guide of choice until it is replaced by a better one. However, birders are becoming more reliant on bird field guide apps for mobile electronic devices; *The Australian Bird Guide* needs to come out as an app if it is to dominate this side of the market too.

Postscript: *On 4 October 2017, the Royal Zoology Society of NSW awarded The Australian Bird Guide its Whitley Medal for the Best Zoology Book of the year. Principal author, Peter Menkhorst, indicated to me privately that the book will be reprinted in time for Christmas to remove the printing and editorial errors that have been identified by birdwatchers.*

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Birds of New Guinea Including Bismarck Archipelago and Bougainville.

Gregory, P. (2017). 464 pp. (Lynx Edicions, Barcelona). Hardcover, 230 x 160 mm. Wt: c. 1,200 g. 54 EUR (c. AUD$80).

This is the first bird field guide that covers mainland Papua New Guinea (PNG), Bougainville and the Bismarck Archipelago (943 species, including vagrants). Previously, birdwatchers relied on separate field guides for the region, namely Pratt & Beehler (2014) for mainland PNG (780 species) and Dutson (2012) for the Melanesian islands (Bismarcks, Solomons, Vanuatu and New Caledonia) (650 species). Therefore, while not covering the full geographical extent of Melanesia as Dutson, Gregory (2017) does provide for the first time a field guide to birds of mainland PNG and associated islands. It is also a good companion guide to respected bird field guides for Indonesia, west of the region (e.g. MacKinnon & Phillipps 1993; Strange 2012).

The introductory chapter describes the geographical coverage of the field guide, aided by a map on the inside of the front and back covers. It also identifies the bird families that are endemic to the region and the geographical, geological and biological processes that have led to this endemism, species of conservation concern and the threats to their status, and descriptions of the climate and main bird habitats in New Guinea. Useful additions to this chapter include advice about how to enhance your birding experiences in New Guinea, the precautions one should take, and there is a comprehensive list of birding hotspots and the bird species that can be found at each hotspot. However, the book lacks a comprehensive map that shows where these hotspots are located. It would have been better for those hotspots to have been mapped on the inside of the back cover, rather than reproducing the same map that is on the inside of the front cover. The remainder of the chapter explains the layout of the book, defines the terms used in the species accounts, and provides information about the author.

The species accounts, understandably, occupy most of the book (422 pages). Vagrant species (75 species) are described and illustrated in a separate appendix to resident and migratory species. This is a very useful separation because many of the world's bird field guides include vagrant species in the main part of the field guide (thus making it less obvious that they are vagrants), list them in an appendix without illustrations or full descriptions, or don't list vagrants at all. The author has recognised the importance of including and describing vagrants in as much detail as other species, because many Palaearctic migrants are known to overshoot mainland south-eastern Asia when on migration, or species are blown out of their usual range by strong winds or cyclones and end up in New Guinea. A full treatment of vagrants is one of the main strengths of this field guide, a section of the book that is likely to grow in size in future editions as more vagrants are recorded.

Species accounts are presented in taxonomic order, beginning with the Casuariidae (cassowaries) and ending with the Nectariniidae (sunbirds). Accounts of species within each family are preceded with a brief description of features that aid in the identification of the family (e.g. characteristic body size and shape, habitats and behaviours). A fascinating aspect of the field guide is its indication of the proportion of the world's bird species in each family that occur within Papua New Guinea, thus demonstrating the region's relative importance in supporting the species diversity and richness of each family.

Between three and five species profiles are written on the left-hand pages of the book and the colour plates of the corresponding species are on the right-hand pages. This format promotes the book's user friendliness, preventing overcrowding of colour plates (a common feature of many bird field guides), allowing the illustrations of each bird to be quite large (thus maintaining the fine detail of plumages), and allowing space for the depiction of subspecific, gender and breeding plumages.

Profiles, while succinct, contain a wealth of information about each species including: common English name and scientific name; alternative English names; global conservation status; its status in New Guinea; body measurements (body and wing lengths); taxonomy (subspecies and their distributions); habitats and diagnostic behaviours; definitive plumage descriptions of adults, immature/juveniles and subspecies; species vocalisations; and a list of species that are similar in appearance.

Phil Gregory has 25 years of ornithological experience in the region, including living there for seven years, and research and birding trips (individually and as a bird guide). Gregory's own observations of species, especially diagnostic behaviours, are incorporated into the species texts, which gives the user confidence in the accuracy of information. For instance, Gregory states that the Olive Flyrobin (*Kempiella flavovirescens*) "*sits upright and still for long periods in middle stages. Quiet and inconspicuous, easily overlooked; sometimes jerks and shivers tail. Usually seen singly or in pairs, sometimes in small (presumed family) groups.*" (p. 384). In this regard, the ecological and behavioural information in the species profiles complements the taxonomic and systematic information of Beehler & Pratt (2016), the current definitive textbook on birds of New Guinea.

I have two minor criticisms of the species text layouts. First, the font is extremely small, and those birding in low-light conditions (e.g. in a closed forest or around dusk) or who are optically-challenged, may have difficulty reading it. But I recognise that the small font also allows more information to be included on a single page and for the guide to remain a manageable size for use in the field. Secondly, the meanings of the acronyms in the texts take a while to sink into the mind, even though they are explained in the introductory chapter, but are less likely to be a problem the more a person uses the field guide.

The colour plates have been prepared by 25 separate wildlife artists, and the illustrations are reproductions of those in del Hoyo & Collar (2014 & 2016), some of which have been modified to show finer details of the plumage. The quality of the illustrations varies somewhat, which is to be expected with so many artists, but they are generally of an extremely high standard. Each species is illustrated with a natural perching posture; marine, freshwater and raptor species are also illustrated in flight; female and male plumages are illustrated in sexually-dimorphic species; and plumages of known subspecies are also depicted, as are breeding and non-breeding plumages of migratory shorebirds. Notable omissions, though, are illustrations of immature birds, which are often depicted in bird field guides, and the user needs to refer to the brief description of the immature plumage in the species text.

Placement of distribution maps alongside the illustrations of each species is an efficient use of otherwise "dead space" within the individual plates. It also instantly assists the birdwatcher to identify species, without having to search for maps elsewhere in the book, the bane of most other bird field guides. However, it is disappointing that the distributions of subspecies are not shown in the maps, especially when subspecies are illustrated in the plates; for this, the birdwatcher has to refer to the species' text, which is cumbersome. Instead, the author has opted to differentiate between permanent resident, breeding visitor, and seasonal migrant distributions of species in the maps. I question the value of that choice because many of the distribution maps depict most species as resident/permanent all-year round throughout their range.

The final part of the book has a comprehensive "*Reference and Further Reading*" section. Such lists are either absent or are not as comprehensive in most of the world's bird field guides. This is a real bonus for birdwatchers and ornithologists who wish to learn more about New Guinean birds, which would largely be a mystery for many first-time users of the field guide.

Use of the species index at the back of the book requires some prior knowledge of bird taxonomy. For instance the index lists species alphabetically according to their proper names (e.g. White-eared Catbird, Black-eared Catbird, Archbold's Catbird) instead of categorically (Catbird, White-eared; Catbird, Black-eared; Catbird, Archbold's). The contents page at the front of the field guide lists the page numbers for each bird family, e.g. "Ptilinorhynchidae (bowerbirds)". Therefore, a user of the field guide who wishes to identify a catbird species would need to be aware that catbirds are bowerbirds. While this may not be problematic for experienced birdwatchers, it is likely to disadvantage novice birdwatchers who wish to identify species quickly and efficiently.

A criticism I have of most modern-day field guides is their unsuitability for field conditions under which they would be expected to be used. This field guide is no exception; it has a hardboard cover, instead of the waterproof plastic cover of most modern field guides, which also makes it more prone to everyday wear and tear when dropped or carried in the backpack. The pages also have a gloss-finish to them to enhance the print quality of the illustrations and text, but this is likely to result in individual pages becoming glued together in moist (high-humidity or light rain) environments, a high risk in PNG environments.

The book's cost, *c*. AUD$80, is expensive compared with Australian bird field guides, which normally retail around AUD$50, and may need to be replaced more frequently if subject to a lot of wear, tear and weathering through regular use. However, it seems to be within the same price range of other PNG and Melanesian bird field guides.

The criticisms I have of this field guide are very minor and serve only as suggestions for improvement in future editions. It is the first comprehensive field guide to the birds of Papua New Guinea that has illustrations of every species. The species accounts, although necessarily brief, focus on features that are most important in identifying free-ranging birds. It includes vagrant species, and the illustrations show, for the first -time in a field guide of this region, the fine plumage details that an observer will see using high-quality digital optical equipment. Therefore, this field guide has made a very significant contribution to bird-watching and public knowledge of birds within the New Guinean region.

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Postscript: *On 4 October 2017, the Royal Zoology Society of NSW awarded Birds of New Guinea a Whitley Awards Certificate of Commendation in the Australasian Field Guide category.*

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TESTING ALTERNATE RESPONSE MODELS OF GRASSY ECOSYSTEMS

A paper by Ryan Sims and David Keith. Ryan is the recipient of the 2015 ECA Conservation Grant. Ryan can be contacted by email at ryan.sims@keybotany.com.au

Introduction

Unlike the savannas of Africa or steppes of Asia and North America, Australian ecosystems did not experience heavy grazing by ungulate herbivores before European settlement (Mack and Thompson 1982). Intense exposure to ungulates and farming practices since settlement has caused dramatic impacts on vegetation composition and function of grassy ecosystems (Lunt *et al.* 2007a). Australia's temperate woodlands differ from other temperate ecosystems worldwide in that most of the latter are either treeless steppes, extensions of subtropical savannas or forests dominated by conifers or broad-leaf deciduous trees (Whittaker 1975).

Livestock exclusion is a major tool to restore vegetation in agricultural landscapes of Australia (Prober *et al.* 2011b), China (Su *et al.* 2015), northern Sinai (El-Bana *et al.* 2003), north America (Yeo 2005), Saudi Arabia (Al-Rowaily *et al.* 2015) and Argentina (KrÖPfl *et al.* 2013), and is often the first step in restoring ecosystems degraded by farming. Many government and industry-sponsored projects provide incentives to landholders to fence remnants to exclude stock and improve ecological condition. Yet the ecological outcomes of these programmes have not been widely evaluated.

Some Australian studies of fencing responses have shown greater tree recruitment, increased cover of native perennial grasses, increases in native species richness, reduced cover of exotic annual species and reduced soil surface compaction at fenced sites relative to unfenced sites (Prober *et al.* 2011b; Spooner *et al.* 2002). Conversely, recovery is not assured and sites can remain in a steady degraded state (Spooner *et al.* 2002; Yates and Hobbs 1997). The failure of many restoration projects to initiate spontaneous recovery suggests that fencing alone may not be enough to initiate such change (Price *et al.* 2010; Spooner *et al.* 2002; Yates and Hobbs 1997). Slow recovery or transition to undesirable states could suggest intrinsic site problems or legacies generated by earlier farming practices. State and transition models have highlighted grazing-induced changes that may be irreversible if ecological thresholds for recovery have been crossed (Prober *et al.* 2002b; Spooner and Allcock 2006; Whalley 1994; Yates and Hobbs 1997; Yates *et al.* 2000). Identification of ecological barriers to recovery is critical for restoration of degraded remnants (Spooner and Allcock 2006), and until these are recognised and ameliorated, successful natural regeneration will remain highly uncertain and resource exhaustive.

To elucidate generalisations about livestock exclusion as a management tool for woodland restoration, four alternate response types for ungulate exclusion may be summarised from the scientific literature on Australian temperate grassy ecosystems:

- Recovery Model - with time since livestock exclusion, there are increases in diversity and abundance of native groundcover species that had been lost or reduced in abundance during grazing;

- Competitive Exclusion Model - with time since livestock exclusion, there are increases in abundance of dominant groundcover species which suppress other species, reducing overall plant diversity;

- Null Model - with time since livestock exclusion, there is no compositional shift and no increase in species diversity or abundance of groundcovers; and

- Woody Encroachment Model - with time since livestock exclusion, there are increases in woody plant abundance that suppress ground cover plants, reducing ground cover species diversity.

For all hypotheses, changes in vegetation may be expected to be detectable over periods of years to decades, with ground layer structure expected to respond more rapidly than woody structure and species composition.

These response types may be elaborated in four candidate response models that have been identified from grazing studies and described below.

Recovery Model: increase in diversity and abundance of native ground plants that were reduced in abundance or lost during grazing

This is an equilibrium model that predicts a simple reversibility response, in which a system returns to its pre-grazing state after removal of herbivores. It assumes that no thresholds are crossed and that the degradation pressure associated with grazing was weak or short-term. This response has been hypothesised across productivity gradients that have undergone low levels of degradation by grazing. On nutrient poor soils, for example, Yates and Hobbs (1997) found mildly degradation of Salmon Gum woodlands could be reversed if complete or near complete removal of grazing occurred. Prober *et al.* (2011b) found fenced York Gum woodlands were more similar in native species richness to benchmark woodlands than unfenced woodlands. Price *et al.* (2010) found a recovery of native species lost during grazing in River Red Gum woodlands of Victoria, while observations by Pettit *et al.* (1995) in nutrient poor Jarrah woodland of south-western Australia are broadly in support. Native understorey species richness returned to similar levels measured at ungrazed sites within three years of exclusion from variable grazing intensity and six years after intensive livestock grazing (Pettit and Froend 2001). However, the re-establishment of vegetation cover appeared to take longer (Pettit and Froend 2001). Lunt *et al.* (2007b) predicted that return of high native diversity after exclusion of grazing was more likely to occur on low productivity sites than high productivity sites. Lunt's prediction appears to be supported by Gibson and Kirkpatrick (1989), who found that a return of understorey species richness was negatively correlated with productivity following grazing exclusion in Tasmanian alpine grassy ecosystems. Conversely, others predict that reversal responses to grazing exclusion may occur on high-productivity sites (e.g. Spooner and Allcock (2006)). Consistent with this, Wahren *et al.* (1994) recorded substantial increases in a number of tall, palatable forbs and short, palatable shrubs after long-term (48 years) livestock exclusion on fertile and highly organic soils of subalpine grasslands of the Victorian Alps. The Recovery Model predicts the system returns to its pre-grazing state after removal of herbivore grazing.

Competitive Exclusion Model: increase in abundance of dominant ground plants which outcompete other species, reducing plant diversity.

This model predicts that a reduction in disturbance associated with grazing results in a decrease in species richness due to rapid growth rates of dominant plants allowing competitive exclusion to occur. More broadly, this conforms with Huston (1979) hypothesis that when reductions in biomass become less frequent, population growth rates of competitors increase, resulting in decreased diversity through the exclusion of weak competitors. This model has empirical support, mainly from high-productivity habitats, as proposed by Schultz *et al.* (2011) and Lunt *et al.* (2007b) for high-productivity habitats (cf. low productivity habitats, Recovery Model). Support for this model comes from several studies, including that of Tremont (1994), who recorded lower species diversity after 16 years of exclusion from sheep grazing in temperate grasslands on rich basaltic soils. The Competitive Exclusion Model predicts a reduction in species diversity due to exclusion of small taxa (i.e. small forb species that inhabit the inter-tussock niche) after removal of herbivores.

Null Model: no compositional shift and no increase in species richness of groundcovers

Under this model, the grazed system shows limited recovery after fencing and no change occurs to species richness with grazing exclusion. Consistent with this null hypothesis, Schultz et al. (2014) found no evidence of competitive exclusion by the dominant grasses, no establishment of species that were not recorded in grazed control plots and no directional shift in composition after 2.5 years of livestock exclusion from native grasslands dominated by warm-season perennial grasses on the North West Slopes of NSW. A crucial limitation of Schultz's study is the short timeframe over which responses to herbivore exclusion were measured. Nonetheless, responses of understorey vegetation to livestock exclusion may be delayed or inhibited by positive feedbacks between soil nutrient cycling and understorey composition (Prober *et al.* 2002b). The Null Model predicts no change in species richness or composition, and that the system maintains a stable state after grazing exclusion.

Woody Encroachment Model: dense woody plant recruitment out-competes understorey plants for resources and reduces species diversity.

This model predicts an increase in woody plant recruitment following livestock removal. As woody plant density increases understorey species richness decreases due to competitive interactions. Consequently, a negative relationship forms between woody plant cover and understorey species diversity. Dense native tree or shrub regeneration has been observed across various regions of Australia following the removal of livestock grazing. In rangelands of central NSW, the exclusion of livestock from Poplar Box (*Eucalyptus populnea*) woodlands saw an increase in shrub density after rainfall (Harrington et al. 1976; Hodgkinson 1976; Tunstall et al. 1981). The removal of sheep grazing in River Red Gum (*Eucalyptus camaldulensis*) woodlands of Victoria resulted in increased woody-plant cover (Price and Morgan 2009). It has been shown that mature trees may suppress understorey vegetation by depriving it of resources (Connell and Slatyer 1977; Prober *et al.* 2002a; Yates *et al.* 1994). In a study of box-ironbark woodlands of Victoria, elevated stem densities (compared against benchmarks) were associated with reduced cover of native and exotic understorey plants (Jones *et al.* 2015). The Woody Encroachment Model predicts a recruitment of dense woody cover that outcompetes groundcover species, reducing overall species richness.

Methods

Experimental design

The study used cross-fence line contrasts of paired plots at 14 sites. Each site consists of a fenced plot excluding livestock grazing (treatment plot) and an unfenced plot being actively grazed by livestock (control plot). Paired plots were located within 100 metres of each other, more than 5 metres from fence lines, and matched as closely as possible in dominant tree species, structure, aspect, slope, topographic position and land management history. Strict selection criteria were developed to minimise the constraints of a space-for-time (SFT) comparative study and limit any non-treatment differences between plots within each pair (Pickett 1989). The criteria ensured that control plots and treatment plots shared a common initial state. That is, each site shared similar grazing history; the control plot maintained a similar grazing regime and intensity to that of the treatment plot before it was destocked.

Landholder Interviews and Selection Criteria

Informal landholder interviews (described in (Briggs *et al.* 2008; Prober *et al.* 2011a) were the first means of further prioritising candidate sites. The aim of the interview was to gain an appreciation of the level and consistency of grazing pressure imposed on the vegetation prior to retirement and the vegetation in actively grazed paddocks. Landholders were asked about the number, type of grazing animal and grazing frequency. This allowed a standardised stocking rate of dry sheep equivalent (DSE) per unit area (hectares) to be estimated for each paddock. Estimating stocking rates of paddocks gave insight into whether grazing histories matched across the fence-line.

Quantitative stocking rates were classified into four broad qualitative grazing intensity classes: negligible/ nil (0-0.1 DSE), light (1.5 DSE), moderate (3.5 DSE) and heavy (5 DSE). Grazing intensity classes were based on carrying capacity estimation of the land, as well as landholder opinion. For example, a DSE of 5 on highly productive soils would impose a lower grazing pressure than if the same DSE of 5 was applied to lowly productive soils.

Study Area and Study System

The study area covers the Central West, Lachlan, and western parts of Hunter-Central Rivers and Hawkesbury Nepean Catchments of NSW, Australia (Figure 1). The study area is characterised by steep hills in the east, and gently undulating landscapes and alluvial river plains, mostly in the west. Soils are derived from parent materials that range from highly fertile alluvials and basalts to sandy loams on granite intrusions and deep sands of the Pilliga sandstones. Rainfall is relatively evenly distributed throughout the year and ranges from 550 to 900 mm per year, declining from east to west.

The study system closely matches the legal definition of box gum woodland and derived native grassland listed under the National *Environment Protection and Biodiversity Conservation Act 1999* and NSW *Threatened Species Conservation Act 1995*. Prior to European settlement grassy box woodlands formed an almost continuous band covering several million hectares on the slopes and tablelands of Victoria, NSW and southern Queensland (Beadle 1981). The community's occurrence on productive soils, has led to extensive clearing for agriculture and modification for livestock grazing. It has been estimated that 93% of its original extent has been cleared in NSW (NSW Department of Environment Climate Change and Water 2010), and is poorly conserved in the national conservation reserve system (Specht 1981; Yates and Hobbs 1999).

The predominant tree canopy comprises White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and/ or Blakely's Red Gum (*Eucalyptus blakelyi*). The latter two species become locally dominant along non-permanent watercourses or on deeper soils of valleys (Moore 1953). Shrubs are generally sparse or absent, though they may be locally common. The trees form an open canopy above a rich diversity of graminoids and herbs (Prober and Thiele 1993). The community becomes shrubbier on poorer, shallower soils (Prober 1996).

Environmental site attribute data (slope, aspect and landscape position) were collected during sampling. Other environmental variables were interrogated from public databases using geographical information systems (GIS) including geology, elevation and climate (temperature, rainfall etc.) Gridded climate modelling by the Bureau of Meteorology (BOM) was used to describe broad climatic conditions of each site. This included seasonality of rainfall, annual average

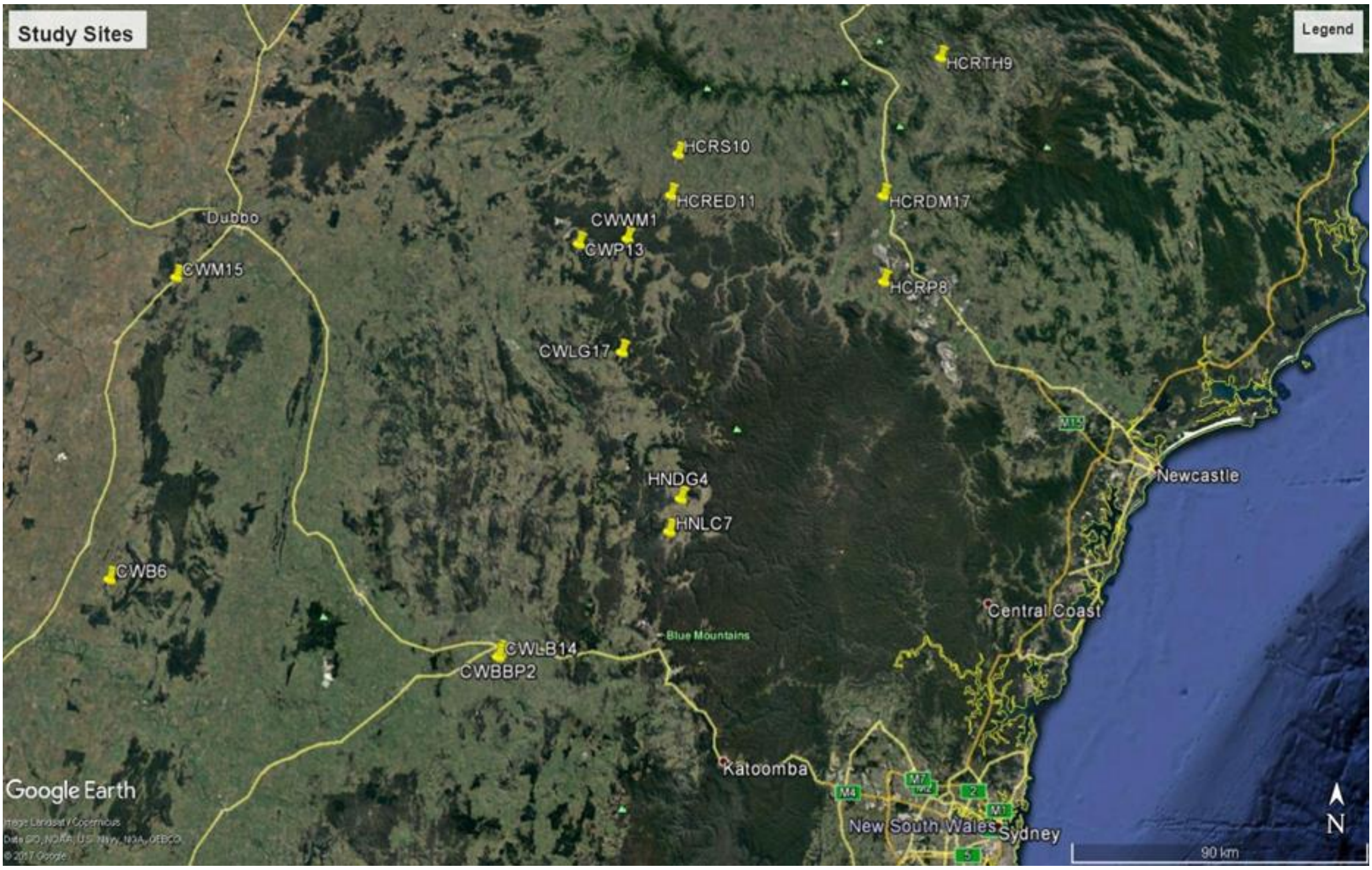

Figure 1. Google Earth Image of Study Area and Study Sites. Yellow pins indicate the location of study sites.

minimum and maximum temperature and annual average rainfall.

Sampling

Sampling was undertaken over six field survey campaigns between 28 January to 30 April 2015. Paired plots were located as close together as possible and stratified both temporally and spatially. Sample sites were grouped into four age classes. Age classes were based on livestock exclusion time (in years) of fenced plot. The four age classes were 0-4, 5-9, 10-14 and 15-19 years of livestock exclusion. Stratification ensured a minimum of 3 sample sites per age class. To mitigate any effect of sampling effort across age classes and time taken to complete sampling, a maximum of two sample sites in any one age class in one region were sampled during any one survey campaign (Figure 1).

Floristic Surveys

To identify changes in vegetation composition and measure species richness, floristic surveys were undertaken at the 14 sites, each of which included a fenced and unfenced plot (28 plots in total). The dimensions of each plot were 20 metres x 20 metres (400 m^2). To control variability whilst avoiding selection bias, fenced and unfenced plots were randomly located within a common domain matched as closely as possible in dominant tree species, structure, aspect, slope, topographic position and land management. Paired plots were located within 150 metres of each other. A handheld geographical positioning system (GPS) was used to record the coordinates of a quadrat corner.

Twenty, 1 m^2 quadrats were randomly located within each plot. All vascular plant species observed rooting within the bounds of the quadrat were identified to species-level, or genus-level for non-flowering monocots. When a species could not be positively identified in the field, samples were taken for later identification. Presence records of each taxon were tallied across the 20 quadrats to give a frequency score (i.e. if a plant was observed in 5 quadrats, irrespective of density, it was awarded 5). Plant species not captured in 1 m^2 quadrats, but observed growing in the 400 m^2 plot were given a nominal score of 0.1 out of 20.

Floristic sampling was undertaken from 28^{th} of January to the 19 March 2015.

Vegetation Structure

A count of each woody plant species was recorded within the same 400 m^2 plots. At sites with very high woody stem densities, counts were undertaken within two 100m^2 (10 m x 10 m) subplots and mean counts were extrapolated across the entire 400 m^2 plot. Trees were tallied according to seven size classes: < 1 m high; 1-2 m high; > 2 m high < 10 cm diameter at breast height (DBH); 10-20 cm DBH; 20-50 cm DBH; 50-100 cm DBH; and >100 cm DBH.

Data Analysis

To assess evidence in support of the Recovery Model the difference among fenced and unfenced plots in native species richness and summed frequencies (abundance) of native species were evaluated as a function of fencing age using simple linear regression models.

To assess evidence in support of the Competitive Exclusion Model, linear regressions were first used to test the relationships between fencing age and: i) changes in abundance of dominant grass species; and ii) changes in inter-tussock species diversity.

Relationships between changes in dominant grass abundance and changes inter-tussock species richness were then tested using simple linear models. Fencing-related changes in both dominant grasses and inter-tussock species were calculated from the difference between fenced and unfenced plots. Dominant grasses were considered any grass with an initial (unfenced) frequency score of at least 10 out of 20, while inter-tussock species included forbs, ferns, sedges and creepers. Species rank abundance curves were calculated for fenced plots and unfenced plots to compare the effects of fencing on species richness and evenness.

To assess evidence in support of the Null Model, differences among fenced and unfenced plots in species richness, species abundance and species composition were evaluated as a function of fencing age using simple linear regression models. For each analysis the data were separated into three different datasets (native composition, exotic composition and combined). Bray-Curtis dissimilarities were calculated for each of the 28 plots using the "vegan" package (Oksanen *et al.* 2015) in R (R Core Team 2016). The difference in Bray-Curtis dissimilarities between fenced and unfenced plots were fitted to simple linear regression models as a function of fencing age. Bray-Curtis was used because it places more weight on species that have high abundances than species with low abundances in those samples. Samples that share the same species in high abundance are more likely to be ecologically similar than samples that share the same species in low abundance. Hence, Bray-Curtis is likely to reflect ecological relationships more faithfully when examining compositional divergence of fenced from unfenced plots.

To assess evidence to support the Woody Encroachment Model, the difference in woody plant density (per 400 m^2) and groundcover richness between fenced and unfenced plots as a function of fencing age were fitted using simple linear models.
All models were evaluated by checking plots of the residuals and transforming where necessary in R v.3.2.3 (R Core Team 2016).

Results

Recovery Model

Linear regression revealed no relationship between fencing age and fenced/unfenced differences in either native species abundance (R^2 = 0.033, P = 0.537) or native species richness (R^2 = 0.066, P = 0.375) (Figures 2 and 3 Appendix A). However, native species richness and abundance generally increased as a result of livestock exclusion fencing.

These results are inconsistent with the Recovery Model predictions and do not support equilibrium model concepts.

Competitive Exclusion Model

No relationship was found between fencing age and fenced/unfenced differences in either dominant grass abundance (R^2 = 0.197, P = 0.112) or inter-tussock plant richness (R^2 = 0.049, P = 0.446). No trend was found between inter-tussock plant abundance and fencing age (R^2 = 0.170, P = 0.143).

No trend was found in pairwise differences between fenced and unfenced plots for inter-tussock plant richness or abundance and dominant grass abundance (R^2 = 0.025, P = 0.586 and R^2 = 0. 152, P = 0.168, Figure 4 Appendix A).

These results are inconsistent with Competitive Exclusion Model predictions.

Null Model

No relationship was found between fenced/unfenced differences in native species richness (R^2 = 0.066, P = 0.375), exotic species richness (R^2 = 0.0002, P = 0.962) or combined species richness (R^2 = 0.071, P = 0.357) with fencing age (Figure 3, 5 and 6 Appendix A, respectively). However, native species richness generally increased as a result of livestock exclusion fencing.

No relationship was found between fenced/unfenced differences in native species abundance (R^2 = 0.026, P = 0.579), exotic species abundance (R^2 = 0.218, P = 0.092) or combined abundance (R^2 = 0.235, P = 0.079) with fencing age (Figure 7 Appendix A). However, native species abundance generally increased as a result of livestock exclusion fencing.

No relationship was found between fenced/unfenced differences in native species composition (R^2 = 0.034, P = 0.529), exotic species composition (R^2 = 0.156, P = 0.163) or combined species composition (R^2 = 0.059, P = 0.402) with fencing age (Figure 8 Appendix A).

These results are consistent with the Null Model predictions.

Woody Encroachment Model

No relationship was observed between fencing age and fenced/unfenced differences in woody plant density (R^2 = 0.154, P = 0.165) or ground cover abundance (R^2 = 0.222, P = 0.089).

No relationship was found between fenced/unfenced differences in groundcover richness and fencing age (R^2 = 0.034, P = 0.529). No relationship was found between changes in groundcover richness (R^2 = 0.009, P = 0.749) or groundcover abundance (R^2 = 0.001, P = 0.903) as a function of woody plant density (Figure 9 and 10 Appendix A, respectively).

These results are inconsistent with Woody Encroachment Model predictions.

Discussion

No evidence was found to support the Recovery Model, Competitive Exclusion Model or Woody Encroachment Model. However, the data did support Null Model predictions (the Null Model). Under this model the grazed system shows limited recovery after fencing to exclude livestock grazing and no consistent trend occurs in species richness, abundance or composition with fencing age. The null model is also supported by Schultz et al. (2014) and Lunt *et al.* (2007b). While the findings of Schultz are only relevant for the first 2.5 years, Lunt *et al.* (2007b) and the current study suggest that the lack of a trend may continue for at least the first 12-17 years after livestock exclusion.

Native species richness did not consistently increase with time-since-livestock-exclusion in this study. Other studies in support of Recovery Model have been conducted in ecosystems shown to be resource poor (i.e. limited by water or nutrients) or only mildly degraded. A lack of support for Recovery Model here, may be explained by site productivity and degree of degradation. For example, rainfall of the study sites (594-805 mm per annum) is in the upper range of that of western slope grassy woodlands (Keith 2004). The sites occur on farming land and are loams and clay soils derived from basalt, granite and sedimentary shale, mud and sandstone. Study sites would conform to degraded vegetation states described in Spooner and Allcock (2006) that have crossed one ecological boundary (i.e. loss of propagules) and possibly a second (i.e. introduction of exotic pasture species and addition of nutrients). Landholder interviews revealed common usage of super phosphate, as well as introduction of exotic pasture species, which was also evident from the species composition data Sites that cross such boundaries require interventions in addition to grazing exclusion, such as direct seeding, supplementary plantings and amelioration of soil conditions to restore species diversity (Gibson-Roy *et al.* 2010; Prober *et al.* 2005).

Test results for the Competitive Exclusion Model suggest that fencing did not promote grass dominance and subsequent decline of smaller inter-tussock species richness. Although the tests failed to detect evidence that livestock exclusiion promoted the recovery of inter -tussock plants over time, the data showed weak trends that may strengthen as more time elapses since livestock exclusion. Lunt and Morgan (1999) found that even after grazing had ceased for 10 years, total floristic richness increased only slightly due to addition of ruderal species. They concluded that even intermittent fire disturbance could not initiate recovery of original woodland flora that had been lost due to past grazing. Studies by Schultz et al. (2011) and Gibson and Kirkpatrick (1989) support the Competitive Exclusion Model. Both authors identify site productivity as the main factor responsible for competitive exclusion. As described above, the productivity of the sample sites is also considered relatively high. So why was the Competitive Exclusion Model undetected in the current study? Schultz et al. (2011) and Gibson and Kirkpatrick (1989) excluded large native herbivores from their fenced treatments; while the current study did not. The effects of uncontrolled native herbivore grazing has been highlighted as a confounding factor in other fencing studies (Price *et al.* 2010). Many of the fenced plots in the current study showed evidence of heavy grazing pressure imposed by native macropods. Alternatively, the measure of plant abundance employed here (frequency in 1 m^2 quadrats) may have insufficient sensitivity to detect subtle plant responses. More sensitive measures of competition from dominant grasses, such as above-ground biomass or light penetration (Grace 1999) may reveal interactions predicted by the Competitive Exclusion Model.

A lack of support for Woody Encroachment Model could be due to slow rates of woody recruitment, which may require more than 17 years of grazing exclusion to detect in this system. Natural regeneration of woody plants, particularly eucalypts, requires a series of coincident conditions. The first requirement is seed fall from proximal sources (Dorrough and Moxham 2005; Venning 1988). Eucalypts disperse the majority of their seed up to 1.5 times the height of parent trees (Lawrence *et al.* 1998) and their seeds do not persist in soils for long periods (Florence 2004). The second requirement is recent rainfall and favourable temperatures (Yates *et al.* 1996). Trees may not produce and release seed every year, and seed production may be influenced by the degree of site degradation or canopy defoliation by insect outbreaks, which occur periodically in fragmented box-gum woodlands (Landsberg *et al.* 1990). Thirdly, tree recruitment requires low seed predation (Yates *et al.* 1995), and finally, a suitable seed bed to facilitate the germination process (Faunt *et al.* 2006). Thus, tree regeneration may be highly episodic. The majority of study sites were open grasslands beyond the limits of seed fall from nearby trees. It is also possible that the events needed to promote woody plant recruitment are yet to coincide at the study sites. Curtis (1990) estimates that eucalypt recruitment conditions coincide only once every 10-20 years in the Northern Tablelands of NSW. If this is the case in the central tablelands, then study sites may need more time for recruitment conditions to occur. Given that most of the sites are degraded, dense tree recruitment may be limited by farming legacies, such as elevated soil nutrients and exotic dominant pastures.

Greater replication of sites may have detected stronger evidence of trends predicted by models. However, greater replication could only be achieved with trade-offs on other aspects of the experimental design, for example by reducing the minimum standard of acceptable cross-fence comparisons. In addition to the 14 sites selected for sampling more than 70 candidate sites were excluded from the study because management histories were unknown or inconsistent between fenced and unfenced areas. Increasing replication by accepting a lower standard for matching between fenced and unfenced plots, would reduce rather than increase the ability to detect trends. Space-for-time substitution sampling designs assume spatial and temporal variation are equivalent and, while commonly used in ecology, are sensitive to short term environmental fluctuations (Pickett 1989). Temporal sampling designs collect data over a longer time period which accounts for natural variation caused by the environment. Space-for-time sampling occurs over a much shorter time-frame which is sensitive to fluctuations in the environment; space-for-time studies are a smaller snapshot in time.

Sampling vegetation across multiple seasons would provide a better representation of true species richness of sites (Schultz *et al.* 2014). Seasonal sampling would also account for below average rainfall, which may affect germination rates and reduce species richness. Some plant life-cycles', including annual species and terrestrial orchids are dormant and undetectable in Autumn. This is particularly important when comparing degraded woodlands invaded by annuals to reference woodlands with cryptic species. Other variables that may explain the null model include limitations of seed dispersal from nearby seed sources. In a study of old-field recolonisation, Standish *et al.* (2007) found higher native species richness at old-field sites adjacent woodland remnants compared to old-field sites of greater distance from woodland remnants. Even though the results showed no linear relationship between increases in native species richness or abundance with time-since-livestock-exclusion, native species richness and abundance was significantly greater in fenced plots compared to unfenced plots. Indeed, at most sites species richness and abundance was greater in the fenced plot, while at some sites, fenced and unfenced plots had similar values of richness. This suggests that some sites receive an immediate restoration benefit within 1-2 years of fencing and subsequently show limited progress, while other sites fail to respond. Although fencing may not always produce positive results, it rarely produces bad results by increasing losses of native species. At a landscape or regional level it therefore still serves as an effective management option with an occasional risk of no effect (Spooner and Briggs 2008).

The lack of support for the three alternative restoration models suggests that time-since-livestock-exclusion is a poor predictor of vegetation response, at least over the 17 years that the response could be observed. In fact, vegetation response was shown to be highly variable among sites and inconsistent through time. Other intrinsic site factors may be stronger predictors than time-since-livestock-exclusion itself. Therefore, livestock exclusion on its own may be insufficient to initiate the establishment of native woodland species and decline of exotic species in degraded woodlands for at least the first 17 years. Fencing in conjunction with a suite of other management actions, including weed control (to supress competitive exotic species), direct seeding (to supplement depleted seed banks) and active planting (to instantly increase native species richness) may produce a more rapid response (Prober *et al.* 2011b; Spooner *et al.* 2002; Yates and Hobbs 1997).

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Appendix A—Result Figures

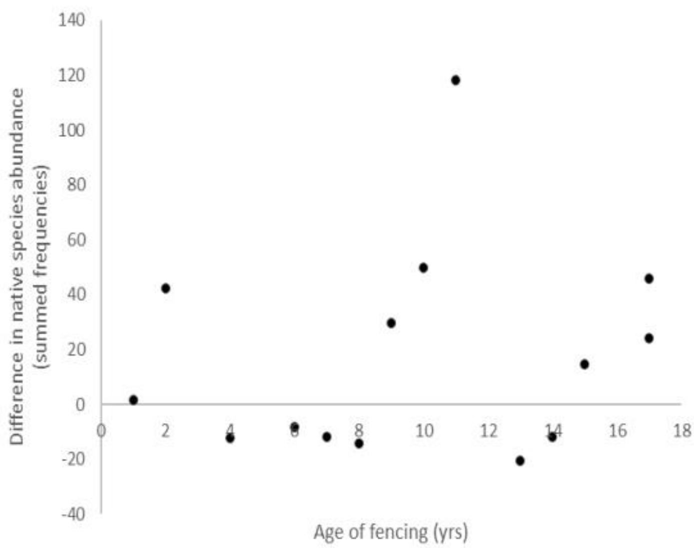

Figure 2. Difference in native species abundance between fenced and unfenced plots with fencing age

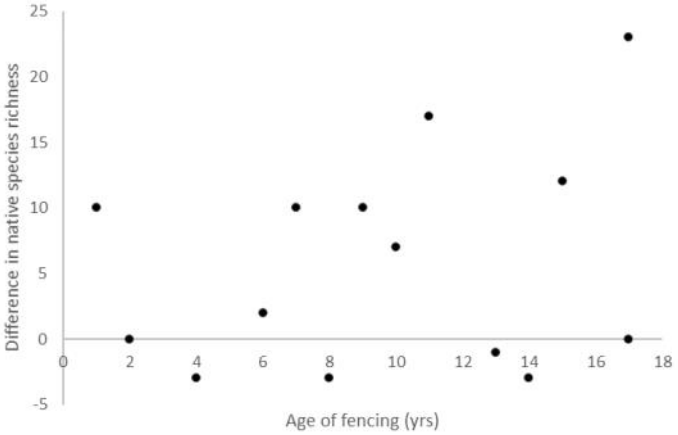

Figure 3. Difference in native species richness between fenced and unfenced plots with fencing age

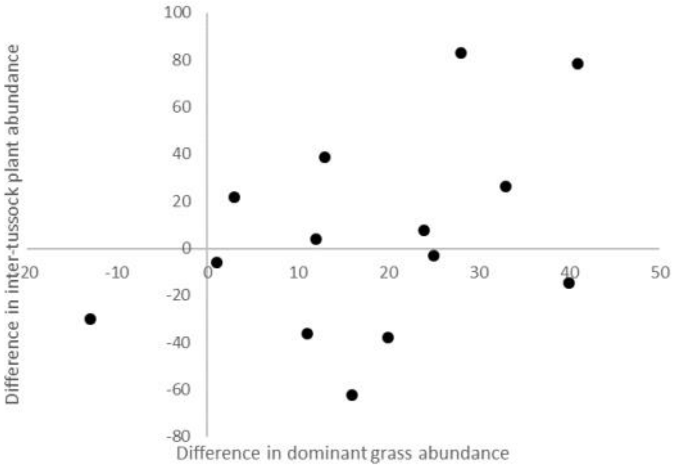

Figure 4. Difference in dominant grass abundance and inter-tussock plant abundance between fenced and unfenced plots

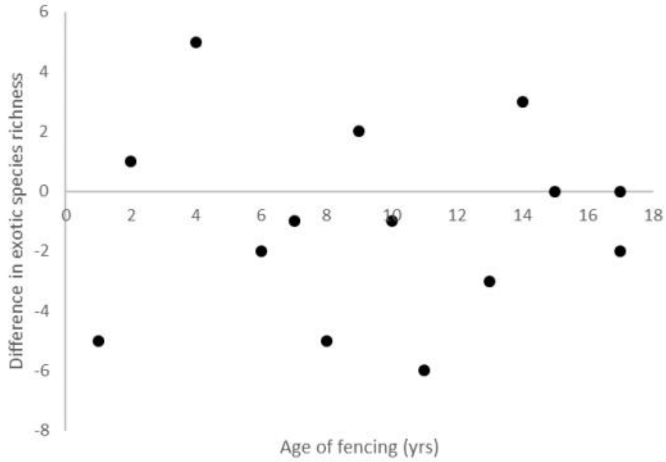

Figure 5. Difference in exotic species richness between fenced and unfenced plots with fencing age

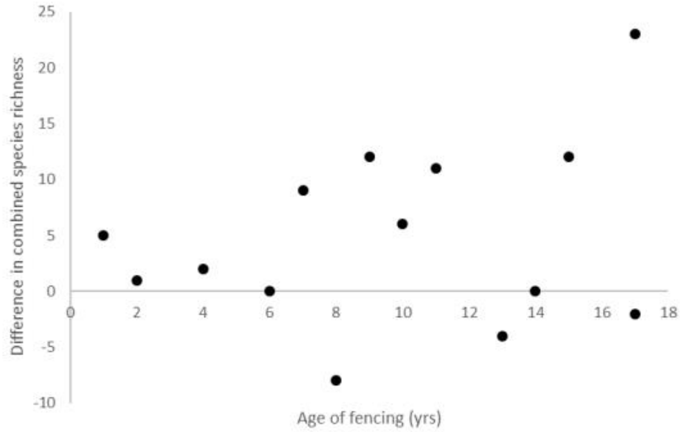

Figure 6. Difference in combined species richness with fencing age

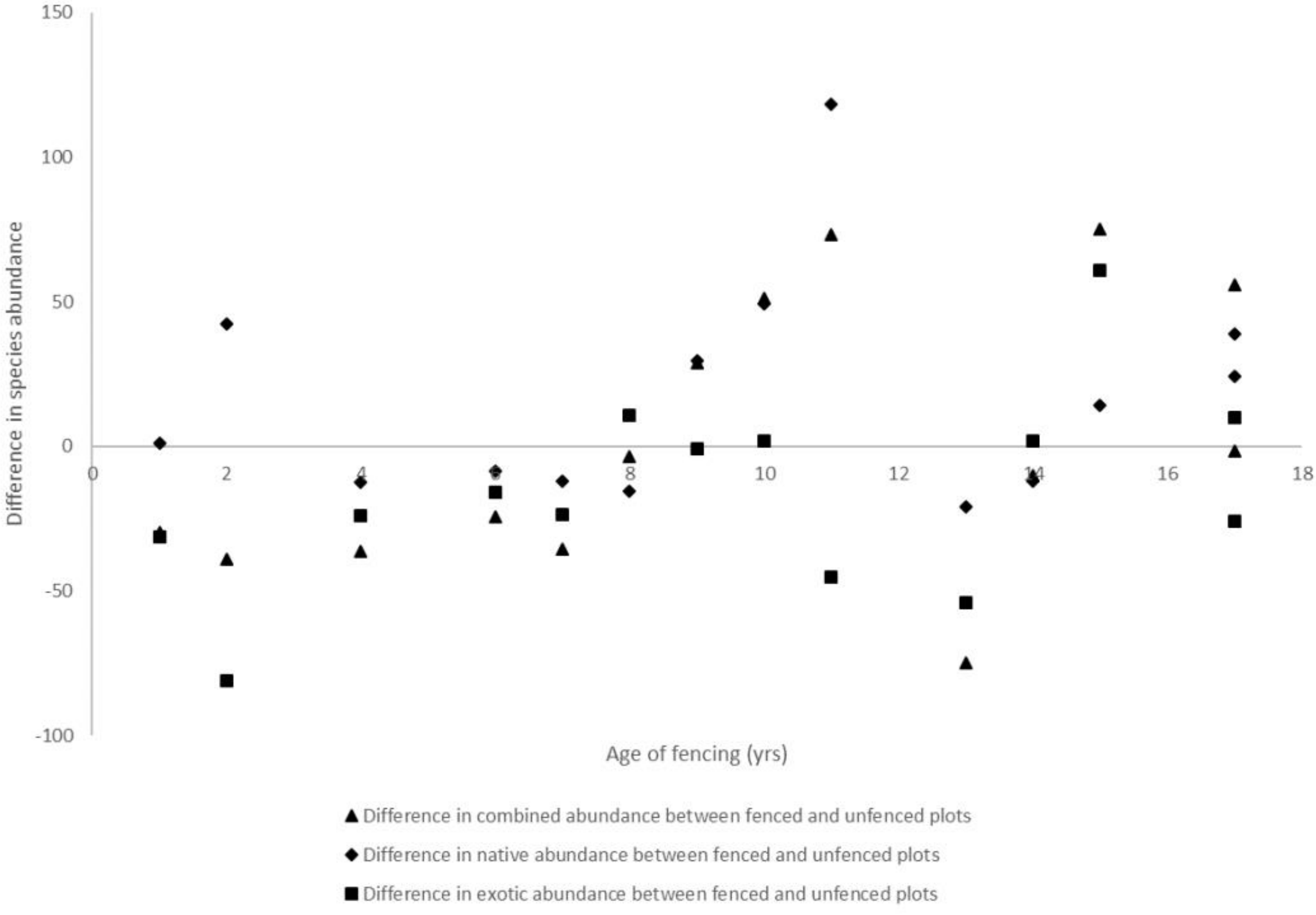

Figure 7. Difference in native, exotic and combined species abundances between fenced and unfenced plots with fencing age

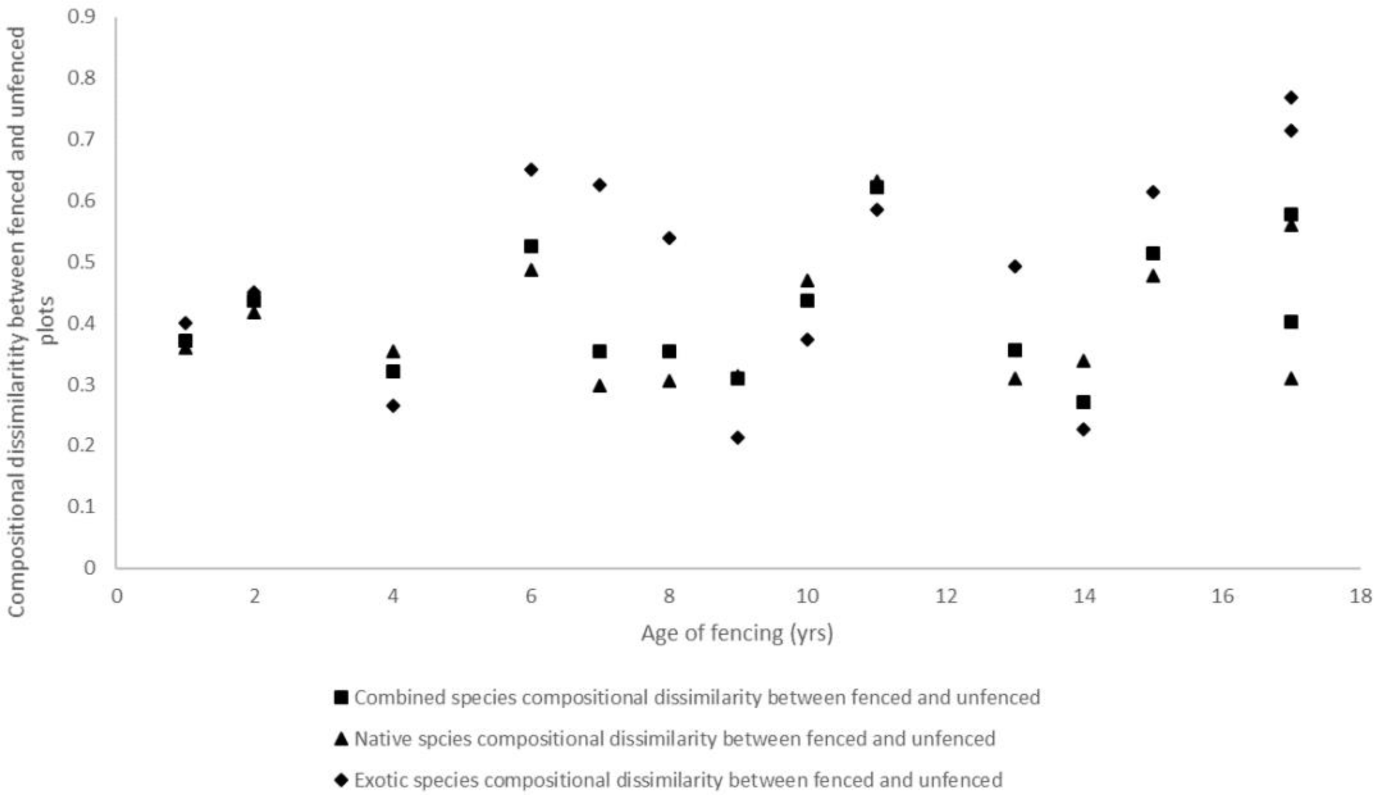

Figure 8. Bray-Curtis dissimilarity between fenced and unfenced plots with fencing age

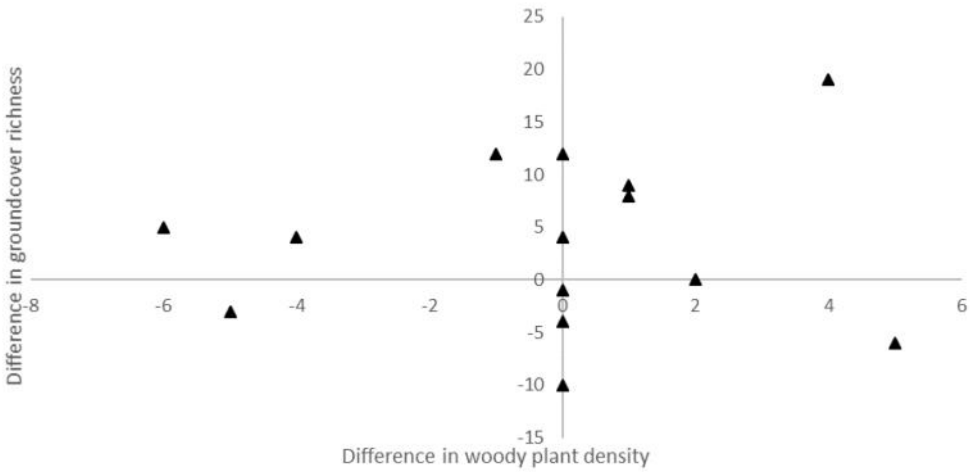

Figure 9. Difference between woody plant density and groundcover richness between fenced and unfenced plots

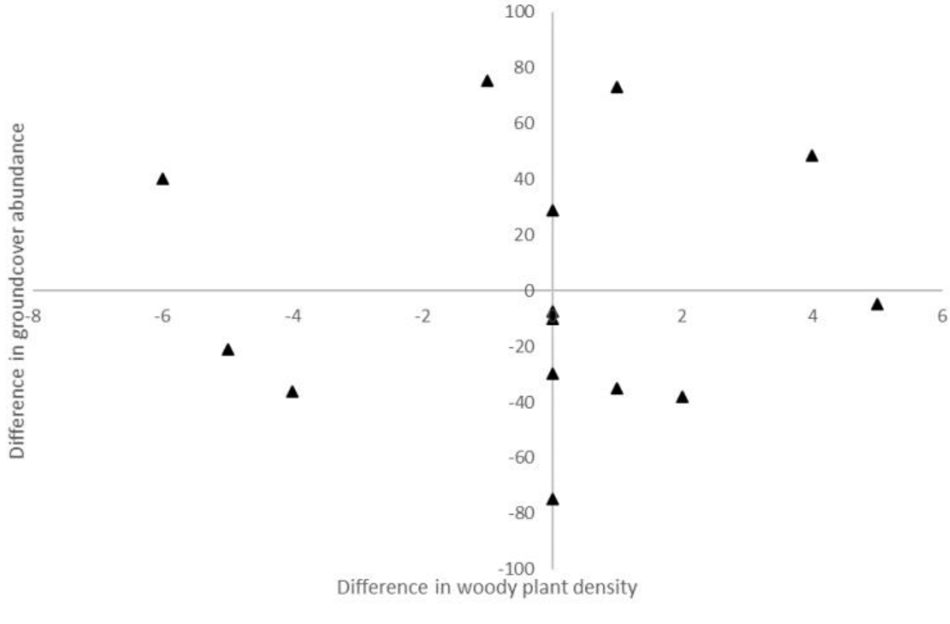

Figure 10. Difference between woody plant density and groundcover abundance between fenced and unfenced plots

THE BIODIVERSITY CONSERVATION ACT – ACCREDITED ASSESSOR OF THE BIODIVERSITY ASSESSMENT METHOD (BAM) TRAINING COURSE

*Daniel McDonald# and Elizabeth Ashby^*

 # Abel Ecology
^ Keystone Ecological

Acknowledgement of Alison Hunt for helpful feedback

Introduction

New legislation enacted by the NSW State Government in August 2017 has and will change the work of most practising ecologists in NSW. Ecologists will be required to conduct their assessments of development in accordance to the new legislation and policies, and consequently many of the assessment and reporting requirements will change.

The Biodiversity Conservation (BC) Act 2016 and amendments to the Local Land Services Act were given assent on 25 August 2017. Final versions of other legislation and policies such as the *BC Regulation 2017* and the *Biodiversity Assessment Method* were also released on 25 August 2017. The objectives of the new legislation and related policies are to deliver a strategic approach to conservation in NSW whilst supporting improved farm productivity and sustainable development. Another aim is the conservation of biodiversity on a bioregional and state scale.

Seven-part tests will be phased out and replaced with similar Five-part tests. However, probably the most substantial and most relevant change is the requirement to use the Biodiversity Assessment Method (BAM) for all Part 4 Development Applications under the *Environmental Planning and Assessment Act 1979*. Once the development is considered to have an impact that is greater than one of the specified thresholds/triggers, a Biodiversity Development Assessment Report (BDAR) must be prepared.

These thresholds/triggers are:

1. Clearing of native vegetation greater than a specified area. The clearing threshold is based upon a sliding scale, for example for a small lot (less than 1 ha in size) clearing greater than 0.25 ha is a trigger, while on the largest lot size (1,000 ha or more) clearing greater than 2 ha is a trigger.
2. If the proposal or activity occurs on land that is mapped as an area of Outstanding Biodiversity Value (somewhat similar to the old Critical Habitat but including a lot of other areas, such as riparian zones).
3. If the proposal or activity involves any of a set of prescribed actions (such as wind farms). More information to come on prescribed actions. We are seeking clarification on when prescribed actions require entry into the Biodiversity Offsets Scheme. We will then provide an update.
4. If a significant effect is found after application of the Five-part test.

If any of these four triggers are activated, a BAM assessment and a BDAR must be prepared and they can only be signed off by a BAM accredited assessor. BAM accredited assessors can also prepare Biodiversity Certification Assessment Reports (BCARs) and Biodiversity Stewardship Assessment Reports (BDARs).

If the proponent is a government agency or similar then the proponent has the option to choose:
i) A BAM assessment and the preparation of a BDAR; or alternatively
ii) prepare an assessment including a 5-part test of significance and if a “significant effect” is concluded a Species Impact Statement (SIS) must be prepared. Note the SIS option is only available for Part 5 assessments. The SIS option is not available for Part 4 assessments.

The thresholds, the procedure for assessment, and the reporting requirements are detailed in the BAM document (http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf).

BAM training

BAM training is provided by Muddy Boots, a Queensland organisation, with support from OEH. The new system is quite like the one used in Queensland, so the Muddy Boots people are well-versed in both theory and application.

A BAM assessment must be prepared either by, or under, the management of a BAM Accredited Assessor. A key part of the accreditation process is to attend a course.

Three courses ran prior to 25 August 2017. All courses to date have only been open to OEH staff, council officers, local land service officers and private consultants who are already accredited Biobanking Assessors. The first two courses were designed to 'Fast Track' ecologists accredited under the previous offsets scheme and consisted of a classroom based three-day course. A five-day course was also offered and this included one day of field work.

Pre-reading material was provided by Muddy Boots and there was a lot of it! This was accompanied by a set of questions that had to be completed prior to commencement of the course. The set of questions primed us (perhaps) for the standard through the course; each day was punctuated with many assessments.

Prepare for fast paced tense days and do not be surprised if you are unable to relax at night. (Despite the course being intense and although tired, unusually I did not sleep very well - DM.) You are required to be competent after each stage of the course, and competency means 100%. Fortunately, you do get two attempts at each question. If you make a mistake the first time you answer a question you are allowed a second attempt to answer the question. The intention is to have competent assessors in the industry, not to trick people into failing. The pace of the course also meant there was not enough time to use the BAM calculator, so you will have to practice it after the course.

The field work day was a welcome break from the intensity of the classroom-based learning activities. The field work included a practical demonstration on conducting the field assessments. We then also all practiced the field assessment method. Our presenter for the field methods and fieldwork component was Michele Deveze, a very experienced ecologist/botanist from Southern Queensland. As part of her preparations for the course she has now visited various botanical sites across NSW with scientists from OEH.

The presenters are very knowledgeable about the new legislation and related documents. Tara Kennedy was the primary presenter and she is trained as a Land and Environment Court lawyer, so she has an appropriate background and can see some of the implications of the new system. Tara has also worked in the compliance section of the Queensland Department of Environment and Heritage Protection and was able to get our attention and scare us when our responsibilities and the potential penalties related to the "Code of Conduct" were explained. BAM accredited assessors will be accountable for their work and the work of people under their instruction.

Jenna Huckenswager reviewed all questionnaires for our session and is also very knowledgeable. OEH also sent a representative most days who was able to provide additional technical information on the new legislation and highlight differences between the new and old legislation and policies. However, many questions arose (and are still arising) to which nobody had a definitive answer. It will undoubtedly take some time for the processes to be bedded down.

As described above a significant change for ecologists is that all BAM accredited assessors must sign a document stating that they will abide by the code of conduct. If a BAM accredited assessor is penalised or prosecuted, the penalties can include any of the following:

- a warning
- temporary or permanent suspension of their accreditation
- a maximum penalty including a $330,000 fine and,
- up to two years imprisonment.

We were advised that OEH will have a newly established compliance section to review the performance of BAM assessors. Be prepared for occasional reviews of your work if you become a BAM assessor. If your work is considered to be inadequate or does not meet the standard expected of a BAM assessor, it is likely you will be reviewed more frequently. BAM assessors will also be required to have administrative processes in place, such as in-house training for staff who are involved in undertaking the BAM. The documentation of this in-house training provides evidence that the BAM assessor has undertaken steps to increase the likelihood that their work will be satisfactory.

While the BAM primarily requires botanical skills such as the ability to identify plants as well as competence and the accurate identification of plant communities, the accredited assessor does not have to be a botanist. However, a competent botanist must be part of the team and the accredited assessor must be confident with the botanist's work as the accredited assessor will face scrutiny if there are problems with the assessment.

Outcomes

The first BAM accredited ecologists were uploaded to the Accredited Assessor Public Register on Friday 22 September. Thirty-nine individuals have been accredited including both government employees and individuals working for ecological consultancies. More are in the system, awaiting the sign-off of OEH. OEH is trying to make this a faster process, but at the moment that delegation sits only with the Department Head.

It appears that the new system will improve the quality of biodiversity assessments; it will certainly standardise them.

Hopefully it will also improve biodiversity outcomes in NSW. Time will tell.

What you should do now

Because there is a long waiting list for training, you may not have the opportunity to attain accreditation for many months. Thus it is important that you acquaint yourself with the legislation, the process, the thresholds and what work you can still do without accreditation. Many assessments will not require a BAM, relying instead on a Five-part test and assessment against local controls. This does not have to be undertaken by an Accredited Assessor.

Also, seek out Accredited Assessors and make arrangements for them to supervise and sign off on your projects so that you can continue to undertake more substantial projects that need the BAM.

Get ready for the ride!

Contributions to the Newsletter, Volume 40

Contributions to the next newsletter should be forwarded to the administration assistant Amy Rowles admin@ecansw.org.au by the **15th of January 2018.**

- Articles may be emailed in WORD, with photos included or referenced in an attached file as a jpg.
- Please keep file size to a minimum, however there is no limit on article size (within reason)
- Ensure all photos are owned by you, or you have permission from the owner
- Ensure that any data presented is yours and you have permission from your client to refer to a specific site (if not please generalise the location).
- All articles will be reviewed by the editorial committee, and we reserve the right to request amendments to submitted articles or not to publish.
- Please avoid inflammatory comments about specific persons or entity

The following contributions are welcome and encouraged:

◊ Relevant articles
◊ Anecdotal ecological observations
◊ Hints and information
◊ Upcoming events
◊ Recent literature
◊ New publications (including reviews)
◊ Photographs

ECA Photo Gallery

Above Left: Northern Pobblebonk *Limnodynastes terraereginae.* **Above Centre:** Graceful Tree Frog *Litoria gracilenta.* **Above Right:** Eastern Dwarf Tree Frog *Litoria fallax*. Photos courtesy of Grant McLean.

Above: *Diuris tricolor* at Denman, NSW. Photo courtesy of Alejandro Barreto. **Below**: *Grevillea acanthifolia.* Photo courtesy of Isaac Mamott

Above: Emperor Gum Moth larva, taken at Polblue camping area, Barrington Tops National Park. Photo Courtesy of Roger Lembit.

Above: Goliath Stick Insect *Eurycnema goliath*. Photo courtesy of David Andrighetto.

Above: Tawny Frogmouths in disguise. Photo courtesy of Tim Johnson.

Right: Litoria chloris at Barrington Tops **Left**: Eastern Grey Kangaroo at Emerald Beach. Photos courtesy of Andrew Carty.

ECA Photo Gallery

Above: A pair of Sarus Cranes with a juvenile , northern Australia. **Above Right:** Black-necked stork northern Australia. **Below**: One of six Freshwater Crocodile in a 100 x 50 m northern Australia. Photos Courtesy of Phil Cameron.

Above: Sturt Desert Pea, taken near Roxby Downs. Photo courtesy of Charlotte Mills.

Left: *Dipodium*. Photo courtesy of Isaac Mamott

Right: Ghost Fungus *Omphalotus nidiformis* in the Blue Mountains. Photo courtesy of Tim Johnson