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Celebrating a new century of wildlife preservation in Australia

Journal of Wildlife Preservation Society of Australia Limited trading as Australian Wildlife Society

(Founded 1909)

TOWRA BEACH



Photos from the Towra Beach restoration. For the full story see page 8.

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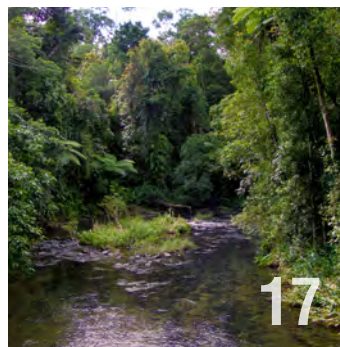
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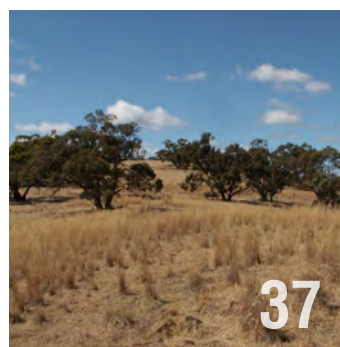
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Suzanne Medway AM
Editor, Australian Wildlife



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Sub-Editor, Australian Wildlife



Front cover:

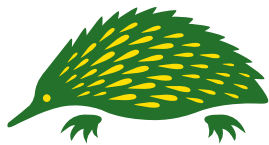
Green-eyed treefrog (*Litoria serrata*). These frogs are endemic to the Wet Tropics of Australia and can be found on plants and rocks along rainforest streams. Populations of green-eyed treefrogs recently declined because of a disease outbreak, but they have now recovered.

Back cover:

Top: Male and female stony creek frog (*Litoria wilcoxii*). Males of this species turn bright yellow during the mating season.

Bottom: Waterfall frog (*Litoria nannotis*). This species lives in and around waterfalls along rainforest streams. Many populations recently disappeared during a disease outbreak, but some of those populations have now been recolonized.

These species are found along rainforest streams in the Wet Tropics; however, a recent disease outbreak caused green-eyed treefrogs and waterfall frogs to decline. Their populations have now largely recovered, and research is underway to understand how they recovered.



Australian Wildlife Society

Conserving Australia's Wildlife since 1909

Australian Wildlife

is the official journal of the Australian Wildlife Society (Wildlife Preservation Society of Australia Limited).

Founded in 1909, the Society is dedicated to the conservation of our unique Australian wildlife in all its forms.

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Notice to our members

The Australian Wildlife Society (Wildlife Preservation Society of Australia Limited) is managed and controlled by an elected board of ten volunteer directors. The Society is a registered company limited by guarantee with ASIC and is responsible for complying with all its regulations.

Any member who might like to consider serving as a director of the Society is invited to contact the national office for more details. The most important qualification to serving as a director is 'a commitment to and love of Australian wildlife'.

The Society holds regular monthly meetings on the first Wednesday of each month in Sydney.

The Editor would like to feature a member's profile in the fortnightly email newsletter and occasionally in our quarterly magazine. Members are invited to consider submitting a short article with a photograph for possible publication.

Our Mission

The Australian Wildlife Society (Wildlife Preservation Society of Australia Limited) is an independent, voluntary, non-profit conservation organisation, formed in 1909, and is committed to the preservation of Australia's precious flora and fauna. We act as a watchdog and provide advice to government agencies and institutions regarding environmental and conservation issues concerning all aspects of wildlife preservation. Our mission is to conserve Australia's fauna and flora through education and involvement of the community. We are dedicated to the conservation of our unique Australian wildlife in all its forms through national environmental education programs, political lobbying, advocacy and hands on conservation work.

Our Society has always known that a conservation battle is never really won until the victory is enshrined in legislation. We have always tried to convince politicians of the necessity to include the preservation of Australia's precious wildlife and its vital conservation habitat in all their planning and environmental issues and discussions.

Articles and comments expressed in this magazine do not necessarily reflect the opinions of the Editor, Society or members. Articles contributed from outside sources are included for the reading enjoyment of members and to encourage discussion on different points of view.

Articles may be copied or quoted with appropriate attribution.

From the President's desk

Suzanne Medway AM - President

The mission statement of the Australian Wildlife Society is to conserve Australia's fauna and flora through education and involvement of the community. We are dedicated to the conservation of our unique Australian wildlife in all its forms through national environmental education programs, political lobbying, advocacy and hands-on conservation work.



The mission statement of the Australian Wildlife Society is to conserve Australia's fauna and flora through education and involvement of the community. We are dedicated to the conservation of our unique Australian wildlife in all its forms through national environmental education programs, political lobbying, advocacy and hands-on conservation work. Part of our commitment to education is the awarding of our university student grants. I am delighted to feature the articles on their projects in this magazine.

Recently I had an enquiry from Liz, who wrote: "My grandson is only four years old but is fascinated by wildlife. He lives in Sydney and I visit from England regularly. I have searched bookshops and internet sites for simple books about plants, mini beasts, birds and animals in the New South Wales area but have never been able to find any. I wondered if you might have some suggestions. In England we have field study guides produced by The Field Study Council which are suitable for all ages. I wish I could find the New South Wales equivalent. I'm sure they would be a popular aid for schools and youth groups as well as for families."

I contacted Chrissy Banks, who is one of our regular contributors to *Australian Wildlife*, and who often writes of her adventures with her children in our environment.

Chrissy replied to Liz: "It always warms my heart to hear that a child loves wildlife and you're so very right in wanting to nourish that love. Children's literature on Australian

wildlife is quite bountiful and I'll attach some links to some excellent websites in a moment, but you're right, it is harder to get books specifically on New South Wales wildlife. I'm working on that one for you and currently waiting for the Department of Environment to get back to me. I do have some ideas to share with you while we wait for them:

bookworm.com.au and booktopia.com.au both have a good range of Australian Wildlife. How it often works with these books is that they are broken up into each state so that your grandson could not only see what wildlife inhabits his area, but in other States as well. Another website to try is rzsnsw.org.au

"It has been my experience that kids learn from fictional work almost as much, if not equally, as they do from non-fiction. A fantastic award winning book that spins a lovely tale (and set in New South Wales) is a story called *Bollygum* (Weldon Kids Publishing, a branch of Weldon Publishing). My children love this book and the story is often revisited. There are also the more well known classics, such as *Diary of A Wombat*, *Edward The Emu*, *Bats In The Library* (by Koala Books), *Wombat Stew* and *Ticklish Tom* (a Tassie devil tale) that all weave fact into the fiction. The *Little Aussie Adventures* by Brolly Books are also beautifully illustrated and entertaining for kids as is the Echidna Club series.

"Angus and Robertson book store stock a large selection of wildlife books for the children which can be accessed via their website.

"For definite factual books publish.csiro.au have a selection you might find suitable, though they will range in thickness. CSIRO books are broken up into species, so you can search for Australian reptiles, then choose from the different states, for example frogs of New South Wales, or at the very least reptiles of New South Wales which should then include frogs. The same can be done with marsupials, mammals, ocean farers etc.

Perhaps you might also consider *Growing Up Greener*, which has some great resources on looking out for our environment. This can be found on kelliellollard.com.au. Booktopia also has caring for our Australian environment literature for children.

I hope this has given you some helpful ideas and links that you can begin with, while we wait to see what the Department of Environment can dig up for us."

Chrissy often contacts me and asks "What do you want me to write about next?" This enquiry from a grandmother gave me the idea to ask Chrissy to write about engendering a love and respect of Australia's unique fauna and flora in her children.

The article featured in this edition of *Australian Wildlife* begins on page 21.

Venomous dingoes, wonky wombat and love thy wildlife

Linda Dennis, Regional Advisor, Australian Wildlife Society

The Australian Wildlife Rehabilitation Conference celebrated its 10th Anniversary in the beautiful Docklands region of Melbourne city in early August. As per usual it was a fantastic event, reuniting old friends, forming new friendships and distributing a wealth of knowledge pertaining to the rehabilitation of Australian native animals.

Kicking off the conference was a Welcome to Country by Aboriginal Wurundjeri Elder Ian Hunter with his hauntingly beautiful didgeridoo playing, followed by the story of Bunjil the Eagle. Bunjil's shelter is Victoria's most important Aboriginal rock site and is located in the Black Range State Forest at Gariwerd (also known as the Grampians).

Steve Parish, famous Australian photographer, was the keynote speaker and he entertained us with his own stories of connecting to country and challenged us all to remember our very first meaningful connection with nature – it had many of us reminiscing, me pondering of my very first raptor experience at Eagle Heritage in Western Australia way back in the 90s. Steve spoke of his interest in forging nature connections for mental health benefits and believes that such connections help to heal sufferers of depression and anxiety. It makes sense; just gazing into my forests at my property 'Habitat' in New South Wales's north truly calms my soul.

Well known as an expert in the field of wildlife rehabilitation, Dr Rosemary Austin gave the first presentation on the occurrence and successful treatment of the viral Herpes respiratory illness in eastern grey kangaroos. If not treated the virus is deadly, however it can be treated and prevented with the drug Valaciclovir.

Dr Shane Simpson, a very entertaining presenter, gave two presentations on reptiles, his field of expertise. Some of the key points from his "Walk on the Wild Side" talk were:

1. Shovels should be kept away from people with no brains (many people who attempt to kill snakes with shovels end up getting bitten, or totally botch up their 'euthanasia' causing serious and cruel injury);
2. Not all reptiles are very smart (as noted in a big-headed gecko rescue, his big head got caught in a large hollowed-out seed pod and he needed rescuing!);
3. Frogs are excellent environmental barometers (they are incredibly sensitive to environmental changes); and
4. Fibreglass is no longer a recommended method for repairing turtle shell fractures (one turtle that had been repaired with fibreglass had the resin seep into the wounds – ouch!).

Colleen Wood spoke on "Rehabbing Two Elusive Gliders", the yellow-bellied and greater gliders; Dr Howard Ralph (a conference favourite) presented "Outcomes of Post Rescue Management" and Nigel Williamson shared his extensive knowledge on "Swooping Magpies". Nigel's main lesson was how to distract a swooping magpie. "Stop, look, point" – as easy as that. You stop what you're doing; face the magpie front on and point to it, letting him know that he's been seen. Apparently it works, but I'm yet to try it.

Day two began with Anne-Marie Dineen, who shared her knowledge on nutritional supplements and homeopathic remedies. A very detailed 17 page report is reproduced in the conference proceedings. Dr Sarah Brett, veterinarian from Kununurra in northern Western Australia complemented the talk with her own tales on homeopathy treatments for her furry patients. Sarah also gave us disturbing news that wildlife is very much in decline in the Top End. Only a few years ago the skies were full of soaring kites, parrots and budgies, goanna sightings were plentiful, as were small mammals including sugar gliders, echidnas and quolls. These days those animals are rarely seen and Sarah believes this is due mainly to human activity: an increase in the burning of the Kimberley, the introduction of pest species (cane toads) and non-endemic animals (blue-winged kookaburras),



Conference workshop. Photo by Sue Ferrari

habitat destruction, pollution and, sadly, animal cruelty.

Desanka Mijovic, also from Kununurra, shared her story of Hobbs, the kingfisher she raised from a tiny pink hatchling. Tania Duratovic (although extremely ill with the flu) presented twice, with invaluable information on providing fluid therapy and first aid for fire victims. Beverley Young encouraged community education as a way to help save our wildlife; Simon Watharow told us about the snake mite and Howard Ralph told us to “respect all” – the animals we care for, ourselves and all other carers.

Howard Ralph presented twice during the conference and his second talk truly blew me away. Howard is known in the wildlife community to be somewhat of a genius! The work he has done on sick and injured wildlife is extraordinary! Howard told us of a small wombat whose mother had been killed by being hit by a car. The joey, in the pouch, was being gnawed on by a fox but luckily a passer-by saw it, shooed the fox away and rescued the wombat, now with two rather mangled paws, one at the back and one at the front. After treating the wombat, ridding all infection and alleviating pain and distress, Howard performed surgery on the extensively mangled forepaw. It only had three digits left which were pretty much... ‘wonky’. Howard reshaped the paw, bringing digits back into alignment thus creating a paw that will still be able to dig. See, genius!

Audrey Koosman took the concept of ‘respect’ a little further in her presentation “Valuing our Volunteers with Support and Understanding”. Always a proudly frank member of the wildlife community and never afraid of speaking up, Audrey told us that we are

all a valuable part of the community, each bringing our own important skills to the mix and, due to the highly emotional work we do, we often see our volunteers become vulnerable with mental health challenges. Burn-outs are not uncommon. We also see people who may have excellent skills in animal care but are not very good at caring for people, and this often brings infighting in wildlife groups. That dreaded touchy subject of ‘wildlife politics’! It was mentioned by another presenter and reiterated by Audrey that we simply aren’t a normal bunch of people! Audrey told us that research shows by providing good solid respect and kindness and trying to understand each other we can build strong working relationships that can only better the work we do. I hope people listened.

Although I very nearly died of nerves I also presented at the conference this year, “Australian Wildlife Society – over 100 years of caring for wildlife”. I told my fellow carers about our great Society and the awesome wildlife opportunities we provide. I was surprised just how many people were unaware of us, the work we do and the valuable contribution we make to ensure the preservation of Australian wildlife. I had many people approach me afterwards to find out more and to praise our work.

Another well-known wildlife rehabilitator, Professor Steve Garlick, spoke on love, “What’s love got to do with it?” – how trans-species learning through emotional engagement can benefit wildlife recovery. He said that “spending relational time amongst wild animals can reveal a new source of knowledge that takes us beyond the usual human ‘knowing about’ chauvinistic pedagogy common to

many wildlife ‘sciences’ that objectify the animal”. His conclusion is that “we can use the emotional state of a wild animal to guide us in the kind of engagement we have as carers. We do this so that we might fine-tune the physical and social care we provide during the recovery process.”

Lyn Watson presented “Politics, Prejudice and Wild Dogma”, a paper on the dingo. We heard the ten more commonly held false beliefs about the dingo. One point that I thought was fascinating is Lyn’s pondering that the dingo wasn’t brought into Australia with Asian seafarers at all and that it is more likely that Asians took them back with them. Other untruths included that “dingoes feast on sheep”, “dingoes are pack-hunting animals”, “dingoes are yellow”, “dingoes are aggressive”, “dingoes stalk humans” and “dingoes are venomous”. That last one gives me a giggle. All of Lyn’s facts on each of these points are covered in her paper, which will be available to download from the AWRC website.

Other subjects presented included sarcoptic mange and how to manage it, avian gastric yeast, saving species and raptor care. There are too many to detail in this report; however, all the proceedings will be available on the conference website soon.

Our last day was a workshop day where we rotated to different subjects of interest. These were “Treatment of Injured Wildlife” by Howard Ralph, “Fluid Therapy” by Tania Duratovic, “Oiled Seabirds” by Phillip Island Nature Park, “Bushfire Basics” by Scott Allen, “Reptile Release” by Simon Watharow, “Mange Management” by Jenni Mattingley and Katja Gutwein, “Wombat Release” by John Merrick, “Faecal Float” by Greg Gordon, “Grass Identification” by Adam Merrick and “Remote Surveillance & Capture Techniques” by Nigel Williamson.

After the conference I had a few days off to explore the inner city. One of my pit stops was the aquarium. Their display of penguins – gentoo and king – was quite spectacular and I watched them for hours. Busy little gentoos collecting rocks for nests and the speed at which the penguins swim, twist and turn, were fascinating!

The next Australian Wildlife Rehabilitation conference will be held in New South Wales in 2018.

The website address for AWRC is <http://www.awrc.org.au/>





Wetlands

are vital for human survival

Suzanne Medway

Wetlands are among the world's most productive environments; cradles of biological diversity that provide the water and productivity upon which countless species of plants and animals depend for survival.

Wetlands are indispensable for the countless benefits or 'ecosystem services' that they provide humanity, ranging from freshwater supply, food and building materials, and biodiversity, to flood control, groundwater recharge, and climate change mitigation. Yet study after study demonstrates that wetland area and quality continue to decline in most regions of the world. As a result, the ecosystem services that wetlands provide to people are compromised.

Managing wetlands is a global challenge and the Ramsar Wetland Convention presently counts over 160 countries as Contracting Parties, which recognises the value of having one international treaty dedicated to a single ecosystem.

The Convention uses a broad definition of wetlands. This includes all lakes and

rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and all human-made sites such as fish ponds, rice paddies, reservoirs and salt pans.

One hundred years ago, amid the chaos of World War I, President Woodrow Wilson and King George V of Great Britain turned their attention to a surprising issue: protecting migratory birds. On 16 August 1916 they signed the Migratory Bird Treaty, a landmark conservation agreement. The treaty and the *Migratory Bird Treaty Act*, which wrote its provisions into U.S. law, protected more than 1,100 migratory bird species by making it illegal to pursue, hunt, take, capture, kill or sell live or dead birds, feathers, eggs and nests, except as permitted through hunting regulations for game birds.

Why did migratory birds warrant so much attention?

Hunters were decimating bird populations across North America (King George signed the treaty representing Canada). Some five million birds, especially waterbirds like egrets and herons, were dying yearly to provide feathers to adorn hats. The last known passenger pigeon had died just two years earlier at the Cincinnati Zoo. Fearing that other species would meet the same fate, national leaders took

Above: The migration of the tiny red-necked stint covers thousands of kilometres: they nest in the Siberian tundra, then migrate south, stopping off on the muddy shores of the Yellow Sea to refuel, before continuing on to northern Australia. Many then extend their journey, flying across the harsh interior of Australia until they reach the shores of the southern coastline, and then in six months' time they do it all again, in reverse.

action. Snowy egrets were hunted close to extinction in the late 1800s to supply plumes for hats.

Today we know much more than early conservationists did about the value of birds. Healthy bird populations provide valuable ecosystem services: they pollinate crops and help plants grow by dispersing seeds and preying on insects.

Migratory birds also contribute billions of dollars to the economy of many countries through recreational activities like tourism and bird watching. And they connect us with nature, especially through the dazzling spectacle of migration.

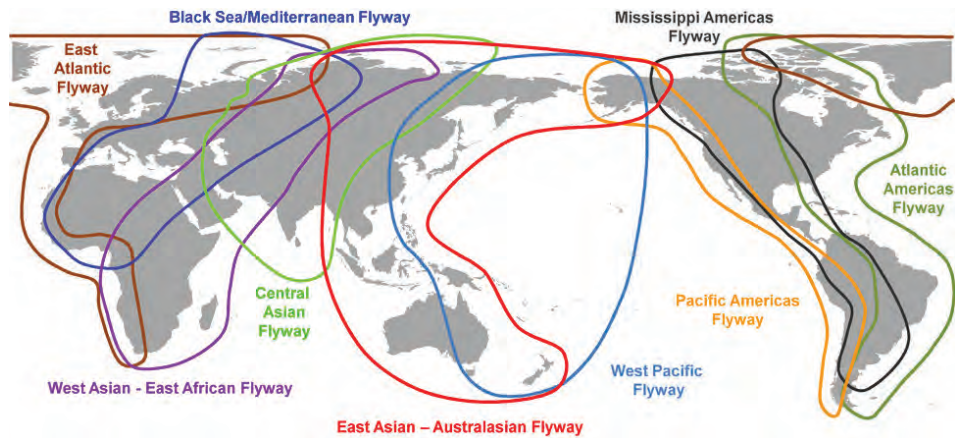
We also know that migratory birds face many threats. International cooperation under the Migratory Bird Treaty and subsequent agreements virtually halted the plume trade and most unregulated harvest. Our Society played a vital role in halting the plume trade in Australia. Today habitat loss, invasive species, pollution and collisions with buildings and other structures are taking heavy tolls on many species. Everything we learn about how widely migratory birds range around the globe underlines the need for coordinated international action to protect birds across borders.

Birds are true global citizens

Migratory birds don't recognise international boundaries. Many animals migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations.

For over 30 years, Australia has played an important role in international cooperation to conserve migratory birds in the East Asian–Australasian Flyway (the Flyway), entering into bilateral migratory bird agreements with Japan in 1974, China in 1986 and most recently the Republic of Korea in 2007. Each of these agreements provides for the protection and conservation of migratory birds and their important habitats, protection from take or trade except under limited circumstances, the exchange of information, and building cooperative relationships.

Birds listed on the annexes to these three agreements, together with those on Appendices I or II of the Bonn Convention, must also be placed on the migratory species list under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).



'Flyway' is the term used to describe a geographic region that supports a group of populations of migratory waterbirds throughout their annual cycle. Up to nine flyways are recognised worldwide, each reflecting a grouping of populations that use similar migratory routes.

JAMBA, CAMBA and ROKAMBA provide an important mechanism for pursuing conservation outcomes for migratory birds, including migratory waterbirds.

Australia

Migratory waterbirds that visit Australia include species such as plovers, sandpipers, stints, curlews and snipes. These incredible birds make round-trip migrations of up to 26,000 kilometres each year between their summer breeding grounds in the northern hemisphere and their feeding areas in the south. These trips are made in several weeks, with brief stops at staging sites along the way to rest and refuel for the next leg of their journey.

The corridor through which these waterbirds migrate is known as the East Asian–Australasian Flyway. It extends

from within the Arctic Circle, through east and south-east Asia, to Australia and New Zealand. Stretching across 22 countries, it is one of eight major waterbird flyways recognised around the globe.

- At least two million migratory waterbirds visit Australia each year during our summer.
- At least 36 species of migratory waterbirds visit Australian wetlands each year.
- A further 16 species occasionally visit Australia.
- Another 15 species – at least 1.1 million birds – permanently live in Australia.

In about September each year, hundreds of thousands of migratory waterbirds



Eastern curlew feeding on Towra Point. The eastern curlew is the largest wader that visits Australia, with a very long down-curved bill. When flying, the barred flight feathers are visible, lighter under the wings and dark above. They are wary birds, quick to take flight. Their wing beats are slow and deliberate.



The Friends of Towra Point Nature Reserve, sponsored by the Australian Wildlife Society.

begin to arrive and inhabit wetlands of Western Australia's north- and south-west as well as the eastern parts of Australia (including Towra Point), feeding mostly on the invertebrates that live in shallow water in drying wetlands, tidal flats and salt marshes.

The most common species include the red-necked stint, curlew sandpiper, sharp-tailed sandpiper, bar-tailed godwit and greenshank.

Strategies for the next century

International cooperation to conserve migratory birds takes many forms, from agreements restricting trade in certain species to partnerships that address specific challenges. The most important threats to migratory birds today are loss and degradation of habitat, which can be caused by land conversion – for example, clearing forests for farming – or by climate

change. Because migratory birds rely on so many different locations from season to season, joint efforts to protect habitat are especially important and urgent.

Birds associated with oceans and tropical and subtropical forests year-round are in the most dire straits. Seabirds are declining due to pollution, unsustainable fishing, energy extraction, pressure from invasive species and climate change. Birds that rely on coasts, arid lands and grasslands also are in serious decline. There are no easy solutions, in part because successful conservation efforts must reach across countries to all of the places birds touch over the course of a year.

Many bird conservation groups and government agencies are paving the way forward. As examples, they have formed international teams to eradicate invasive predators on islands that



The curlew sandpiper is a common visitor during the Australian summer, congregating in large flocks, sometimes comprising thousands of birds, at sheltered intertidal mudflats and also at the muddy margins of terrestrial wetlands. Feeding becomes more intense as migration time approaches, with birds fuelling up for their long flight back to their breeding grounds in Siberia.

are critical to breeding seabirds, and drafted multinational agreements to clean up large floating mats of garbage in our seas that can choke, trap or poison seabirds and other animals.

Bird conservation is also about people. Many nonprofit groups such as our Society work with government departments and other conservation groups to develop practices that meet local community needs while conserving bird habitat. Approaches like this are an essential part of conservation, especially in working landscapes that support already struggling communities.

At a time when political divisions dominate the news, international collaborations show the power of countries acting together. Birds are a shared resource among nations, and where we have acted, we have successfully protected migratory birds and the habitat they depend on.

About Ramsar

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

- Number of Contracting Parties: 169
- Number of Ramsar Sites: 2,241
- Total surface of designated sites: 215,247,631 hectares

The convention entered into force in Australia on 21 December 1975. Australia currently has 65 sites designated as Wetlands of International Importance (Ramsar Sites), with a surface area of 8,319,663 hectares.

Australia

When most Australians think about wetlands, usually Kakadu or the struggling Murray–Darling Basin come to mind. But Australia has over 65 Ramsar sites, covering more than 8.3 million hectares, including the lesser-known Towra Point Nature Reserve.

The first significant wetland marked for conservation was located in Australia at the Cobourg Peninsula in the Northern Territory.

Cobourg Peninsula

In May 1974, Australia listed the Cobourg Peninsula as the world's first Wetland of International Importance

under the Ramsar Convention, bringing international recognition to this remote and unspoiled area. During the 40 years since its designation, the unique values and the ecological character of the site have been maintained, through its joint management by the traditional owners (the Arrarrkbi) and the Northern Territory government (through the Parks and Wildlife Commission), its isolation and its status as a Ramsar site and conservation reserve.

Cobourg Peninsula is significant internationally as well as nationally for its endemic species, relatively unmodified landscapes, extensive wetlands and rainforest, habitat for over 20 threatened species and nesting sites for threatened marine turtles.

The site is a large peninsula on the northern coastline of Australia, covering 220,000 hectares, with extensive tidal flats, fringing coral, rocky reefs, estuaries, mangroves, riverine wetlands, freshwater pools and melaleuca (paperbark) swamps, along with eucalypt forests.

The site supports several globally threatened marine species such as the loggerhead turtle, green turtle and hawksbill turtle. It is also one of the few locations in Australia where leatherback turtles have been known to nest.

Cobourg Peninsula supports breeding resident shorebirds and also provides feeding and resting sites for migratory shorebirds listed in the bilateral agreements between Australia and Japan, China and the Republic of Korea, which travel north to Siberia and Alaska to breed. These shorebirds include populations of sandpipers, plovers, terns and the great knot.

Macquarie Marshes

The Macquarie Marshes Nature Reserve is a protected natural wetland reserve that is located within the Macquarie Marshes, in the region along the lower Macquarie River in northwestern New South Wales, Australia.

Macquarie Marshes Nature Reserve was created in January 1971. It covers an area of 21,927 hectares. It was listed as a Ramsar Wetlands site in 1986.

The Macquarie Marshes are one of the largest remaining inland semi-permanent wetlands in south-eastern Australia and are of international importance. The nature reserve samples all the habitat types present in the



The sharp-tailed sandpiper is a summer migrant from Arctic Siberia, being found on wetlands throughout Australia. The species is a medium sized wader with a straight black bill that has an olive-grey base and is commonly seen with other waders during its migration from northern breeding grounds.

Marshes and is a major waterbird breeding area, an important refuge for a large number of other wildlife species and has significant cultural values.

Principally managed for its important wetland features, this nature reserve does not cater for day-visitors, or campers. Access is restricted to management and research personnel. However, when conditions are suitable, the NPWS runs guided activities around the reserve.

Hunter Estuary Wetlands

The Hunter Estuary Wetlands Ramsar site is comprised of the Kooragang component of the Hunter Wetlands National Park (formerly Kooragang Nature Reserve), which was listed in 1984, and Shortland Wetlands (now called the Hunter Wetlands Centre Australia), which was added to the Ramsar site in 2002.

The Hunter Estuary Wetlands comprise a group of associated wetlands at and near the mouth of the Hunter River in the city of Newcastle, New South Wales. Some 30 square kilometres of the wetlands has been recognised as being of international importance by designation under the Ramsar Convention.

It was listed on 21 February 1984 as Ramsar site 287. A larger area of the wetlands has been identified by BirdLife International as an Important Bird Area (IBA). The wetlands are recognised as the most important area in New South Wales for waders, or shorebirds.

Kooragang Island is an artificial, estuarine island liable to flooding at high tide. Its habitats include mangroves, brackish and freshwater swamps, saltmarsh, Casuarina forest, mudflats, beaches and rock walls. The site is important for migratory waders and the mangroves are important for fish.



The Towra Point Steering Committee conducting a final inspection.



Bernie Clarke and Patrick Medway on Towra Beach.



The bar-tailed godwit breeds on Arctic coasts and tundra, and winters on coasts in temperate and tropical regions of Australia and New Zealand. Its migration is the longest known non-stop flight of any bird and also the longest journey without pausing to feed by any animal.

Shortland is a small (45 ha) complex of various wetland types that was added to the Ramsar site in 2002. It contains Melaleuca swamp forest, freshwater reed marsh, and a mangrove-lined creek, surrounded by urban development. The previously degraded wetlands have been restored through the establishment of the Shortland Wetlands Centre (now the Hunter Wetlands Centre Australia) in 1984.

The Kooragang Wetland Rehabilitation Project (KWRP) was launched in 1993 to protect, restore and create habitat for wildlife in the Hunter estuary. KWRP covers 1,590 hectares on three sites in the Hunter River estuary. It is one of the largest active coastal rehabilitation projects in Australia. KWRP was also initiated to compensate for the loss of fish and shorebird habitat in the Hunter estuary caused by 200 years of draining, filling and clearing. The wetlands feature expanses of mangrove and saltmarsh, and in non-tidal areas, riparian woodlands, remnants of lowland floodplain rainforest and ephemeral, freshwater wetlands.

Towra Point Nature Reserve, Botany Bay

Towra Point joins the Kurnell Peninsula that forms the southern and eastern boundary of Botany Bay. The sandstone headland adjacent to Captain Cook's landing place at Kurnell was originally an island. At about the time when sea levels were stabilising, between 9,000 and 6,000 BC, tombolo formed connecting Kurnell Island to Cronulla mainland.

Only 16 kilometres south of the centre of Sydney, Towra Point Nature Reserve sits in Botany Bay and is one of the most important wetland areas in New South Wales.

Two ancient river systems, Cooks and Georges Rivers, which flowed into the sea beneath the present sand-dunes near Wanda, became blocked with accumulating sand as the sea level rose. This gradual silting-up forced the Cooks-Georges River system to take an easier route to the sea via La Perouse rather than continue to maintain an opening in an ever-growing sand barrier near Wanda. Eventually the Kurnell-Cronulla bay mouth closed and the Kurnell and Towra Peninsulas were born and Botany Bay took its present shape.

Towra is now a low-lying promontory only 6 metres above high water level at its highest point and is surrounded by

mangroves and saltmarsh. It occupies an area of 660 hectares and is the last example of a complete estuarine wetland in the Sydney region. It is the remnant of a large complex of freshwater and saltwater marshes and swamps lost to shifting sands of the Kurnell dunes caused by forest logging.

Its importance mainly lies in it being a special habitat for migratory wading birds travelling from Siberia, Japan and China. Wading birds in the Towra Point area are associated with water, their preferred feeding habitat being intertidal beach zones, sandspits, tidal mudflats and saltmarsh. They are active small or medium-sized birds. The smallest is the red-necked stint, only 14 centimetres long and a summer visitor from north-eastern Siberia and north-western Alaska. The largest is the eastern curlew, with a length of 61 centimetres. It is a regular spring and summer migrant from north-eastern Siberia.

The population of waders at Towra includes resident and migratory species. Nearly all are seasonal visitors. Most migrate from their northern hemisphere breeding grounds of the Arctic Circle, Alaska, Asia and Siberia. The double-banded dotterel breeds in New Zealand and the Latham's snipe flies direct from Japan without a stopover. Most waders have long, slender bills – straight, turned up or down-curved – used to probe deep into the habitat of crustacea and invertebrates, their principal food. Some waders use their bills to turn over shells, stones and seaweed in search of food. They are equipped with semi-webbed feet with long toes adapted for walking on soft feeding habitats and have long legs for their body size.

Towra Point habitat is one of only three sites in New South Wales accorded special protection under the Convention on Wetlands of International Importance (especially as waterfowl habitat). The waters surrounding Towra Point peninsula were gazetted as Aquatic Reserve on 24 December 1987 and include Quibray Bay, Weeney Bay, Stinkpot Bay and Woollooware Bay. The site was chosen because it is of special ecological significance. The entire Aquatic Reserve was carpeted with banksias, but more than one-third has been lost due to erosion.

The nature reserve is made up of many component ecosystems including



The great knot is a medium-sized shorebird with a straight, slender bill of medium length and a heavily streaked head and neck. These birds forage on mudflats and beaches, probing or picking up food by sight. They mainly eat molluscs and insects.

saltmarsh, mangrove stands, tea tree, she-oak swamp, freshwater swamps, saline lagoons and reed swamps. It is a habitat of extreme diversity and high biological value. Following the transfer of Towra Point land to the New South Wales government little was done to protect the reserve or to maintain its integrity.

Australian Wildlife Society's involvement to save Towra Point

In 1996 Patrick Medway as the Executive Director of the Society attended the International Convention of Ramsar to mark its 25th anniversary.

The convention was held in Brisbane and attended by some 1,000 delegates from all over the world. Of particular interest was the growing need to protect the migratory wading birds and their fragile habitats on all continents.

Speaking with federal and state government officials about what a society such as the Australian Wildlife Society can do to help, the name of Bernie Clarke came up. On returning to Sydney, he set out to convince the council that the Society needed a new project to galvanise the members into some real wildlife preservation action. He was convinced, from talking to



Greenshanks are readily distinguished when flushed from the muddy margins of estuaries or other wetlands by a prominent white triangle on the back. They regularly fly between Australia and Siberia, but they leave Australia in two distinct waves: in February and early March, some fly from southern Australia to northern Australia, then both populations leave together, while other birds from southern Australia leave later, not stopping on northern shores.

conservationists around the country, that the Society should take a lead role and establish a focus on an area of major concern where Australian wildlife was in real peril.

Patrick became a representative for the Society on the National Parks and Wildlife Service Steering Committee. He assisted in developing the new Plan of Management and the new Erosion Mitigation Plan for Towra Beach and took over the chairmanship of the committee to expedite action.

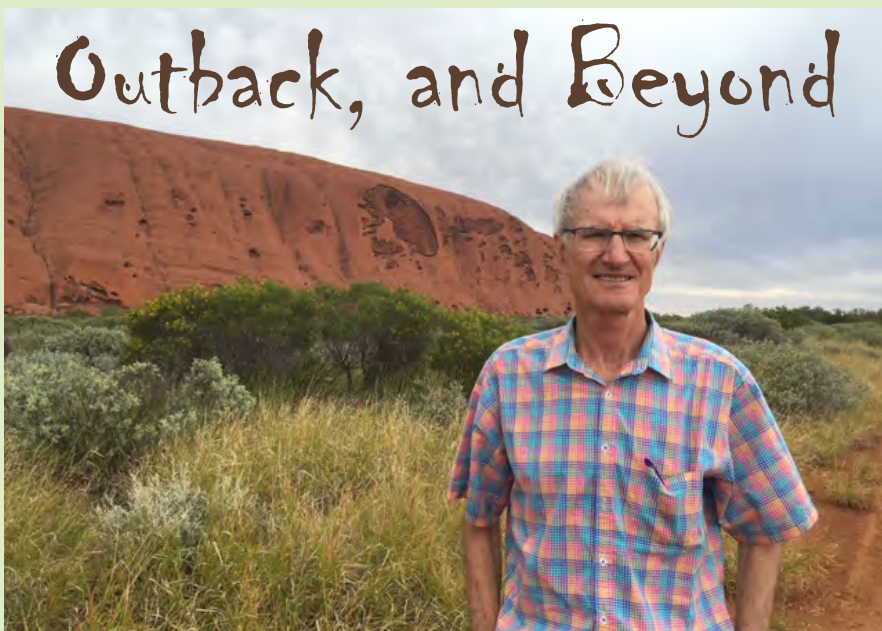
The NSW Minister for the Environment, the Hon. Pam Allan MP, officially launched the new Friends of Towra Point Nature Reserve at the reserve on Saturday, 8 February 1997 before a crowd of 135 conservation supporters. This new conservation group grew out of a series of successful meetings between the Society and the Sutherland Shire Environment Centre and the National Parks and Wildlife Service on how to provide future support for Towra Point Nature Reserve.

The Friends of Towra Point Nature Reserve, sponsored by the Society, and working with the NPWS, promoted the area for environmental interpretive studies associated with the Kurnell Environmental Education Centre for the whole of the historic Kurnell Peninsula.

After much work and many frustrations in getting the plan accepted by NPWS, the new plan was completed and officially launched by the Minister for the Environment, the Hon. Bob Debus MP, in December 2000. The Society successfully lobbied the state government and received grants totalling \$1.45 million.

Throughout 2001 and 2002 the Friends struggled to implement the Plan of Management and to address the serious erosion along Towra Beach. Much work was carried out in preparing the environmental impact statement for this beach erosion repair work and this work still continues at present. By 2004 the restoration was finished after a ten-year struggle.

Over many years, members of the Society and the Friends group worked with the rangers on monitoring the little tern breeding program on Spit Island of the Towra Point Nature Reserve. This program has seen increases in the number of little terns successfully breeding on the sand spit.



Fred Simpson is a 67-year-old practising General Practitioner, as well as a published poet and novelist. He was raised in rural Zimbabwe, where he first fell in love with 'creatures'. He and his wife moved to New Zealand thirty years ago, but their two adult children have settled in Australia. This has provided them with the opportunity to explore the best of both wild worlds.

MASKED FROG

A frog, no bigger than my thumb nail, but young, clings effortlessly to a pandanus 'palm', his foot pads fused to the bark like an epiphyte, his mouth more grimace than smile, and his bulging eyes disguised by the brush of a warrior.

JACANA

Her comb captures the morning light, adorning lilies with vermilion, while her gait, like a Norwegian in snow boots, makes no impression. But her legs, as thin as my vibrissae, assemble themselves like scaffold, to cartoon toes.

FILE SNAKE

Insinuated in submerged roots, the snake, with skin as rough as my heel, strangles a catfish. Without needing to breathe for forty minutes, it winds itself around its prey like a colon, jaw ready to dislocate, ecstatic in the reverse of birth.

GREEN WEAVER ANTS

I brush a bush in the Kakadu, and ants with green bums, like lollipops, rush up my arm spitting formic acid, and nipping. Frenetic as corpuscles in capillaries, they fight and forage robotically – programmed to serve tangled nests of silk and saliva.

BARKING OWL

Using last light he leaves his hollow to hunt, settling on a dead, red gum. He barks for her, and she barks back: 'Woo-woof' – 'Woo-woof.' Then his head pivots like a fun-fare clown on twice my number of vertebrae, before his irresistible eyes sear the earth for scurries.

DESERT DEATH ADDER

We were warned to watch for an elapid with long teeth and lethal venom, one with more patience than weathering stone. But to see him is impossible. He lies with his fat body buried in adapted sand – only his tail, flicking like a stricken insect, visible, as a lizard draws near.

SPLENDID FAIRYWREN

While on the river looking out for reptiles, a flash, and then another, distracted me – a minuscule wren, with feathers that no hat could imagine, was flitting from twig to twig in a ballet of cerulean. Nothing else existed, not even a nudging crocodile with crooked teeth.

WEDGE TAIL EAGLE

A raptor, with the talons of a pterodactyl and the eyes of an addict, rips and tears at meat – carrion tenderised by a truck. Once satiated, her beak another claw, she staggers and flaps like a vulture, before unfolding into the very prototype of grace, and soars above breath.



DON'T FEED NATIVE BIRDS

SUZANNE MEDWAY

One of the strongest arguments against feeding native birds is the danger to native animals from domestic predators such as cats and dogs. If the native animal loses its natural instinct to survive, then it becomes easy prey.

Our rationale for advising people not to feed native birds is:

Predation – feeding stations can be magnets for predators, especially cats and dogs. Native animals that lose their natural instincts of predator awareness become easy prey.

Dependency – animals may become dependent upon artificial sources of food and become less inclined to forage naturally.

Poor nutrition – many people do not provide appropriate food or sufficient variety to cover the birds' or animals' dietary needs. In the case of birds, parental birds may take poor foods

back to the nest, which may affect the healthy development of young native birds.

Nuisance – hand feeding native birds can make them aggressive and they can become a nuisance by stealing food from unaware humans.

Feeding birds does neither the birds nor cats any favours, unless the birds are starving due to adverse climatic conditions. Bird feeders are irresistible magnets to some cats and even if they only watch proceedings from a distance, this may be sufficient to send cat haters into a frenzy. But a far bigger problem is that feeding native birds encourages

the larger grain-eating parrots, which soon displace most other species like the smaller honeyeaters and insect eaters from the vicinity. Even worse is encouraging the large meat-eating birds like currawongs and kookaburras with handouts of mince and meat. Currawongs with their melodious call have taken over completely in some

Above: New Holland Honeyeaters are active feeders. They mostly eat the nectar of flowers, and busily dart from flower to flower in search of this high-energy food. Other food items include fruit, insects and spiders. Birds may feed alone, but normally gather in quite large groups. Most feeding takes place in lower areas of bushes and thickets.



Flowering grevilleas - mostly confined to Australia the 340-odd species of this genus belong to the protea (Proteaceae) family and range from small shrubs to large trees. They are evergreen plants, with needle-like to fern-like foliage and distinctive flowers. They are valued not only for their great beauty, but also for the timber of several species. Many have nectar-rich flowers that attract insects, birds or animals, all of which are pollinators.

urban areas. Not only do they viciously attack and drive away other smaller birds, but they raid nests and eat eggs and chicks. Other reasons wildlife experts discourage the feeding of native birds is that the birds become dependent on the easy handouts. The human handouts are often not correct or balanced for the particular species of bird or animal.

Obviously the best solution to these problems is to stop feeding the birds altogether. The only feeding method recommended is to arrange for the planting of a variety of flowering native shrubs, such as grevilleas, callistemon (bottlebrushes) and banksias, around the area. These plants not only look good; they also provide safe, healthy food

for blossom-feeding birds such as lorikeets and honeyeaters.

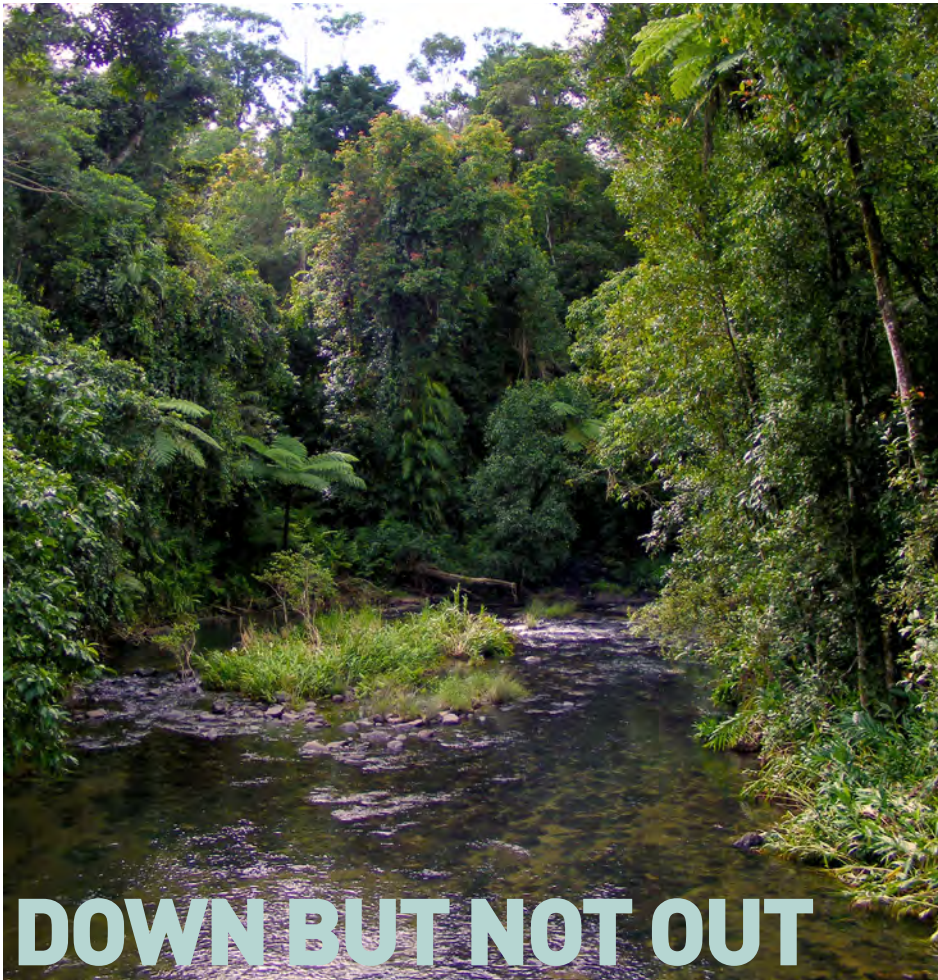
When asked about this subject, our late President of Honour, Dr Vincent Serventy AM, wrote: "Should humans upset the world of nature by feeding wildlife, in particular birds? A cause of hot disputes where even science has its worries."



A domestic cat stalking a bird.



Currawongs feed on a variety of foods including small lizards, insects, caterpillars and berries. They also take a large number of small and young birds, especially around urban areas where suitable cover is scarce. Larger prey, up to the size of a young possum, is also taken, and birds will occasionally hunt as a group.



DOWN BUT NOT OUT

HUMAN-DISTURBED TROPICAL RAINFOREST

Mason J. Campbell, Ana C. Palma, Mohammed Alamgir and Claudia Paz
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Introduction

As you travel throughout the tropical regions of the world it becomes apparent that some vegetative characters are ubiquitous: pleasantly scented frangipanis, divinely aesthetic orchids, dangerous falling coconuts and the iconic hibiscus. Though the latter are most prolific as the cotton and dye variety on the loudly coloured clothing of locals. Yet dig a little deeper amongst the agricultural endeavors of the local populace and you will find another form of ubiquitous vegetation: that of the scattered patches of weed-filled, often logged, human-disturbed or degraded (hereafter referred to as disturbed) tropical rainforest.

The global area of disturbed rainforests is currently estimated to exceed that of primary (untouched) rainforests as the predominant form of tropical forest cover. The area of disturbed rainforest is also rapidly expanding as the world's human population of 7.2 billion continues to grow. This growth leads to increased resource demands to feed

and house this profusion of humanity and thus we continue to add to the inglorious figure of approximately 100 million ha of tropical forest converted to farmland between 1980 and 2012 alone. In fact, it is currently estimated that we have already lost more than 50 percent of the irreplaceable apex of global biodiversity, the once-mighty primary rainforests. Invariably, along with this forest loss comes its nefarious cousin – forest disturbance. Consequently, many scientific researchers are now shifting their research focus from primary forests to disturbed rainforests. More specifically, their aim is to understand how best to manage the remnant biological diversity of disturbed rainforest and increase its conservation potential.

Within tropical Australia, vast swathes of one of the earth's most ancient and highly diverse rainforest fell to the axes of the early European timber-getters and the economic pursuits of the subsequent settlers. For instance, the Atherton Tablelands of Far North Queensland are

estimated to have lost ~ 80 000 ha of rainforest prior to 1983, meaning much of the remaining forested area is now small patches of disturbed rainforest. Despite this loss, the rainforests of the Atherton Tablelands form part of the largest contiguous extent of tropical rainforest on the Australian continent, known as the Wet Tropics, which stretches ~ 450 km along the north-east coastline of Queensland from just north of Townsville in the south to Cooktown in the north. The Wet Tropics, although comprising only 0.1 percent of the area of Australia, contain approximately 17 percent of its vascular plant biodiversity. Moreover, the greater Wet Tropics World Heritage Area, in a recent analysis of the data of 173,000 terrestrial protected areas around the world, ranked as the second most irreplaceable natural World Heritage site. Thus, although many of the forest patches of the Atherton Tablelands are disturbed, they provide the primary or only biodiversity repository for the preservation of rare and endangered species and threatened ecosystems. Preserved species include the iconic Lumholtz's tree kangaroo (*Dendrolagus lumholtzi*) and the southern cassowary (*Casuaris casuaris johnsonii*) often found in conjunction with the extremely rare Mabi rainforest type. Consequently, conserving the remaining disturbed forest patches of the Wet Tropics and the Atherton Tablelands is important if we are to retain a significant proportion of Australia's tropical biodiversity.

Unfortunately, the conservation value of disturbed tropical forests is not always well known as attested to by their colloquial nomenclature of 'scrubs' and their frequent use as sites for illegal dumping. And although many of these disturbed rainforest patches are under some form of legislative protection, the maximisation of their conservation values requires that they are not only retained, but are managed effectively, which necessitates an understanding of their internal ecology and functioning. Consequently, our collective recent postgraduate research endeavours have aimed to increase the knowledge of processes that affect the disturbed rainforest patches of the Atherton Tablelands, with the long-term goal of conserving the biological value they retain.

Above: Human-disturbed rainforests can still provide many ecosystem services including erosion control as can be seen by the crystal-clear water in this rainforest creek.



Remnants of the historical logging of the Atherton Tablelands rainforest still exist, a fact to which this axe-felled tree stump can attest.



Iconic animals such as this southern cassowary (*Casuarus casuarus johnsonii*) still call the disturbed forests of the Atherton Tablelands of Far North Queensland their home.

Forest fragmentation - Mason

During the initial process of rainforest lost and fragmentation (breaking upon of the once continuous forest into smaller pieces) on the Atherton Tablelands, it is highly likely that many species of flora and fauna had their population size significantly reduced, with some even going extinct. However, under the new environmental conditions present within the remnant disturbed forest patches, many other species and guilds of organisms have flourished. Both lianas (woody vines) and rattans (climbing palms) proliferate in disturbed forests (e.g. after cyclonic events) and can threaten resident trees, decreasing their growth, fecundity and recruitment success. In addition, our recent work is the first in the world to find that they can threaten resident epiphytic fern populations (e.g. staghorn ferns). However, it is not all bad news as our work is also showing that they could play a vital role in restoration plantings. We continue to untangle (pun intended) the complex interactions climbing plants have with other floral and faunal species, with the long-term aim of providing managerial directives for their effective yet conservative management.

Forest regeneration - Ana

Studying some of the approximately 2,500 patches (11,000 ha) of regenerating rainforests on the Atherton and nearby Evelyn Tablelands can help us understand how these forests regain diversity and what species they are missing, allowing us to actively aid their recovery. By surveying the soil seed banks and the plant communities of regenerating forest (4 to 41 years old) we found that younger forests have key native pioneer species (e.g. silky tamarind (*Guioa lasioneura*) and pink ash (*Alphitonia petriei*)), and retain at least 70 percent of the local floral diversity, although they also contain many exotic species (weeds). Moreover, older secondary forests have more tree species and less exotics, indicating that with time, younger forests may recover some of their 'missing' diversity. However, our work has found that tree species with big seeds, such as the Tooram walnut (*Beilschmiedia tooram*) and Tarzali silkwood (*Cryptocarya oblata*), are practically absent from all patches of regenerating forests in the landscape, even in those of the oldest ages. This finding is of considerable concern given their importance as a

food source for cassowaries and other animals. Worldwide approximately 80 percent of tropical fruits need animals to disperse their seeds and locally. Cassowaries eat and disperse more than 150 different species of tropical fruits and are the only disperser of some of the larger fruited species within the region. So it is important that these animals are attracted to regenerating forest patches and not excluded (e.g. by fences) if patches are to attain maximal diversity. Our findings have identified large-seeded species which require active planting in younger regenerating forests of the Atherton Tablelands. These species additions will not only increase forest diversity but will eventually allow for the return of cassowaries and other animal species so that one day they obtain the world-renowned diversity of their undisturbed brethren.

Regenerating forest carbon storage and soils - Claudia

Tropical forests store 40 percent of the world's terrestrial carbon, thereby assisting to mitigate human-induced climate change. As well as storing carbon in the trunks of trees regenerating rainforests store approximately 30 percent of their carbon underground.



Vines love the disturbed forests of the Atherton Tablelands of Far North Queensland.



The landscape of the Atherton Tablelands of Far North Queensland is a heterogeneous array of active dairying pastures and agriculture, remnant rainforest patches and secondary forest patches of differing ages.



Lumholtz's tree-kangaroo (*Dendrolagus lumholtzi*) is a heavy-bodied tree-kangaroo found in rainforests of the Atherton Tableland region of Queensland. Its status is classified as least concern by the IUCN, although local authorities classify it as rare. It is named after the Norwegian explorer Carl Sofus Lumholtz (1851–1922), who discovered the first specimen in 1883.

These underground carbon stocks are dynamic and can accumulate quite rapidly in regenerating forests. For instance, we found that soil carbon stocks in regenerating forest that were less than 30 years old were comparable to those in primary (untouched) forests. These findings agree with other studies across the tropics which show that within two to three decades, regenerating forests are able to store as much carbon (both above-ground and below-ground) as mature forests. The ability of regenerating forests to effectively capture carbon is good news as reducing carbon from the atmosphere is essential in the face of human-induced climate change. Interestingly, we also found that different soil types can store different amounts of carbon during forest regeneration. For instance, the rich red volcanic basalt soils that cover much of the Atherton Tableland stored more carbon and were more resilient to pasture use than the poorer granite-based soils of the region. So not all soils are equal!

Ecosystem services provisioning - Mohammed

Ecosystem services are the benefits communities receive from ecosystem such as: carbon sequestration, habitat for biodiversity, soil erosion protection, cyclone protection, eco-tourism and cultural values. Tropical forests are the largest contributor of global ecosystem services provision of all the terrestrial (land-based) systems. However, the capacity of the tropical forests to

provide multiple ecosystem services is reduced through forest disturbance by humans and climate change. In the Wet Tropics we found that rainforests, and in particular upland rainforests, such as those of the Atherton Tablelands, possess the highest capacity to supply multiple ecosystem services. However, rehabilitated disturbed rainforests were not far behind, especially if rehabilitation efforts used local rainforest species and forests being rehabilitated still contained some large trees. It is also noteworthy that even heavily disturbed rainforests still retained some capacity to supply ecosystem services. Therefore, the conservation and rehabilitation of disturbed forests of the Wet Tropics would result in the provision of a multitude of ecosystem services and the community benefits these provide.

Conclusion

Of the world's remaining tropical forest only 24 percent is intact with the other 46 percent fragmented and 30 percent otherwise disturbed. As the intact forests succumb to the onslaught of human endeavors and are disturbed or otherwise modified, it will become increasingly important that they are retained wherever possible if we are to preserve their inherent biodiversity.

Globally, retention of disturbed (and intact) tropical rainforests will continue to increase in importance. Whether retention occurs for the benefit of the current 1.2 to 1.5 billion people who directly rely on these forests for food,

timber, medicines and other ecosystem services, or simply for the aesthetic values they possess (or any other reason in between), maintaining disturbed forests should be important for all of humanity, not just hibiscus-motif shirt-wearing locals. This is especially true as we progress throughout this century as although the tropics currently house approximately 40 percent of the world's population, and 55 percent of its children under five, by 2050 it is expected that more than half the world's population and a phenomenal 67 percent of its young children (under 5) will reside there, placing further demands on the remaining rainforests.

Whilst many of these global figures sound alarming they also ring true locally for the forests of Queensland where clearing of native bushland continues to increase unabated with rates in 2015 (~ 300,000 ha) three-fold that of land clearing in 2010. Consequently the retention and restoration of disturbed tropical rainforest takes on greater importance as a means to conserve biodiversity not just globally and also here in Queensland. So the next time you travel to a tropical region and someone dismissively mentions the local 'scrub', we hope you will enlighten them on the value of disturbed forests and the major role they play in species conservation and ecosystem functioning.

Biography

Mason Campbell is a PhD student at James Cook University Cairns, where he examines the ecology of lianas (woody vines) and rattans (climbing palms) in remnant rainforest fragments.

Mohammed Alamgir recently completed his PhD from James Cook University Cairns, where he examined ecosystem services provisions of the Wet Tropics forests and likely climate change impacts on the future supply of ecosystem services.

Claudia Paz recently completed her PhD at James Cook University Cairns, where she examined the role of soil features on the rainforest regeneration process and forest carbon storage.

Ana C. Palma recently completed her PhD at James Cook University Cairns, where she studied the recovery of secondary forests of different ages, including experimenting with seeds and seedlings, as a means of expediting regenerating forest recovery.



THE NATURAL BOND sharing the wonder

Chrissy Banks

Many of my favourite memories as a kid are outdoorsy ones: climbing trees, skipping stones, throwing stones, making daisy chains, wheeling my brother along a stone wall in a wheelbarrow and tipping us both off into a shrub full of red ants... yeh, sorry about that one, bro. If we weren't up a tree, or chasing someone *around* a tree, then we were building forts, making mud pies, tearing about the neighbourhood on our pushbikes and generally doing what kids do. That's if the weather was good. If not then we were either out in it anyway, or inside building forts with the kitchen chairs, lounge chairs and blankets – thanks Mum, you're awesome!

As children, wildlife was intricate and fascinating. We knew where to find tadpoles, spiders and beetles, we understood explicitly that cockroaches were as big as saucers, run up your leg and would survive a nuclear blast. We dug around to see what the earthworms were doing, tried to get butterflies to land on us and spent countless hours catching and releasing grasshoppers. Once, over a short couple of weeks my sister and I caught many rhinoceros beetles and subjected them to living in awesome little homes we built for them. Some died and Mum rescued the rest (again, Mum, awesome work). It was a blunder on our part but we learned; the cool rhino beetle with his fabulous horn and grumpy hiss doesn't

like living in a shoebox. Best to keep the wild, wild. We watched bees lumber by laden with pollen, knew the drone of a wasp before seeing it and learned which ants to ignore and which ones to avoid. Sure, we stood on bindies, got scrapes, were bitten by ants, stung by wasps, itched by caterpillars, slimed by slugs and sprayed by stink-bugs, but we got back out there because the outdoors was a wonderland full of amazing and interesting things.

Kids being kids, right? And nothing has changed.

Only that's not true, it has changed and hugely. Fewer kids are outdoors and engaging with nature than in my day. The stats are shockingly high, around 70

percent of youth interviewed in a study preferring to be indoors. That's had me thinking. It was a couple of years ago that I heard about the negative condition labelled 'desensitisation to nature'. It now goes by another name: 'nature deficit disorder'. It is a term being used to describe a growing trend in the youth of today. At the time it hit on a concern already harbouring within me so I began to research. And, sadly, it seems experts are all saying that exact same thing: kids are rarely getting out there.

But why? Let's look for a brief moment at causes. The first is very obvious. Technology. What a paradox this is: it is both helping and hindering a love of nature in kids. Here's how it *isn't* helping. Social media – Facebook, Instagram, Twitter and Snap Chat,

Above: This little joey was a roadkill rescue. A young male, he was already trying his boxing skills on Evan while attempting to climb into Ebony's jacket pocket. On this day my two learned the importance of 'pouch-checking'. If someone hadn't cared enough to do so this cutie would have died with his mother.



Being free to discover for themselves, kids will spend hours simply observing and interacting with the natural world.

to name a few. These non-realities are demanding a massive amount of our youths' attention. Rather than grab a bike and go see a friend they communicate from within the walls of their own homes. Gaming is another huge player. Hours upon hours of free time is being spent fighting the forces of an imaginary technological world full of horrifying creatures. And while there has been a recent sudden influx of youth outdoors it isn't to catch grasshoppers, but Pokémon. Are you kidding me?! And not just kids and youth either! In a bid to be the first to 'catch' a virtual creature, they are

walking right over, through and by without noticing how the sun is causing that grey gum to shimmer, or stop to see the brightly coloured parrot above their heads. They just don't care.

Sadly, research suggests that kids pried off their games by frustrated parents are likely to react grumpily and with aggression. In their mindset, the virtual world is fun and awesome and the real world dull and boring. How has this happened?!

Techology is a tool for knowledge, not a portal for experience. At the tip of fingers one can learn an immeasurable



Relevant scientists agree that 'free play' builds strong social skills between children and a budding respect for nature.

amount about animals from a factual point of view, without ever knowing what the creature smells like, how it reacts when it sees you, what it feels like. Learning by technology (while it has its place) uses only two of our five senses. That isn't enough to endear a child to the natural world and its wildlife.

I applaud the media work environmentalists and naturalists are doing – in our house documentaries are watched frequently – but most kids believe that while these creatures and places are amazing they'll never see them, or interact with them in any way. Interestingly, it has been noted in one United Kingdom study by Stephen Moss, naturalist, author and broadcaster, that kids today actually care more about saving the environment than ever before *because* of exposure to these programs (TV), however, very few ever experience the natural world for themselves, thus not genuinely loving the earth and its creatures – and this is causing very real concern for leading naturalists across the globe. They are beginning to fear there are none rising to take their places.

Astonishingly, in that same United Kingdom study most youth couldn't tell the difference between an introduced species and an endemic one. It got me thinking and so I asked questions. Answers were surprising and not in a good way. Most couldn't tell me for sure what the national fauna emblem for Australia is and had incorrect guesses at different state faunal emblems. One went so far as to ask what a platypus was and that numbats aren't for real and when I pointed to an echidna it was called a porcupine! None knew what the Devil's Ark program was about or that devils are even in trouble so I can safely guess that more intimate knowledge of local fauna is pretty much zero on average.

Concerned? Yeah, me too. We need to let them get outdoors, people, to play and explore and 'research' in the natural, curious, hands-on way of kids.

If only it were that simple. Kids are time poor these days, busy until sundown, and that's our fault as adults. Organised activities are to blame. Society has reached a point where we are pushing our kids into as many structured activities as we can manage: multiple sports, dance, martial arts disciplines...

Whatever's going we're signing them up for it. Most children today participate in either before-school or after-school activities most days of the week, or both. As parents we want to give them every opportunity to excel, succeed and interact, and these are good things, but in filling up their schedules we're unintentionally interfering with the natural balance of things.

"An experience as simple as climbing a tree can help a child's physical, mental, emotional and social health and development," says Daniel Hamilton of ABC Local. He's backed up by a growing list of doctors, scientists and sociologists warning that in unwittingly stripping our kids of 'free play', we're potentially doing them harm. Regular unstructured and unsupervised outdoors time boosts focus, self-reliance, self-discipline, curiosity, flexibility, cooperation with other kids, problem-solving skills, general health and emotional contentment.

Kids who play outdoors interact with the things that live outdoors and are more inclined to care about them. The boy who notices the chrysalis is more likely to watch the butterfly emerge and marvel at the miracle. The girl who notices the tadpoles learns the different stages of development and delights as they eventually hop away. Those who see chicks in a nest watch with satisfaction and wonder as the chick grows and takes its first attempts at flight and song. The eyes that see the reptiles creeping out into spring warmth learn they need sun to warm their blood to move fast enough to hunt...

It is a shame that as adults we have forgotten to do the same. Instead we worry for their safety and won't let them go. Stranger Danger is a true fear in the hearts of us parents. Traffic can be a nightmare for a child caught up in racing for the park. The demolition of natural habitat and murder of the wildlife for the sake of housing expansion is robbing our children of places where they can immerse themselves in nature.

So how do we change the disinterested mindset of our youth? How can we reconnect them with the natural world when it's not so readily accessible?

Here in Australia there are organisations offering solutions. Nature Play in Western Australia, South Australia, Queensland and Canberra is doing an



They will observe what we do and learn. My Ebony bellies out on a rock to photograph creatures in a tidal pool captivated by their watery world.

incredible job in these states to engage not just the kids, but also their families, in the great outdoors. Their mission statement says it all: *For unstructured outdoor play to become a normal part of every child's life, so that they can develop into resilient, healthy and creative members of the community. We aim to work innovatively and collaboratively to make nature play a normal part of childhood again.* The Western Australia webpage has a mantra that's just as good: *Make Memories Outdoors.*

For years my kids were a part of this and it was **fun!**

In most states you will find adventure camps where kids learn how to play again, how to interact with the natural world around them. The Australian Museum constantly puts up great programs that are fun and informative and they have a fantastic, easy-to-use wildlife field guide app. There are wildlife parks and zoos galore and even groups willing to come into our schools and bring a wildlife encounter to our children.

Brilliant as all this is, they generally cost money and to be truthful there is still something far cooler in discovering



It is very easy to lead the way in educating our kids in how to interact with wildlife. I kinda didn't want to give this bearded dragon back to its owner – psst, don't tell, but they're kind of a favourite with me.



Starfish are surprisingly easy to find on our coastal shores. If you find one beached, put it straight into the water where waves won't wash it ashore again. If it is already in a rock pool, handle it carefully and avoid lifting it above the surface. This starfish was lucky to be found by Evan and carefully homed in a nearby rock pool.

things for yourself. My son raced for his favourite tree a few days back only to come skidding to a halt. "Mum!" he shouts, "You've gotta see this. I nearly didn't. I nearly squished it." I raced out and there, perfectly camouflaged against the bark of the tree, was an incredibly intricate moth. Stunning. Evan's eyes were all lit up with the joy of his find. "Isn't it cool, Mum, get your camera." He wants to make a lasting memory and who am I to say no. So I took some pics. For ages. I just couldn't stop. I was caught up in it too.

It actually isn't all that hard to engage your children in wildlife. Can I make some suggestions?

Limit technology time and increase outdoors time. I understand that some of you, many in fact, live in solid suburbia, or apartments, but there are small things you can still do to enrich their time out there; plant a small vege-patch with them, put in bee-friendly plants, build a small frog-bog and see who turns up... do *something*. Get out there, make the effort and take your offspring with you. Learn about it together. It's fun. Gardening is a great idea for younger kids, but what about the tweenies (10-12-year-olds) and the teenagers? Taking it up a notch doesn't hurt, but will require your time and no doubt patience. If you have bushland nearby,



A teen in the wild – it does happen! Ebony peacefully wanders a rocky island she waded to through rushing shallows. Even the simplest of places are a treasure trove of interesting things if given the time to explore.

beach, river, even a park, get them out there with you. Maybe they'll be disinterested at first, but find a spot and then let them wander. Don't push. They'll eventually explore on their own accord. My daughter (13) grumbled about going to a reserve yesterday afternoon, but ended up having a great time on the rocky shores of a river listening to the different sounds rocks make when you clunk them with another rock from different depths. And while she was doing that she noticed a family of blue wrens, a bright orange beetle and ants busily working around where she was sitting. She was noticing the smell of the river and river vegetation while her brother waded in and began building a rocky dam. Kids outdoors. They looked peaceful and happy, which made me feel peaceful and happy too.

It doesn't take much on our part. Just a bit of time, a bit of effort and a willingness to be aware of what is around you where you live, then share the knowledge. We have a park up the road that is home to the beautiful turquoise parrot. They're such a delight to see. We didn't have this species in Perth and after eight months I'm still amazed by them. And that's the thing really, isn't it, to allow ourselves to be amazed by nature and to adopt an outdoorsy attitude. Do you know that every single person I know who fights for the earth and its creatures in one form or another was constantly outdoors as a kid?

If you're not in it, you can't connect with it and if you can't connect with it you can't care about it; and if you don't care about it then you won't lift a finger to save it – and it needs saving, through us and through our children. I believe kids and youth inherently love nature, it just needs to be nurtured in them, like a seed needs nourishment to germinate and grow. Give them a chance by reintroducing them to the outdoor world. Climb a tree yourself, catch a grasshopper and endear your kids with stories of you as a kid and all the fun you had in the great outdoors.

Let your enthusiasm for the earth and its animals infuse your children – and one day, when you watch them doing the same for their own kids, you will smile and be grateful that you helped strengthen the bond between man and earth.

Australian Wildlife Society Wildlife Ecology Research Scholarship

This \$5,000 scholarship is awarded each year to University of Technology Sydney postgraduate research students who are undertaking a research project that is of direct relevance to the conservation of Australian native wildlife (flora or fauna).

The scholarship is provided to support operational costs associated with the successful candidate's research project, such as travel associated with the research project, fieldwork expenses, and specialist software and small items of equipment.

The winner for 2016 is Naomi Walters, who is conducting a scientific research project in Australian wildlife ecology

Safeguarding northern quolls from cane toads

Naomi Walters

During the last few decades as cane toads have spread across Northern Australia, northern quolls (*Dasyurus hallucatus*) have been significantly impacted. As the invasion continues to spread, the introduced pest poses an imminent threat to the endangered northern quoll living in the Kimberley, Western Australia. While there is no silver bullet to halt the spread of, or to eradicate, the toxic toads, research has been working towards ways to prevent quoll extinctions by training quolls to avoid eating cane toads before the toad's invasion spreads any further:

My PhD project in the Kimberley, Western Australia, aims to prevent the extinction of northern quoll populations at Mornington Wildlife Sanctuary (owned by the Australian Wildlife Conservancy) and the neighbouring crown land. The mechanisms and techniques required to apply conditioned taste aversion at a landscape level to northern quolls has never been examined. The research conducted during my PhD is integral to filling in the gaps in knowledge required to enable broad-scale deployment. This project will yield direct conservation benefits to an iconic endangered marsupial predator. The major costs of this project are field-related expenses that are unavoidable given the remote location of my sites. Therefore this research would not be made possible without



Northern quoll (*Dasyurus hallucatus*) and Naomi Walters.

the generous contribution made by the Australian Wildlife Society Research Scholarship.

Thus far we have learned that wild quolls can be taught to not eat cane toads by deploying 'toad aversion baits' ahead of the toad invasion front. Quolls that consumed such baits would become ill, and would subsequently associate the smell and

taste of cane toads with illness, and would then ignore live cane toads thus reducing toad-induced mortality rates. This process is called 'conditioned taste aversion'.

Provided that some female quolls survive in a toad-infested landscape, then their offspring may learn to avoid toads as prey via social learning (i.e. by foraging with their mothers).



Northern quoll (*Dasyurus hallucatus*) captured on camera trap at Australian Wildlife Conservancy's Artesian Range property.

Preliminary results in the field suggest that wild quolls readily consume toad baits, and in the lab, quolls that consumed toad baits subsequently ignored live toads as prey. Thus, the technique could conceivably train a large number of quolls to avoid cane toads without them requiring a stage in captivity. This research is integral to filling in the gaps in knowledge required for land managers to enable such broad-scale deployment. If the project is successful, the toad aversion baits could be used to protect northern quolls from the threat of cane toads over large geographic areas as far-reaching as from Queensland through to Western Australia.

About me:

Conducting a scientific research project in Australian Wildlife Ecology has always been a goal of mine. I am deeply passionate about conserving Australia's unique endemic species and always wanted to do research that can make a difference. Thus, I am excited

to be doing a PhD that aims to prevent the extinction of northern quolls in the Kimberley.

Demonstrating that the deployment of taste aversion baits can help to prevent local extinctions of northern quolls is a major logistical challenge. However, the payoffs are enormous, as the technique, if successful, could be used for landscape-scale conservation of this endangered species. I am very excited to play a leading role in developing and field-testing a novel technique that has the potential to prevent future declines of northern quolls. Additionally, the potential to support a team that has a clear mandate to prevent further extinctions and remains united in their commitment to the conservation of Australia's unique environment is especially appealing to me.

Studying marsupials in a remote area of the world which most people have not visited is a particularly rewarding aspect of my research. As

the Kimberley is so vast and largely understudied I am confident that I can make an important contribution to on-ground management practices that will help to conserve the northern quoll for future generations. Even in this project's infancy, the novelty of this technique and the iconic nature of the northern quoll has engaged the local community of the Kimberley and has received much interest from the broader Australian audience.

This project has great potential to excite and educate the public about the importance of science and wildlife conservation.

The assistance provided by the Australian Wildlife Society's Wildlife Ecology Research Scholarship has provided a significant contribution to my project, and has allowed me to continue to carry out my research in such a remote area of Australia. For that I am extremely grateful!

2016

University Student Grants Scheme winners

The Australian Wildlife Society's University Research Grants are scholarships offered to honours or postgraduate students at Australian universities. Each year, ten grants of \$1,500 are awarded. Grants are available for research projects of direct relevance to the conservation of Australian wildlife; plant or animal. Grants may be used for the purchase of equipment and consumables, travel expenses related to field research, or attendance at conferences at which you are presenting your work.

The Australian Wildlife Society is delighted to announce the winners of the ten grants of \$1,500 each to honours or postgraduate students conducting research that will contribute to the conservation of Australian wildlife. The winners for 2016 are:

HANNAH BANNISTER - The University of Adelaide
Project title: Identifying successful reintroduction techniques for brushtail possums (*Trichosurus vulpecula*) in a semi-arid environment

ANICEE LOMBAL - School of Biological Sciences, University of Tasmania
Project title: Re-establishment plan of Providence petrels (*Pterodroma solandri*) on Norfolk Island

DONALD McKNIGHT - James Cook University, Townsville
Project title: Do bacterial immune defences drive the recovery of threatened frog populations?

GARY PALMER - Griffith University
Project title: Seed predators in rainforests: What are they eating, and how are they influenced by forest fragmentation?

LAUREN ROMAN - Institute for Marine and Antarctic Studies (IMAS), University of Tasmania
Project title: "We've had a gutful of this rubbish"; Population-level effects of plastic ingestion in Australasian seabirds

EMILY ROY-DUFRESNE - The University of Adelaide
Project title: Mapping the distribution of the European rabbits (*Oryctolagus cuniculus*) in Australia using occurrence data from targeted and non-targeted field studies

MONIQUE SMITH - The University of Adelaide
Project title: Interactions between native and introduced grass species in the context of restoration of grassy habitats

PATRICK TAGGART - The University of Adelaide
Project title: Investigating correlates of *Toxoplasma gondii* infection to explain its higher seroprevalence on Kangaroo Island

JACK TATLER - The University of Adelaide
Project title: Spying on Dingoes in the desert – New insights into the behaviour energetics and resource selection of free ranging dingoes – *Canis lupus dingo*

LUKE TILLEY - The University of Adelaide
Project title: Potential impacts of Western Quolls (*Dasyurus geoffroii*) on in situ species at Arid Recovery



In this issue and the Summer edition of *Australian Wildlife*, the articles on the winners' projects will be featured.



Do bacterial immune defences drive the recovery of threatened frog populations?

DONALD MCKNIGHT

James Cook University, Townsville

Recent decades have seen major declines in amphibian populations throughout the world. Multiple factors are causing these declines, but one of the most important threats is an emerging infectious disease known as amphibian chytridiomycosis. This disease is caused by the fungal pathogen *Batrachochytrium dendrobatidis* (or just *Bd* for short) which parasitises amphibians' skin and prevents them from maintaining a proper balance of water and salts, ultimately resulting in cardiac arrest. Currently, *Bd* can be found on every continent except Antarctica, and it has caused over 200 species to decline or even become extinct.

The Wet Tropics of Australia is one of the regions that has been heavily

impacted by this disease, and in the late 1980s a large outbreak caused many frog populations in Queensland to disappear. However, not all species and sites were affected, and high elevation populations were particularly prone to declines. Thus, for several species such as the waterfall frog (*Litoria nannotis*) and the green-eyed treefrog (*Litoria serrata*), high elevation populations declined or disappeared, but populations below 300 metres survived and remained stable. Remarkably, in the time since the initial outbreak, many of the high elevation populations that had disappeared have come back, and these new populations seem to be stable, despite the fact that *Bd* is still present. Currently, no one knows how these populations recovered or why they are currently able to coexist with the pathogen. Therefore, the goal

of my research is to determine how these populations have recovered, so that we can use that information to both manage current populations and aid other populations in recovering.

One of the most exciting possibilities is that populations have recovered by shifting their microbiomes. Amphibians have a rich collection of bacteria that live on their skin (collectively known as a microbiome), and laboratory trials have shown that some bacterial species are capable of fighting *Bd* infections. These studies found that giving the frogs additional beneficial bacteria resulted in the *Bd* infections being cleared, whereas individuals that were given

Above: Donald McKnight: Photo by Jen McKnight



A waterfall frog (*Litoria nannotis*) at a low elevation site. Photo: Donald McKnight

antibiotics to reduce their bacteria were even more susceptible to the infection. Based on those results, it is possible that wild populations could coexist with the fungus if their microbiomes shifted to contain more beneficial bacteria, and that is what I am going to examine.

To test this hypothesis, I will compare the microbiomes of upland and lowland populations of waterfall frogs and green-eyed treefrogs. Because both of these species declined or disappeared at high elevation sites but remained stable at low elevation sites, this will let me see if the upland populations have recovered through changes in their microbiomes. In other words, if bacteria have played an important role in the recovery of the upland populations, then I expect those populations to contain disproportionately more anti-fungal bacteria than are contained in the low elevation populations. I am also going to examine the microbiomes of upland and lowland populations of the stony creek frog (*Litoria wilcoxii*), because this species occurs along the same streams as waterfall frogs and green-eyed treefrogs, but it did not decline at any elevation during the *Bd* outbreak. Therefore, this species will provide a control that will allow me to account for elevational differences that are being caused by factors other than *Bd*.

Collecting bacterial samples will be relatively straightforward. I will capture wild frogs along their streams, gently run a sterile swab along their bodies, then release them where I captured them. The more complicated component of this project will take place later, in the laboratory, where I will extract the bacterial DNA from the swabs, then sequence that DNA to determine which species of bacteria are present and how abundant they are. The funding from the Australian Wildlife Society has allowed me to purchase many of the chemical reagents necessary for this laboratory work, and I am grateful for their support.

The results of my project have the potential to be very useful for amphibian conservation efforts. For example, many biologists have suggested that we can help populations recover by seeding them with beneficial bacteria. So, by testing whether or not bacteria are already playing a role in the recovery of some populations, my study will help to shed light on the usefulness of this potential conservation strategy, as well as identifying candidate bacteria to use in recovery efforts.



Litoria nannotis. Photo: Donald McKnight



Litoria nannotis. Photo: Donald McKnight



Litoria nannotis. Photo: Donald McKnight



How does rainforest fragmentation affect the composition and feeding behaviour of a post-dispersal vertebrate seed predator community?

GARY PALMER
Griffith University

Rainforest fragmentation leads to a loss of original habitat, reduction in remnant size, and increasing isolation of remnants from each other. This can lead to significant changes to vertebrate species assemblages. Many terrestrial bird and mammal species are major seed predators in rainforests. Changes in abundance of vertebrate seed predators are likely to lead to altered rates of seed predation, thereby affecting the ability of fragments to maintain original patterns of plant recruitment. Most research investigating the effects of fragmentation on vertebrates has focused on mammal or bird community composition, irrespective of diet. The general finding of this research is that responses to fragmentation are complex and highly variable. However, species composition of vertebrate seed predator communities, as well as the effects of fragmentation, has received little attention.

Much of the subtropical lowland forests of southern Queensland and northern New South Wales have been cleared or converted for agriculture (and some to forestry plantations) from the mid-19th century. The 'Big Scrub' is a region of highly fragmented

subtropical rainforest in north eastern New South Wales. Agricultural development of the Big Scrub region began in the late 1800s, resulting in significant land clearing. Remnants of the Big Scrub are scattered across a highly modified landscape, largely consisting of livestock pasture, together with substantial areas of macadamia tree plantations, as well as woody forest regrowth. The remaining areas of original rainforest are estimated to be between 300 ha and 556 ha in total area, or 0.4% to 0.7% of the original 75,000 ha rainforest cover.

Using video footage from infra-red camera traps, this study will for the first time identify the species composition of a post-dispersal vertebrate seed predator community across a range of common rainforest tree species, and also quantify the level of interactions between seed predators



Rainforest fragments in the Big Scrub, surrounded by agricultural land.

and seeds. The effects of rainforest fragmentation on both the species composition of the seed predator community and levels of interactions between predators and seeds will also be investigated. Understanding the consequences of fragmentation for seed predators and subsequent rates of seed predation is important for ongoing conservation management.

This project will provide information to help manage fragmented rainforests and thereby improve the likelihood that various rainforest tree species are able to persist over the long term.



Rainforest fragments in the Big Scrub, surrounded by agricultural land.





Hannah releasing a possum after processing

Factors influencing the population persistence of brushtail possums (*Trichosurus vulpecula*) in a semi-arid environment

HANNAH BANNISTER

The University of Adelaide

'Common' brushtail possums (*Trichosurus vulpecula*) have significantly declined over the past 200 years, particularly in arid and semi-arid areas, having totally disappeared from more than 50 percent of their historical range. Brushtail possums are listed as 'Rare' in South Australia (*National Parks and Wildlife Act 1972*) and their population trend is listed as 'decreasing' by the International Union for Conservation of Nature (IUCN). Along with habitat loss, competition with introduced and domestic herbivores and persecution, predation by introduced predators is one of the key contributors to their decline. In the Ikara-Flinders Ranges National Park, in semi-arid South Australia, introduced foxes (*Vulpes vulpes*) are successfully controlled through the *Bounceback* program (DEWNR). The suppression of foxes led to a trial reintroduction of brushtail possums to the park in 2015, where they had not been present since the 1940s. With reintroduction projects often failing, it is vital to understand factors that may influence reintroduction success and ultimately population persistence.

Habitat requirements for brushtail possums vary greatly depending on the environment they are found in, and few studies have been conducted on brushtail possum ecology in semi-arid environments. Perhaps most important for the reintroduction and for remnant brushtail possum populations is the ability of the offspring of the founder population to survive, disperse and reproduce; that is, the ability of the population to persist. In Australia, few studies have focused on monitoring the survival and dispersal of juvenile brushtail possums, and this could provide an insight into potential threats to long-term population persistence

as well as identifying key actions to be undertaken for conservation of the species in remnant and reintroduced populations. The primary objective of this research is to identify factors that may affect the short- and long-term persistence of brushtail possums in the Ikara-Flinders Ranges National Park following their reintroduction. My main aims are: (1) to determine which habitat features are necessary for population persistence of brushtail possums in a semi-arid environment, and (2) to understand the ecology of juvenile brushtail possums, including their survival, age and weight at dispersal, when reproductive maturity is reached and their movements in relation to their maternal home range.

To achieve this, I will be monitoring the types of shelter sites used by radio-collared possums. Additional information on canopy connectivity, mid-storey abundance, plant species diversity, distance to water and basal area of trees will also be recorded along with the movements (home range) of individuals. I will also be radio-collaring successive juveniles from a focal group of thirteen females to monitor their movements and survival – once out of the pouch, juveniles can be fitted with a small 7g radio-transmitter. A small number of home-made GPS collars, cheaper than traditional GPS collars, will be constructed using VHF transmitters and

commercially available GPS data loggers. These collars will be used to collect home range information and to compare the location of females with their offspring, once dispersed, at regular intervals. By improving our understanding of the requirements for brushtail possums to persist in semi-arid environments we may not only improve reintroduction success but may also inform management decisions regarding the conservation of the species, which should no longer be considered the 'common' brushtail possum.



A female and her dependent young (5.5 months old), both radio-collared to monitor movement and survival. Juveniles may be particularly vulnerable to predation – this dependent juvenile (aged 6 months) was killed by a feral cat a week after this photo was taken.



Spying on dingoes in the desert:

How do they behave and where do they go when no one is looking?

JACK TATLER

The University of Adelaide

Remote monitoring technology is an undeniably powerful tool for furthering our knowledge of the natural world. In recent decades, outstanding developments in the reliability, accuracy and scope of remote monitoring technology has provided researchers with the means to quantitatively measure an animal's behaviour and physiology whilst in the wild. Data collected from these animal-attached sensors can be translated into behavioural states such as walking, running and hunting, and can also be used to make interpretations about daily energy

expenditure. Furthermore, fine-scale location data obtained from similarly attached GPS devices can be used in conjunction with environmental variables to explain how animals selectively use resources within their geographic range. The value in understanding behaviour, energy expenditure and resource selection by animals is that it can be used to guide management and conservation over broad extents and diverse habitats.

Dingoes are an iconic and ecologically important species in Australia. Unfortunately, quantitative data on

the behaviour, energetics and resource selection of free-ranging dingoes is all but absent from the literature, yet is fundamental to predicting how they will interact with management strategies, habitat destruction, native species and reintroduction endeavours. This project aims to quantify behavioural states, measure behavioural complexity and determine the drivers of habitat selection and movement patterns of free-ranging dingoes.

Our study site is located approximately 900 km north of Adelaide at



Warburton River with water from January rain.

Kalamurina Sanctuary, a 667,000 ha expanse of land owned and run by the Australian Wildlife Conservancy. Much of the landscape is characterised by elongated parallel sand dunes but there are also a diversity of ecosystems including freshwater lakes, desert woodlands and riparian floodplains. In April 2016, we successfully deployed 10 custom-made Iridium GPS collars with inbuilt accelerometers and temperature sensors on adult dingoes (6 females and 4 males).

We have received high-quality data from 9 of our 10 collared dingoes (one collar failed after release) and they are scheduled to drop off at the end of August. These dingoes have remained relatively close to their point of capture, with seven concentrating their movements along the Warburton River, which is one of the only sources of free water (that is not hypersaline) on the entire sanctuary). All dingoes are exhibiting home-range philopatry; five occupy overlapping home ranges and four clearly avoid those areas inhabited by other collared dingoes. Sand dune swales and paleo-drainage lines appear to be important corridors for dingo movement throughout the landscape. Home-range size and average movement distance are smallest for dingoes using densely vegetated habitat along the Warburton and largest for individuals occupying open, sand dune-dominated habitat.

We are currently collecting accelerometer data from captive dingoes at Cleland Wildlife Park, which we will combine with direct observations to classify behavioural classes. We will access the accelerometer data from free-ranging dingoes once the collars are retrieved in September and assign behavioural classes to the data by using the model we created from captive dingoes. We will also measure the complexity of the accelerometer/behavioural data in order to link physiological function with ecological processes. Six more GPS collars were deployed in September 2016 and up to ten more in April 2017. It is important to track dingoes throughout the year in order to assess how habitat selection and behaviour change throughout time and with considerable variation in available resources.



Jack Tatler radio-tracking dingoes at Kalamurina in April 2016.



Jack Tatler installing a humane foothold trap to catch a dingo.



Potential impacts of western quolls (*Dasyurus geoffroii*) on in situ species at Arid Recovery

LUKE TILLEY
The University of Adelaide

The western quoll, once found throughout the majority of the Australian continent, has now been restricted primarily to the jarrah forests of south-west Western Australia. After the success of a 2013 reintroduction program in the Flinders Ranges (South Australia), it was proposed that a population could also be established at Arid Recovery (South Australia). Apart from the potential to see the return of the species to an arid habitat, the quolls could also be highly beneficial to the

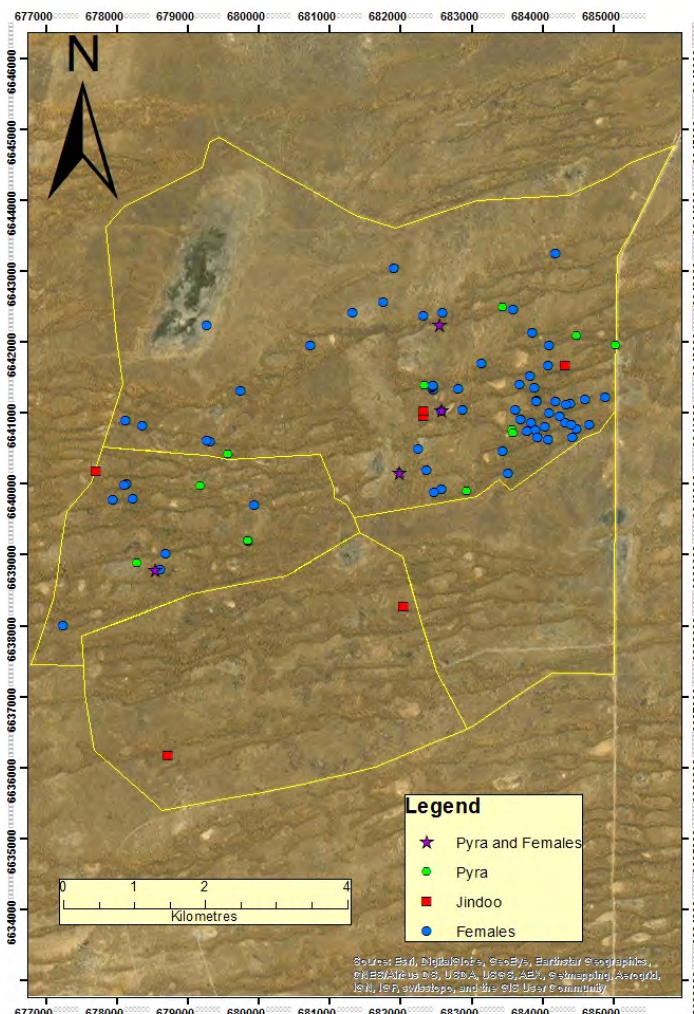
reserve, with an overpopulation of the burrowing bettong a key management concern.

This project aims to determine what the potential impacts of reintroducing the western quoll to Arid Recovery could be on the four nationally threatened species, burrowing bettong (*Bettongia lesueur*), greater bilby (*Macrotis leucura*), western barred bandicoot (*Perameles bougainville*) and greater stick nest rat (*Leporillus conditor*). Previous research has

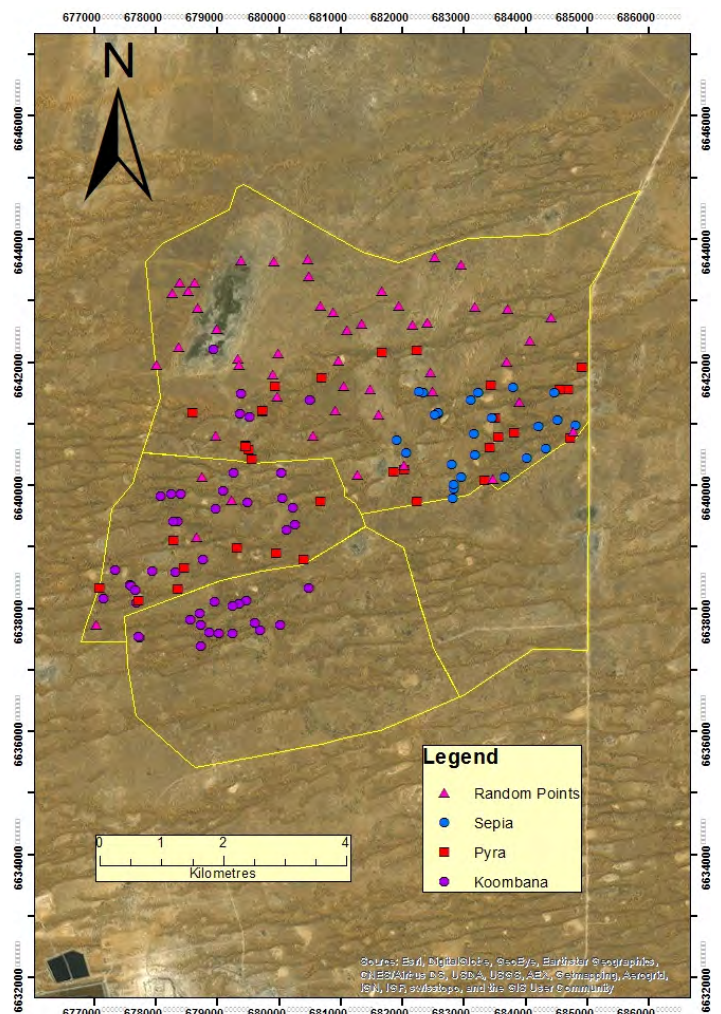
indicated that the western quoll is an opportunistic predator, and thus the hope is the species will not have a significant impact on the populations of more vulnerable species like the greater stick nest rat (small body size and low abundance within the reserve), and possibly help contribute to reducing the population of more problematic species like the burrowing bettong.

Two male quolls (named Pyra and Jindoo) were released into the reserve

Western Quoll Shelter Site Locations Within Arid Recovery



Western Quoll Habitat Use Within Arid Recovery



during May 2016, to accompany two females (Sepia and Koombana) released in 2015. The four quolls were radio-tracked to daytime shelter sites using VHF collars. Characteristics of 87 shelter sites the quolls are known to have used were collected, as well as 74 available shelter sites within the reserve. Characteristics of 100 (33 male and 67 female) used habitat points and 50 randomly generated habitat points were also collected using GPS pin point collars fitted to the quolls for a duration of three weeks each. Both used and available shelter sites and habitat points will be compared to determine if there are any factors the quolls are selecting for, that are likely to contribute to a negative impact on the other reintroduced species within the reserve. Scats were collected by visiting shelter sites, and searching for latrines, in order to analyse diet.

Unfortunately, one of the males (Jindoo) escaped the reserve within two weeks of release, and was unable to be relocated despite extensive efforts to radio-track aerially. The scats collected during this project are still being analysed by Desert Wildlife Services, but results from 2015 indicated the female quoll diet contained spinifex hopping mice (*Notomys alexis*), juvenile bettong and western barred bandicoot. The scats collected in this project will help to confirm if male quolls have the potential to target different species or species at a varying frequency, with n=33 scats collected from the male (Pyra) that remained within the reserve.

Shelter site and habitat data indicates the quolls are spending 90 percent of their time in dune habitat and also prefer to shelter in dunes, over swale habitat. They shelter within bettong warrens and burrows (predominantly warrens). Only one greater stick nest rat nest was utilised by a male quoll for shelter (not believed to be active at the time) and habitat usage thus far does not seem to bias the location of nests. Classification trees will be used to look at fine-scale habitat and shelter preferences and confirm this. An honours thesis on this project is due to be submitted on 26 October 2016.

A positive sign for any future full-scale reintroductions is that the quolls can successfully breed within the reserve, with female Sepia now the proud mother of four pouch young.



Sepia, a female quoll with a GPS collar attached. Photo by Elizabeth Florance, 2015.



Rebecca West (Supervisor) with Pyra.



Dr Rebecca West (UNSW) discovering the first four quolls born within Arid Recovery to mother Sepia and father Pyra (Rebecca West, 2016).



Interactions between native and invasive grass species and the role of soil microbes in grassland restoration

MONIQUE SMITH

School of Biological Sciences,
The University of Adelaide

Lowland temperate grasslands and open grassy woodlands have been labelled Australia's most threatened ecosystems with around only one percent remaining. Large-scale clearance of these habitats occurred mostly due to the suitability of such areas for agriculture. As a result, restoration of grassy habitats is needed to conserve these unique ecosystems and the organisms that inhabit them. Areas of farmland that was previously cultivated and now abandoned (old-fields) are difficult to restore as they lack a native seed source and are often overrun by invasive plants. These areas also suffer from increased nutrient availability and soil compaction due to past farming practices, resulting in unfavourable conditions for native plants. These properties of old-fields

can also affect the soil microbial community, which in turn has the potential to further reduce the success of restoration attempts.

Soil microbes, particularly fungi and bacteria, can affect plants either positively or negatively through pathogenic effects, aeration of soils and controlling nutrient cycles. Symbiotic relationships between plants and microbes are very important for plant growth and establishment, with around 80 percent of vascular plants relying on soil microbes to aid nutrient uptake in exchange for organic matter to feed on. Weed invasions can create feedback loops whereby the invasive plants create conditions favourable to their soil microbe symbionts, giving them a further advantage over native

plants. Researchers and restoration practitioners are beginning to consider how soil microbes may be utilised to improve restoration outcomes. This is a relatively new approach and so much is still unknown on the importance of soil microbes for grassland restoration.

This is where my Ph.D. research comes in. I have carried out a glasshouse experiment to investigate the effects of changes in soil microbial communities on native and invasive grass growth. I compared the performance of two native (*Rytidosperma auriculatum* and *Austrostipa nodosa*) and one invasive (*Lolium rigidum*) grass species grown in the presence of three different soil microbial communities. One of these communities was collected from an old-field dominated by the invasive



Soil was taken from a seed orchard like this one to see whether the microbial communities under the monoculture of native grasses can improve the success of future restoration projects. The results found that remnant soil microbes were much better for native grass performance. Photo: Andrew Fairney

grass *Avena barbata*, another was from a remnant grassland, and the third soil microbial community was from an orchard of native grasses. I used this experiment to test the following questions:

- Does the presence of one invasive grass aid establishment of other invasives? If so, is this a result of changes to the soil microbial community?
- Does native grass growth and establishment benefit from the presence of remnant microbial communities?
- Does planting in a monoculture of native species produce microbial communities that improve the success of future restoration projects?

My results indicate that the microbes present in soil collected from the remnant area improved native grass performance with increased growth (see picture below) and lowered mortality. The orchard soil microbes did not appear to be a suitable replacement for remnant microbes, with reduced growth in plants growing in the presence of these microbes. This suggests that planting in a monoculture of natives may not be sufficient for creating conditions suitable for a diverse microbial community. Native plants grown in the presence of soil microbes from the old-field had the highest mortality (up to 60 percent in one native grass). This leads to less effective restoration outcomes and a lowered reproductive output. The invasive species, on the other hand, appeared to not discriminate between microbial communities, growing just as well



Grass-dominated systems, such as this open grassy woodland, are among our most threatened systems in Australia. This photo was taken at my field site, Para Woodlands Reserve, South Australia, where the remnant soil was collected and where my field trials take place. Photo: Dragos Moise

in soil containing old-field microbes compared to those grown with remnant microbes.

So, to improve restoration success in old-fields and to reduce invasion by weed species, consideration and management of below-ground biota may be critical to native plant growth and establishment. Taking soil microbes from remnant areas and inoculating old-fields with them may help to reduce the mortality of replanted communities and give them a competitive edge against invasive species. In order to get a better understanding of the differences in these soil microbial communities, I am now using a technique called DNA metabarcoding to assess what microbial species are found in the

different soil types. This will help us to identify which soil microbes may be important for the native grasses.

Thanks to the funding from the Australian Wildlife Society, I will be heading to Europe later this year, where I will be sharing these results with an international audience at the British Ecological Society Annual Meeting in Liverpool, United Kingdom. Whilst there I will also be visiting two research groups, one at the James Hutton Institute in Dundee, Scotland and the other at the University of Tartu in Estonia. These lab visits will give me insight into the methods used by other groups for addressing similar questions to mine and this should hopefully improve the analysis of and outcomes from my own research.



The picture above demonstrates the difference in growth of the native grass *Rytidosperma auriculatum* when grown in a sterile control, or with microbes from a monoculture of a native grass, an old-field or a remnant site (pots left to right, respectively, and labelled control, orchard, field and remnant).



Investigating correlates of *Toxoplasma gondii* infection to explain its higher seroprevalence on Kangaroo Island

PATRICK TAGGART

The University of Adelaide

Why does *Toxoplasma gondii* like the island life?

Toxoplasma gondii is a parasite which causes the disease toxoplasmosis. This parasite is carried by and sexually reproduces in species of the feline family, including domestic cats. In Australia, the only host within which *Toxoplasma gondii* can sexually reproduce is the domestic cat (*Felis catus*). The cat is termed the primary or definitive host. Following their first infection with *T. gondii*, cats pass an infective egg-type stage of the parasite, the oocyst, into the environment. These oocysts are extremely hardy and can last for a long time in the environment, up to 18 months, much longer than the faeces itself! Wildlife subsequently become infected by consuming food, water or soil contaminated with

infective oocysts. *Toxoplasma gondii* is also said to be able to infect all warm-blooded animals, and causes significant and debilitating disease in wildlife, livestock and even humans! Australian marsupials are particularly susceptible to toxoplasmosis compared to wildlife in other countries. Scientists attribute this to Australian wildlife evolving in an environment free from cats, and hence, the parasites they unwittingly carry.

Toxoplasmosis can cause a huge array of symptoms in wildlife, including blindness, incoordination and death. Some of the symptoms, such as blindness, incoordination, and other neurological problems, make animals more susceptible to predation, assuming, of course, the disease doesn't kill them first. There is also

preliminary evidence that *T. gondii* infection may induce behavioural changes in wildlife that make animals more risk-averse, similar to how *T. gondii* infection causes mice to lose their innate fear of cats. It is thought this symptom occurs to encourage prey to be eaten by cats to perpetuate the life cycle of *T. gondii*.

On Kangaroo Island in South Australia, a very high rate of *T. gondii* infection has been shown in cats and sheep, among the highest recorded from any Australian location. This high rate of infection in cats and sheep on Kangaroo Island is concerning as it suggests a high and sustained level of environmental contamination with infective oocysts. This exposes threatened and endemic Kangaroo Island wildlife, such as the



A feral cat on Kangaroo Island. The cat is termed the primary or definitive host of *Toxoplasma gondii*.

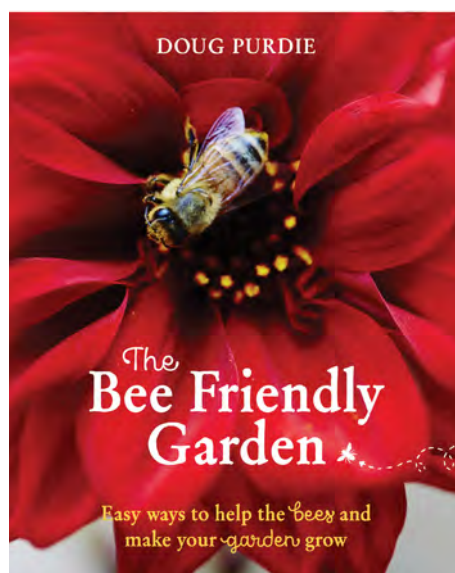
Kangaroo Island dunnart (*Sminthopsis aiteni*), southern brown bandicoot (*Isodon obesulus*) and Australian sea lion (*Neophoca cinerea*) to a high risk of infection; not to mention the threat to other wildlife, and increased risk to livestock and public health. However, reasons for this high rate of *T. gondii* infection on Kangaroo Island are not properly understood. This is where my project comes in. My project will investigate why the rate of *T. gondii* infection on Kangaroo Island is substantially higher than on the Australian mainland. Possible explanations include differences in the population density of cats or the secondary hosts (wildlife, livestock and humans), *T. gondii* infection rate in secondary hosts, the availability

and accessibility of *T. gondii* infected carrion, environmental conditions, cat behaviour, or a combination of these factors. My project will investigate each of the listed explanations to determine the reason for the higher infection rate of *T. gondii* on Kangaroo Island. This information will fill our current knowledge gap, and be used by conservation and land managers to identify practical ways to reduce the rate of *T. gondii* infection on Kangaroo Island. The findings of this project will also be applicable to the management of *T. gondii* infection on other Australian islands, such as Tasmania and Christmas Island, which provide the last remaining refuges for many threatened species now extinct on the Australian mainland.

In August, I commenced my first component of field work where I deployed infrared cameras at a number of locations on Kangaroo Island and the Fleurieu Peninsula. This will allow me to compare cat population densities between the island and the mainland, which would be the most obvious reason for a higher rate of infection by a cat-borne parasite on Kangaroo Island.

I am passionate about preserving Australia's unique wildlife and have a keen interest in disease ecology. It's exciting to now have my own project which combines the fields of wildlife conservation and disease. I look forward to sharing my results in another 12 months.

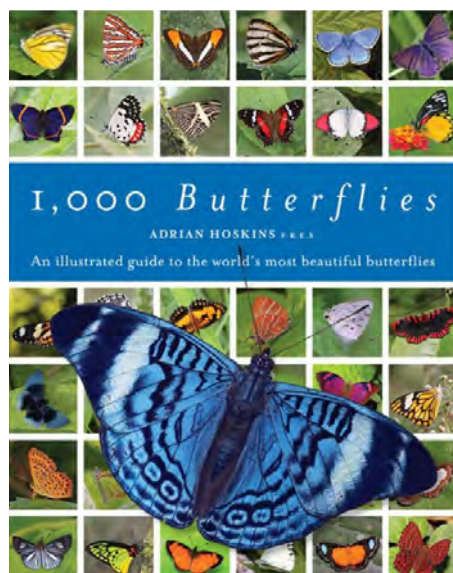
Book Reviews



The Bee Friendly Garden by Doug Purdie

For every gardener who cares about the planet, this guide to designing a bee garden helps you create a stunningly colourful, vibrant, healthy habitat that attracts both honeybees and native bees. In *The Bee-Friendly Garden*, award-winning garden designer Kate Frey and bee expert Gretchen LeBuhn provide everything you need to know to create a dazzling garden that helps both the threatened honeybee and our own native bees. No matter how small or large your space, and regardless of whether you live in the city, suburbs, or country, just a few simple changes to your garden can fight the effects of colony collapse disorder and the worldwide decline in bee population that threatens our global food chain. There are many personal benefits of having a bee garden as well!

Publisher: Murdoch Books
RRP: \$39.99



1,000 Butterflies by Adrian Hopkins

This wonderfully illustrated book is essentially a photographic guide to the butterflies of the world. It covers 1,000 species from every corner of the globe, encompassing all key families and species, including the likes of monarchs, birdwings, swordtails, morphos, glasswings, and so on. Species are arranged by family with six to eight to a spread (and some flagship species receive a full page), and each stunning image, taken of wild butterflies in their natural surroundings, is accompanied by useful text on ID, interesting features and geographical distribution. *1,000 Butterflies* is the best book of its kind on the market anywhere in the world. It is an essential reference for butterfly enthusiasts everywhere, from amateurs right through to academics.

Publisher: New Holland
RRP: \$40



Are We Smart Enough to Know How Smart Animals Are? by Frans de Waal

From world-renowned biologist and primatologist Frans de Waal, a groundbreaking work on animal intelligence destined to become a classic. What separates your mind from an animal's? Maybe you think it's your ability to design tools, your sense of self, or your grasp of past and future – all traits that have helped us define ourselves as the planet's pre-eminent species. But in recent decades, these claims have eroded, or even been disproved outright, by a revolution in the study of animal cognition. De Waal's landmark work will convince you to rethink everything you thought you knew about animal – and human – intelligence.

RRP: \$34.99
Publisher: Allen & Unwin

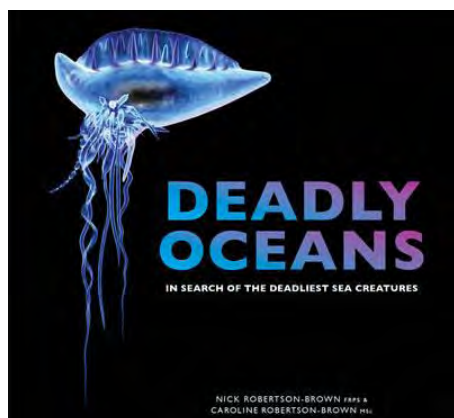


MALCOLM SMITH

Gone Wild by Malcolm Smith

Often amusing, sometimes romantic or fraught with danger, the 30 short stories in *Gone Wild* are about local people, spectacular places and the special wildlife the author sets out to find. The stories include seeking out Arabian oryx on the searing plains of the Saudi desert; eiderdown collecting in Iceland, crouching in swirling clouds and darkness on a knife-edge ridge in the rugged Madeiran mountains and swimming with grey seals off the Pembroke coast. The author describes incredible encounters with spectacular animals from lumbering manatees and dangerous rhinos to unforgettable experiences such as being led by a honeyguide with a Kenyan Dorobo tribesman to the nest of wild bees and watching cranes tip-toeing their courtship dances. These are just a few of the remarkable experiences recounted by Malcolm in a lifetime searching out some of the most interesting, and some of the rarest, animals on Earth.

Publisher: Whittles Publishing



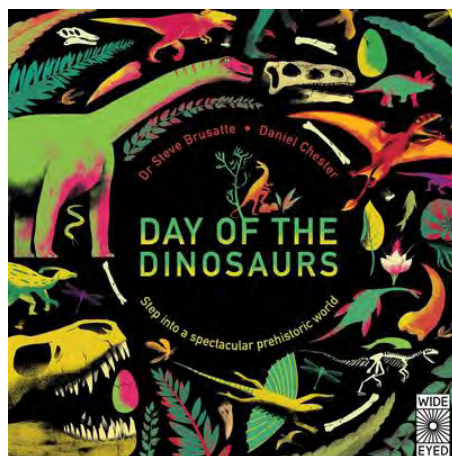
Deadly Oceans by Nick Robertson-Brown & Caroline Robertson-Brown

The world's oceans are filled with an array of venomous and toxic marine life, not to mention a whole host of apex carnivores. Join divers and photographers Nick and Caroline Robertson-Brown as they tour the world in search of the 50 deadliest sea creatures.

Animals covered come from all around the globe and include jellyfish, sea snakes, blue-ringed octopuses, lionfish, pufferfish, stingrays, cone shells, leopard seals, orcas, crocodiles and, of course, a whole range of sharks. And there's an intriguing twist in deciding just which one is the most deadly. This is a stunning, but slightly scary book with amazing photography.

RRP: \$65

Publisher: New Holland Publishers Australia

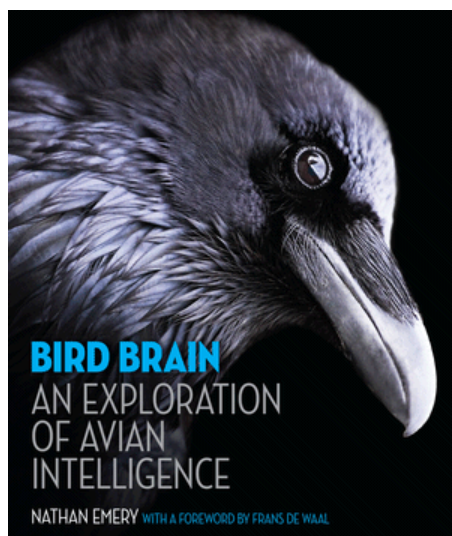


Day of the Dinosaurs by Dr Steve Brusatte & Daniel Chester

This is a great book for any child that is a budding palaeontologist. They can learn everything they ever wanted to know about dinosaurs in this book that allows them to compare the biggest, fastest and fiercest creatures of the land, sea and sky from four different prehistoric periods: the Triassic, the early Jurassic, the late Jurassic and the Cretaceous. Sections on diet, weapons and defence, and dinosaur senses make this a comprehensive introduction to one of the earth's most successful animals. Fact-filled, fully illustrated and in an exciting large format, this is a thrilling read.

Publisher: Allen & Unwin

RRP: \$35



Bird Brain by Dr. Nathan Emery

Bird Brain by Dr. Nathan Emery is a beautifully illustrated and interesting book with an informative presentation on the

latest research into avian intelligence. It presents an absorbing study of how birds think, revealing how science is exploding the myth of our feathered friends being 'bird brained', and how recent discoveries may call for us to re-evaluate how we identify and classify intelligence in other animals.

Publisher: Princeton University Press

RRP: \$29.95



Amazing Animals of Australia's National Parks by Gina M. Newton

With its enticing and colourful design and its fascinating information, this is a book that children will want to pore over – either at home, in the classroom or on a road trip. This book brings together 55 national parks, selected across all Australian states and territories, and over 120 animals. It is divided into seven sections according to habitat (woodlands and grasslands; forests; rainforests; arid zones; mountains; wetlands and waterways; coasts, oceans and islands), each including a number of national parks and a selection of the fish, reptiles, frogs, birds and mammals that inhabit them. At the end of the book is a section on 'little critters' – beetles, spiders, butterflies, grasshoppers, bugs and so on. Each habitat section opens with photographs of the featured national parks and a description of the habitat. Each animal has its own page, which has a stunning colour photograph of the species, a map of its distribution range, its conservation status and scientific information about the species. The information is divided into the following sections: 'Fast Facts' gives you all the vital statistics, such as size, lifespan and number of young; 'Where Does It Live?' tells you where in Australia you can find the species and provides details about its home; 'What's Its Life Like?' tells you a bit about how the animal moves, behaves, eats and has young; and 'Interesting Info' has quirky and fascinating facts.

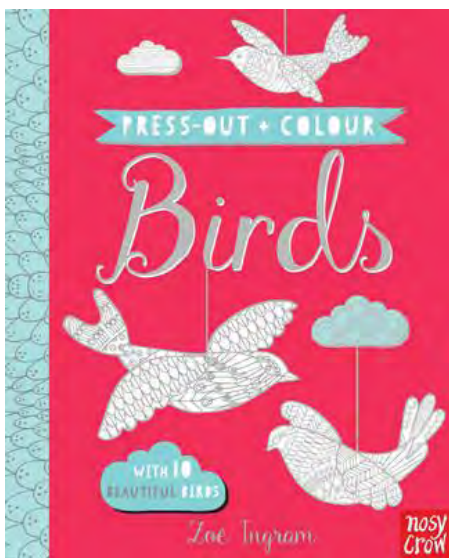
Publisher: NLA Publishing

RRP: \$29.99



A Little Wombat Called Maggie by Indi Dennis, Illustrated by Fiona Saxton

A Little Wombat Called Maggie is a fictional children's story about a little orphaned bare-nosed wombat joey called Maggie. The story of Maggie is heart-warming and has come from personal experience. It's a brilliant concept and the artwork with the factual information regarding wombats is very clever and will assist people/kids in understanding the wombat way of life. The book has the do's and don'ts of proper wombat care woven throughout the story. Reviewed and approved by Jackie French, renowned author of *Diary of a Wombat*, Maggie's story with its gorgeous colour illustrations will burrow its way into your life and leave a smile on your face! To purchase *Maggie* please email Linda at linda@fourthcrossingwildlife.com

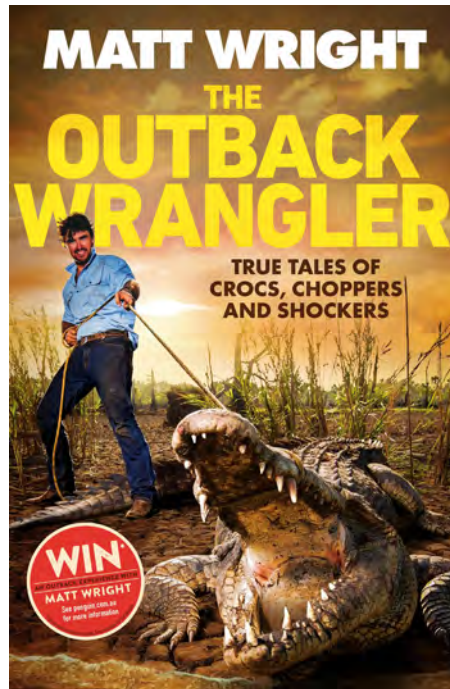


Press-out + Colour Birds by Zoe Ingram

This book introduces an incredible new activity series – press out and colour. The first book in the series is Press Out and

Colour: Birds. These gorgeous birds are perfect to hang around the home and add sparkle to any setting. Make your own beautiful 3D decorations with these board books of press-out ornaments – each press-out design is intricately decorated with foil and perfect for all ages to colour in. Featuring 10 unique, the press-out pieces can be slotted together to create bright and cheerful hanging ornaments.

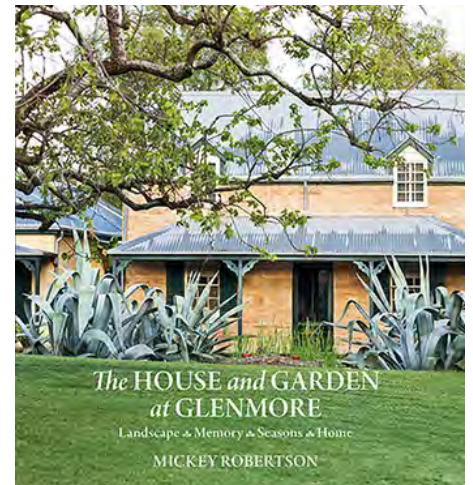
RRP: \$19.99
 Publisher: Allen & Unwin



The Outback Wrangler by Matt Wright

The Outback Wrangler takes you on a wild ride through the rugged Top End – where that special outback flavour of danger, adrenaline and adventure come together in the personal stories of a unique Australian. National Geographic conservationist and chopper pilot Matt Wright was born for a life of action and adventure. Raised in the wilds of Papua New Guinea and outback Australia, as a child he would catch deadly snakes for fun or lizards and turtles for show and tell at school. From his early life working in the outback to a short stint in the army, Matt's life reads like a boy's own adventure story but he was always one to go his own way – sometimes making the rules up as he went along. Today he is the star of his own international TV show on National Geographic, a renowned outback adventurer and a wrangler of deadly animals. Giant saltwater crocodiles are a big part of Matt's story but jumping in his chopper and rounding up wild buffalo, brumbies and Brahman cattle keep him pretty busy too!

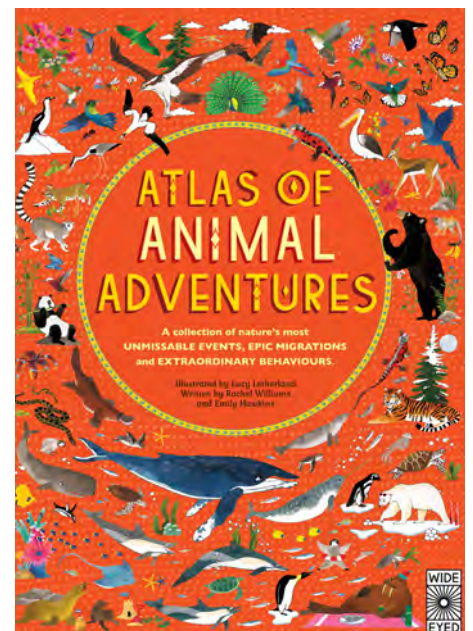
Publisher: Penguin Random House
 RRP: \$35



The House and Garden at Glenmore by Mickey Robertson

This gorgeous 'coffee table' book is the story of the author's home and world-class garden and her relationship with nature and the seasons, also including recipes featuring produce from the working kitchen garden. Twenty-five years ago, Mickey Robertson and her husband Larry made an impulsive decision to purchase a collection of historic but dilapidated Georgian farm buildings in country New South Wales. Thus began an unplanned, intensely emotional journey of restoration and renewal, traced in this richly illustrated book through a warmly engaging narrative and inspirational images by photographer Daniel Shipp.

RRP: \$59.99 | Publisher: Murdoch Books

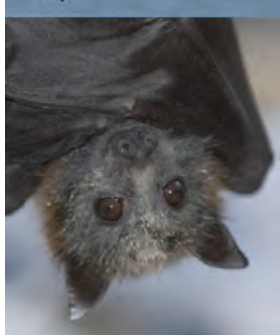


Atlas of Animal Adventures by Rachel Williams & Emily Hawkins, Illustrated by Lucy Letherland

This adventure book collects together the most unmissable events, epic migrations and extraordinary behaviours of the animal kingdom from around the world. It is a fascinating and beautifully illustrated book, and children can find hundreds of things to spot and at the same time learn new facts about every animal.

Publisher: Allen & Unwin | RRP: \$35

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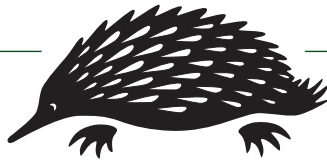
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