AUSTRALIAN Wildlife

SPRING Vol: 4/2013
$10 (non-members)

AUSTRALIAN FLORAL EMBLEMS

Celebrating a new century of wildlife preservation in Australia

Journal of the Wildlife Preservation Society of Australia Limited

(Founded 1909)

WILDLIFE STUDIES AT AUSTRALIAN MUSEUM, SYDNEY

Following an invitation from the Director of the Australian Museum, our Society set up a wildlife Society display on the Search and Discovery floor of the Museum over the school holidays to encourage more young people to understand and appreciate the conservation of our native wildlife in all its forms.

Directors Clive Williams and Ken Mason assisted CEO Patrick Medway with the Society's display and handed out magazines, answered questions and supervised an ongoing student's drawing program over the holiday period. Most popular was the drawing and colouring-in wildlife programs for the younger visitors to the Museum.

Each day hundreds of young people came into the Museum to look at the major **Wildlife Photographer of the Year** display on the ground floor and many came up to look at the Search and Discovery displays on Level 2 where a wildlife awareness display program had been arranged for the school holidays.

We handed out hundreds of magazines and brochures on the Society and its wildlife conservation work and many children won a prize of a Society mug for their outstanding drawings of wombats, butterflies and koalas. We were delighted with the interest in our display and thank all our supporters for their help.

We appreciated the invitation and the active support from Yvette Simpson, acting volunteer coordinator, for her great support and assistance with the program.

Any member who would like to participate with the Society in staging wildlife information days, please contact the office via email at info@wpsa.org.au

Contents

features

regulars

Front and back cover:

Australia's floral emblems

Spring brings a profusion of flowers to our environment. Each of Australia's states and territories has their own floral emblem as distinct as the state they represent.

In the background of the coat of arms of Australia is a wreath of golden wattle (*Acacia pynantha*), the official national floral emblem of Australia, though the representation of the species is not botanically accurate.

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.

Print Post Approval No: PP243459/00117

ISSN 0155-266X

Price $10 (for non-members)

Membership

Individual Members: $55

Family Members: $70
(being husband, wife and children jointly)

Concession: $50
(pensioner, student, child)

E-mag Members: $30
(Australian Wildlife magazine will be distributed via email as a pdf document - no hard copy of the magazine will be sent)

Associate Members: $85
(being schools or incorporated or unincorporated associations with a principal object related to conservation, nature study or education)

Corporate Members: $125
(being incorprated or unincorporated associations not being associate members)

Includes postage within Australia.
Add $40 for overseas postage

Three Year Membership

Individual Members: $150
Family Members: $190
Concession: $135
E-mag Members: $81
Associate Members: $230
Corporate Members: $340

Includes postage within Australia.
Add $100 for overseas postage

President

Suzanne Medway AM

Tel: (02) 9556 1537

Fax: (02) 9599 0000

Contact

National Office
Australian Wildlife Society
(Wildlife Preservation Society of Australia Limited)

PO Box 42
BRIGHTON LE SANDS NSW 2216

Tel: (02) 9556 1537

Fax: (02) 9599 0000

Email: info@wpsa.org.au

Website: aws.org.au

Correspondence to:

Hon Secretary:
Australian Wildlife Society

PO Box 42

BRIGHTON LE SANDS NSW 2216

Directors 2013

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.

From the President's desk

Suzanne Medway AM - President

Politics is always interesting. One thing is a given: no matter who is elected, someone will be happy and someone will be disappointed. It remains to be seen whether the new environment minister will be good for the conservation movement or a disappointment.

Interestingly, there is a lot of "politics" in the environment and conservation movements. There seems to be resentment and competition between different organisations, not to mention infighting within organisations.

An example of this infighting happened many years ago within the Wildlife Preservation Society of Australia and the repercussions on this infighting can still be felt today.

Let me go back to the 1920s.

Two people dominated the activities of the Society for its first sixty years – David Stead and his third wife, Thistle Harris. David Stead was President of the Society in 1919 and served in this capacity until 1922. He was again President from 1924 to 1930. When David Stead died in 1957 it was the end of an era. The Society had been his dream and his achievement. His unflinching idealism built this Society into a factor of real significance in the community.

Thistle Harris Stead was President of the Society from 1949 to 1953. In 1966 Vincent Serventy became President of the Society and Thistle was Vice-President.

In 1958, after David Stead's death, the Society established the David George Stead Memorial Fund. Circumstance decreed that the property now known as Wirrimbirra would be acquired in 1962 and, with Stead family agreement, this became David Stead's memorial; finances from the David George Stead Memorial Fund were diverted to this project. However, it is also a memorial to Thistle Stead, who worked tirelessly in her later life to make the Sanctuary a worthy contribution to research and education on behalf of the Australian environment.

Thistle held concerns from the outset about the future security of this memorial to David Stead and in December 1965 the property was signed over to the National Trust of Australia (NSW) who agreed to accept Wirrimbirra Sanctuary, without payment, as one of its properties.

In 1975 Thistle again became President of the Society while Vincent Serventy was overseas. Vincent returned to Australian in January 1976 to be alerted that Thistle intended to wind up the Society and merge it into the Stead Foundation. The move was not successful.

Financial matters were a concern for Thistle, and in the early 1970s she sold the block of land adjoining her house at Watson's Bay that had been left to her by David Stead and made donations over time to Wirrimbirra. Upon her death, her estate was also directed to Wirrimbirra.

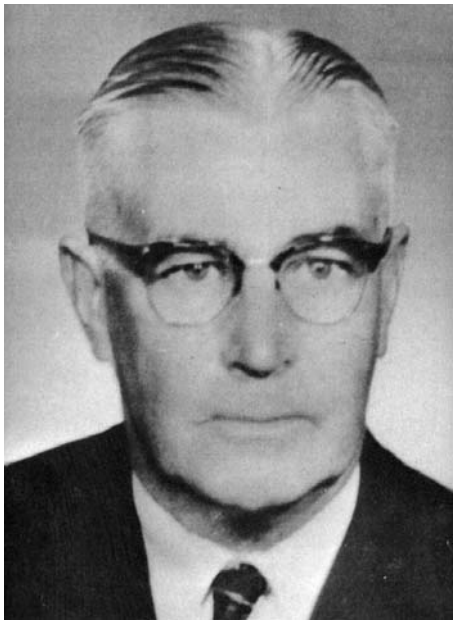
In 2012 the National Trust of Australia (NSW) decided to divest itself of the Wirrimbirra Sanctuary and because of our Society's historical connection agreed to sell it to us for $1.3 million.

Thistle Stead

And now for the infighting. Factions within the David Stead Foundation are vehemently opposed to our Society acquiring the property, but the majority of the members are firmly in favour of our Society buying the property.

Personally, I am of the opinion that if the National Trust of Australia is no longer interested in Wirrimbirra, they should hand it back at no cost to the Stead Foundation. BUT this is commercially impractical and we have been emphatically told that there is no way the property will be handed over at no cost.

Surely, it is a better alternative then that our Society purchase the property which has stagnated since the 1960s and once again establish Wirrimbirra as it was originally intended - a place of worthy contribution to research and education on behalf of the Australian environment.



David Stead

Celebrating 50 years

The David G Stead Memorial Wild Life Research Foundation of Australia, commemorated the 50th anniversary of its formation in 1963 at the Wirrimbirra Sanctuary, situated at Bargo in New South Wales, with a delightful luncheon on Saturday 21 September 2013.

The luncheon celebrated the achievements of the Stead Foundation, as the managers of Wirrimbirra Sanctuary, who have kept the Sanctuary open to the public for fifty years – all by wonderful volunteers.

The guest speaker was David Shoebridge MLC, who has been a Green Member of the NSW Upper House since 2010. He was a former green councillor on the Woollahra Council and a barrister working in industrial relations law. David is a strong campaigner for the protection of the environment. He recently supported a motion in the NSW Parliament noting the 50 years of service by the volunteers of Wirrimbirra Sanctuary.

A number of Directors of the Board of our Society attended the 50th Anniversary luncheon and congratulated the Stead Foundation President, Margaret Kitson, on this special occasion. Dr David Murray, Vice President and a former President of the Stead Foundation, former director Dr Mike Augee, Director Ken Mason and Director Peter Hardiman accompanied the Chief Executive Officer, Patrick W Medway AM.

Society Director Ken Mason presented a copy of our magazine to David Shoebridge MLC who was the guest speaker at the 50 Anniversary luncheon

We congratulate the Stead Foundation on celebrating 50 years of dedicated service to the Wirrimbirra Sanctuary through its wonderful team of volunteers.

L to R: Ken Mason, Stead Foundation Secretary Kerry Timms (seated), Peter Hardiman, Patrick Medway and David Murray

Fundraising appeal to purchase the historic Wirrimbirra Sanctuary at Bargo

A unique opportunity has arisen for the Society to purchase the Wirrimbirra Sanctuary from the National Trust of Australia (NSW). The Board of Directors has now agreed to launch a national appeal to raise the funds necessary to both purchase this property and to assist in updating and modernising the educational facilities at Bargo for a national headquarters for the Society.

Visitor's centre at Wirrimbirra

Wirrimbirra was set up as a memorial to one of our founding fathers, David George Stead (1889-1957), by his wife Thistle Harris Stead (1902-1990) in 1962 while she was serving as secretary of our Society. Thistle Stead, herself a lifelong member of the Society, and former president of the Society, was a very committed environmentalist and a great botanist and educator. Thistle formed the **David G Stead Memorial Wild Life Research Foundation of Australia** in 1963 and devoted the rest of her life to environmental education and wildlife research. Many prominent conservationists and environmentalists served on the board of the Foundation including Dr Vincent Serventy AM and Dr David Murray. Milo Dunphy designed the two cottages and the education centre that are still part of the Sanctuary today.

In 1965 the Wirrimbirra Sanctuary became the property of the National Trust of Australia (NSW) and was leased back to the newly formed David G Stead memorial Wild Life Research Foundation of Australia and was managed by a keen group of volunteers.

On learning that the National Trust was unable to properly resource the Sanctuary, the Australian Wildlife Society made an offer to the National Trust of Australia to purchase the property and to upgrade its facilities into a modern environmental education and wildlife research centre committed to wildlife conservation of native flora and fauna.

In order to acquire the property and to upgrade the facilities to put the Sanctuary on a sustainable commercial operational footing, we now appeal to all our members and friends to help us raise the funds necessary to complete this transaction.

We are very mindful that both David Stead and Thistle Harris Stead were prominent members of the Society from its very beginning in May 1909. So much wonderful work has been done over the past 104 years for wildlife conservation by the dedicated and committed volunteers from both Societies and now is the time to move forward.

The Australian Wildlife Society has never had a permanent home or national office from which to operate. Now is the time to provide a sound sustainable base from which to operate. By acquiring this historic property as a permanent memorial to both Thistle Harris and her late husband David George Stead we will have the opportunity to establish a permanent office. What a fitting home for the ongoing and future wildlife conservation work for the Society!

Please give generously to this special appeal, which is fully tax deductible and you will also receive a special Commemorative Certificate. All donations will be fully and wholly committed to the acquisition of the Wirrimbirra Sanctuary property and its modernisation. Help make a real difference for environmental education and the conservation of our native fauna and flora.

Send your tax deductible donations to:

Australian Wildlife Society
P O Box 42
BRIGHTON LE SANDS NSW 2216

Australia's floral emblems

Spring brings a profusion of flowers to our environment. Each of Australia's states and territories has their own floral emblem as distinct as the state they represent.

In the background of the coat of arms of Australia is a wreath of golden wattle (*Acacia pynantha)*, the official national floral emblem of Australia, though the representation of the species is not botanically accurate.

NATIONAL golden wattle (*Acacia pynantha)*

NSW waratah (*Telopea speciosissima*)

SA Sturt's desert pea (*Swainsona formosa*)

ACT royal bluebell (*Wahlenbergia gloriosa*)

QLD Cooktown orchid (*Dendrobium phalaenopsis*)

NT Sturt's desert rose (*Gossyplum sturtianum*)
(Image courtesy of Olive Pink Botanic Garden, Alice Springs, NT)

VIC common heath (*Epacris impressa*)

WA red & green kangaroo paw (*Anigozanthos manglesii*)

TAS Tasmanian blue gum (*Eucalyptus globulus*)

Fabulous Amphibia

The motorbike frog (*Litoria moorei*)

Chrissy Banks

Wrapped in the myths of time dwells the humble frog. From personifying thunder, to being deliverers of rain, to bringing exceptionally good or bad luck if sighted, to replacing the chap on the moon and being dumped with the utterly ridiculous blame for warts! The tales are varied and ancient. Yet even today, a frog hopping across the path will get our undivided attention. So what is it about these funny looking creatures that fascinate us so? Perhaps the answers to that are in fact and not fiction.

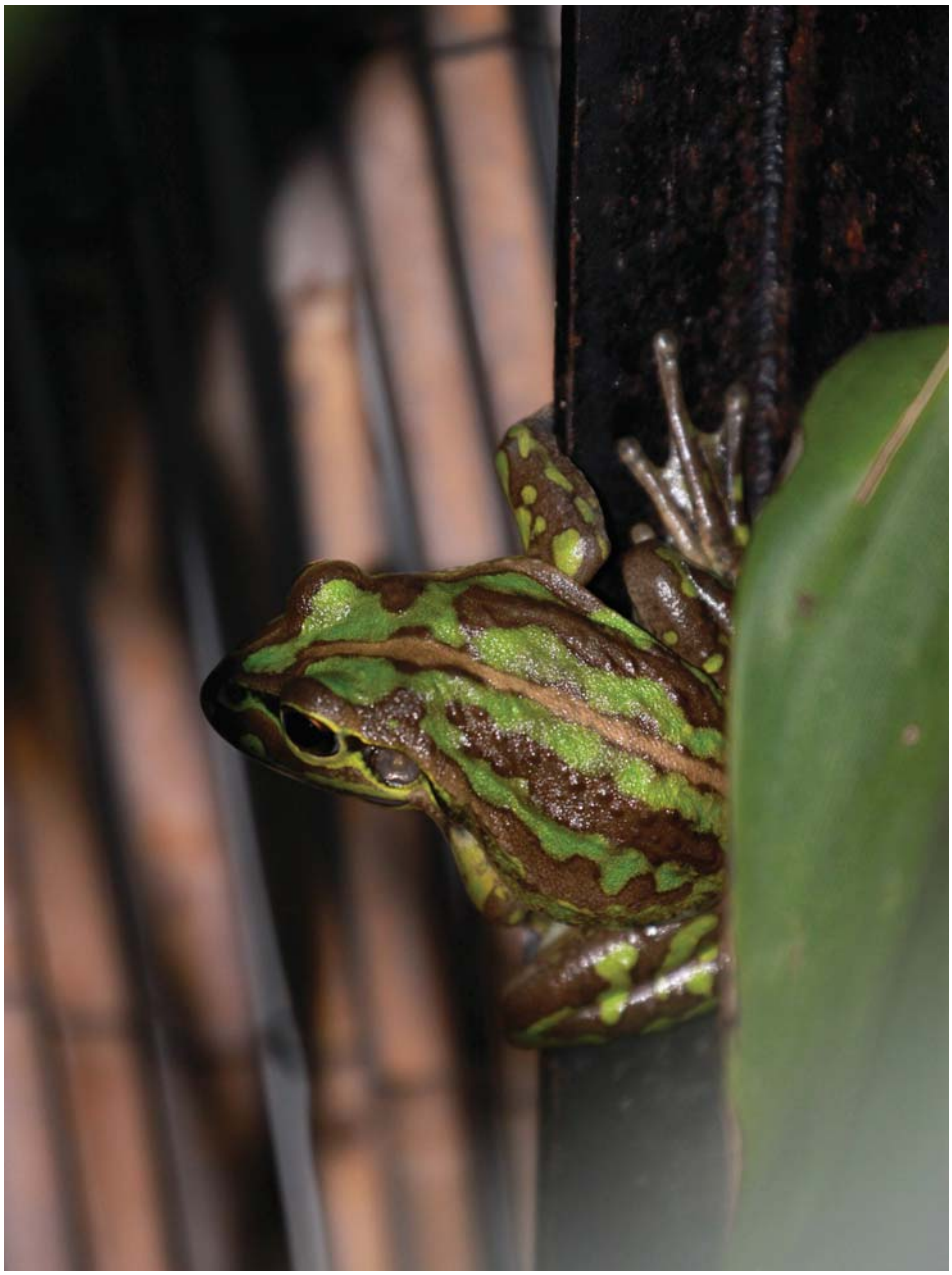
There are an estimated 4,740 identified species of frog worldwide, but I want to introduce you to just one. It inhabits territory from north of Geraldton in Western Australia to the southern regions of Albany, out east to the western wheatbelt and throughout the Swan coastal plain and is a frog of many names. It's known as Moore's frog, the western green and golden bell frog, western bell frog, and the western tree frog – but for most West Aussies, this gorgeous, smiling amphibian is simply known as the motorbike frog.

Now you might be forgiven at this point for imagining little green amphibians decked out in black leather, hooning about on miniature Harley Davidson's. Amusing as that image might be (go on, have a chuckle), it's definitely *not* why these delightful amphibians have their name.

It's all to do with gaining the chance to breed. The mating call of the male sounds much like a small motorbike revving through its gears, increasing in pitch with each revolution – *baarrr, baarrr, baarrr* – punctuated at the end by a very distinctive *bobobop!* Males call loud and long in a bid to 'out-sing' rivals and attract receptive female company. Incidentally, it can be highly entertaining to get involved in the competition. Imitate the call when you hear it and invariably you'll be challenged. My children were in stitches last summer when I competed against a male MF in our garden. I graciously bowed out when his calls became so intense he was in danger of exploding. *No worries mate, this is your patch. Don't hurt yourself!* It's hard to imagine that this determined chap (along with his siblings) started out looking a little like extra-lumpy caviar.

Motorbike frogs begin life in an egg, clumped together with approximately 49 others, glued up in translucent 'jelly'. Within a day or two, tadpoles emerge feeding largely on pond debris. The body is a uniform dark brown with a silver sheen. Tail fins taper to a distinct point and are deeply flecked. While initially minute, and very shy as being a tadpole makes you a delicacy for just about anything else above or below the surface of the water, the tadpoles will grow as large as eight centimetres. Toward late summer they begin the metamorphosis process, beginning

Above: This peaceful-looking male will make quite a ruckus come spring to earn the right to mate. For now, at the end of the season, he's content to chill out by the pond. Motorbike frogs can alter their colour slightly to blend in better with their daytime environment. Like all frogs, they shed as they grow and generally eat the discarded skin.



Motorbike frogs are excellent swimmers due to partially webbed back feet

Female motorbike frog just emerged from hibernation. Motorbike frogs hibernate under soil or leaf litter during cooler months and emerge as spring grows warmer.

with the development of back legs, then front, the gills disappear and lungs develop, the digestive system changes to accommodate a carnivorous diet, the body rounds out and the tale shrivels away to nothing. It is an utterly fascinating and miraculous process.

Averaging eight centimetres, but growing as large as 14 centimetres in length from snout to vent, adults are a meaty and powerful package. They are a hardy species that can tolerate a considerable time away from water. Skin tone varies from brown to green with golden mottling down the back. Undersides range from pale green to light brown with a green tinge at inner thigh and groin. Hind legs are long and strong with partially webbed feet, while front feet have long, slender digits. Each digit, front and back, end in a toe pad that enables climbing on smooth surfaces, as well as plants or walls. During mating season, a male will grow nuptial pads on the outside of the toe discs, enabling him to cling to a female's back during pseudocopulation, which means the female lays eggs outside of her body and the male fertilises them with his sperm. This process is called amphlexis. Breeding takes place in early summer with the frogs partially submerged in water. The female (typically larger than the male) lays her eggs on floating plants or debris – and so the lifecycle continues.

Natural predators include snakes, lizards, water birds including ibis, the laughing kookaburra and crows; even ants have a go at the froglets. The frogs' diet consists of arthropods and smaller frogs. They've also been known to gobble down juveniles of the same species (not brilliant parents then).

Incidentally, the tongue of the MF is a fascinating bit of equipment. It is thick and fleshy and sits at the front of the mouth ready to snap out and back again in a fraction of a second. Due to the location of the tongue, however, it doesn't assist in the swallowing of food, instead the frog must gulp its dinner down, working its throat for as long as it takes to swallow. Surprisingly, it's the eyes not the tongue that assists in eating. Frogs blink heavily when swallowing, retracting their eyes into the skull to apply pressure to the food, thus 'pushing' it down the hatch.

Though classed as a tree frog, this lot rarely climb higher than a low shrub or plant, and spend most of the day sun baking on a broad leaf of choice. As the day melts into night they come down to hunt on the ground. They are still capable of catching dinner while in a tree as my daughter and I found out by witnessing a stand-off between a cricket and a MF in our bird of paradise bush. The frog eventually leapt so fast I missed the shot entirely. "Did you see that happen?" I asked Ebony. "Nup," came the dry reply. The speed of the kill was incredible. I didn't even blink and I still missed it! It showed me that while MFs are predominantly nocturnal hunters, they're also opportunistic. If a cricket is daft enough to land on their sun baking leaf and in their field of vision, it's going to get munched.

I love that this sort of 'day in the life of frogs' goes on in our yard. Motorbike frogs seem less shy than other species and seem content to make suburban gardens their home. This is a brilliant bit of adaption on their part and since we're largely responsible for the loss of their habitat, due to pollution and urbanization, there's a way we can make it up to them. Here's how.

Frog bogging!

I know, it sounds like a mad new sport, right? In fact, it's simply creating a habitat in which frogs can live and breed in relative safety. The process is simple and doesn't have to be expensive (we use the old baby bath). Google 'How to create a frog bog' and a number of websites will pop up to take you through the steps. A useful tip is to ensure aquatic and amphibian-friendly plants are included. They oxygenate the water and provide basking places and protective coverage. *Syngonium* (wanda), *Echinodorus cordifolius* (creeping burrhead) and *Hydrocotyle* spp. (pennywort) are three plants suitable for frog bogging. However, be aware of the dangers of over-oxygenating the water, as tadpoles feed off pond algae and highly aerated water won't produce enough pond scum for the tadpoles' diet.

It's worth noting that creating a frog bog won't *ensure* a frog's safety, but eliminating obvious threats helps. Domestic pets are an obvious threat, cats in particular, because while Bobo the dog sleeps at night, cats, like frogs, are most active from dusk until dawn.

A stand-off between a motorbike frog and a cricket right before the frog made a successful meal of it

Motorbike frogs vary greatly in colouring and this one shows a distinct silvery sheen in its mottled pattern

Creating a frog bog doesn't have to be expensive. It can be as simple as using an old baby bath, with a dash of aquatic soil, a splash of water and some frog friendly water plants. Three suitable plant choices are Wanda, creeping burrhead and pennywort.

Female motorbike frog – in for a little sunbaking. It is an essential part of their growth to sunbake for a number of hours a day. Females don't make a peep leaving all the hooning to the males.

A few summers ago I found a dead froglet in my garden with a neat claw hole through its middle – and I don't even own a cat! The solution? Keep kitty in at night. *All* nocturnal native wildlife will thank you. But pusskins isn't the only threat. We have to own our fair share of the guilt. It's human nature to want to touch anything that takes our fancy. Sometimes this is okay, but unless you've been taught how to do so correctly, handling a frog can cause it serious damage. Frogs have tiny bones easily broken by mishandling, and their skin is part of their respiration, so anything on our hands will pass into their skin (imagine sunscreen in your lungs). Best to 'look but not touch'. In the event that a frog has to be moved from a dangerous location, for example behind the wheel of your car, it is best to usher them clear. Startled frogs do tend to jump, so shunt from behind in the direction you want them to go. Even then, things don't always work to plan as my sister found out while shunting a tree frog off the hood of her car. It leapt onto her face – still, better a two centimetre tree frog on your face than a 14 centimetres motorbike frog.

If you find handling a frog is unavoidable, wash your hands thoroughly in water first. Our skin is naturally dry while a frog's skin is moist. Wetting hands will ensure we don't leave sore, dry spots on their skin and also helps remove any harmful residue off our hands (sunscreen, fragrances, creams) that will cause them burning and discomfort. Regardless of how hardy some species appear, these are still delicate creatures and if stressed out too much, even the chilled-out motorbike frog will move away from the relative safety of a garden pond.

The sad truth is, frogs worldwide are on the decline due to urbanisation, pollution of natural waterways and disease (Chytrid fungus). In Australia alone there are 214 known species of frog – 57 of which are in various stages of endangerment. Three are classed as extinct.

With so many species in trouble, why am I telling you about just one? So you know it exists and to get you thinking about which frogs live in your area. What if each of us were to know a significant amount about our local frogs – what they look like, sound like, habitats and dangers? Would it make a difference to their survival? I believe it would. Absolutely. Because the more we know, the more we tend to care. The more we care, the more inclined we are to protect what we care about. Knowledge is a powerful motivator.

And for what it's worth, the more I know about these guys, the more intriguing they become. They don't need mythology to make them special, they simply are. All you have to do is be around them to know it's true. It's hard to be grumpy in the company of frogs. For me, motorbike frogs are the champions of the frog world – they sound funny, make me smile and brighten my garden considerably.

But that's just me. What about you? Why not try frog-bogging and see what turns up? Go on then, it'll be riveting – I promise.

NB: Chytrid fungus is a disease thought to originate from extensive contact with tadpoles and/or contaminated water. The fungus attacks the skin which frogs use for respiration. Once the frog is infected it begins to lose its ability to move and eat. It becomes easy prey.

INSPIRED BY NATURE COMPETITION

The winner of a complete set of Steve Parish's *Inspired by Nature* collection is Michael Alesandro. Here is Alexandro's winning entry:

> "After spending in excess of three months in Taiji, Japan trying to understand and offer alternatives to the dolphin hunting I was invited into a discussion on the traditional hunting of turtles and dugongs in Brisbane. On picking up Bob Irwin (senior) from the airport for the conference he said to me "you know that our own wildlife need your help too" which led me to be a WIRES rescuer and carer focussing on possums. Today I have aviaries for the sick, the injured and the orphaned inside and out around my home. I owe this to Bob."

It was decided to award two books from the collection to Trudy Worme as a second prize. This is Trudy's winning entry:

> "After Ken Simpson, coauthor of the Simpson and Day bird identification books and my college lecturer, taught me how to make a simple sound to attract birds to me I was so excited as the first wrens, robins and honeyeaters flew in close to check me out, and my life long love of Australian birds, birdwatching and bird photography began at that moment."

Congratulations to Alexandra and Trudy.

Decision-making for conserving biodiversity
under climate change and land-cover change

Chrystal Mantyka-Pringle

Climate change and land-use change are global drivers of biodiversity loss. To date their impacts have largely been assessed separately, but they are likely to interact. These interactions could potentially have large impacts on biodiversity and important implications for habitat and landscape management. Only a few studies investigate the nature of these interactions, because these are much harder to study without careful experimental and analytical design. The overarching purpose of my PhD project was to understand and quantify the combined and interactive effects of climate change and land-use change on biodiversity so that effective strategies can be developed for biodiversity conservation under global change.

I demonstrated that a business-as-usual approach to biodiversity conservation under a changing climate (ie ignoring the combined or interactive effects) will fall short of meeting the challenge. The combined effects of a changing climate and land-use change may significantly magnify the biodiversity crisis both globally and locally. A transformation is therefore required in the way managers and decision-makers consider conservation planning and the threats presented by climate and land-use change.

I quantified the independent and combined effects of climate change and urban growth on freshwater macro-invertebrates and native fish. I discovered little change in richness averaged across catchments, but identified important impacts and effects at the finer scale. High nutrients and high runoff as a result of urbanisation interacted with high nutrients and high water temperature as a result of climate change, and was the leading driver of potential declines in macro-invertebrates and native fish at fine scales. By identifying these mechanisms behind predicted biodiversity loss, I was able to identify management strategies that can simultaneously tackle both climate change and land-use change. The good-news story that came out of this study was that I identified riparian vegetation restoration as an important adaptation tool that can mitigate the negative effects of climate change and land-use change on freshwater biodiversity.

With limited resources on hand for conservation, not all areas and actions identified as being important to biodiversity conservation will be implemented immediately. Conservation priorities should be selected based on an approach that integrates costs and benefits as well as multiple threats and future changes in threats to reflect a real-world decision-making process. In my PhD I presented a decision-making framework for optimally allocating conservation dollars

Above: Agricultural land representing 'land-use change'

to different management actions for the conservation of freshwater biodiversity under climate change, land-cover change and their combined effects. My results show that channel restoration (ie the protection, rehabilitation and/or restoration of riparian vegetation/zones) as a single management strategy can provide the greatest overall protection of macro-invertebrate and native fish richness in response to climate change and/or urban growth. I also reveal that farm/land management (ie management of pesticide and fertiliser inputs, burning practices and livestock grazing) and channel restoration together can provide the greatest conservation benefits per dollar spent.

My research is being published in international scientific journals and has been communicated to the Australian Government through reports and seminars. The findings of my research are now being considered in the next Regional Developmental Plan for Queensland.

Editor's note:

Chrystal was awarded Australian Wildlife Society of Australian University Grants in 2010 and 2012.

Chrystal is now employed as a Post-Doctoral Fellow with CSIRO Ecosystem Sciences. If you wish to contact her regarding her PhD work please email her at c.mantyka-pringle@csiro.au

Chrystal Mantyka-Pringle

Wallaby stranded during the Queensland floods (2011)

Restored riparian vegetation along river

Eradication of foxes in New South Wales

Peter Hardiman

The dog family (Canidae), which includes foxes, is quite large. All of its members belong to that group of animals known as carnivores or flesh eaters. The domestic dog (*Canis familiaris*) is the best known member of the family. There are more than 100 breeds of domestic dogs, ranging from the huge St Bernard to the tiny Mexican Chihuahua.

There are quite a number of wild relations, packs of which still roam throughout areas of the world. The North American coyote (*Canis latranis*) is related to the dog, as are dingoes, foxes, jackals and wolves.

Foxes are a very shy, cunning and resourceful animal and a scourge to our environment.

The European red fox was successfully introduced to Victoria by fox hunters in 1871 and declared a pest in that state by 1901. Foxes crossed the border into New South Wales around 1893 and were declared a pest soon after. They reached South Australia by 1901, Queensland by 1907, Western Australia by 1912 and most of southern Australia by the 1930s.

Mapping shows areas of medium to high densities of European red foxes over most of New South Wales. They are most abundant where there is plenty of food and cover, especially in fragmented agricultural lands west of the Great Dividing Range. Foxes have been spotted in many Sydney suburbs, but are diminishing. They are least prevalent in large continuous areas of forest in north-eastern New South Wales.

Around 44 percent of the 1.1 million hectares in New South Wales that are free of foxes are in national parks. This means that New South Wales national parks have relatively more area free from this pest animal than other land tenures.

Predation by the European red fox was declared a key threatening process to native species in 1998. Foxes have been identified as a primary threat to about 40 threatened native species, such as the rufous bettong, bandicoot, brush-tailed rock-wallaby, malleefowl, little tern and the Bellinger freshwater turtle.

Foxes also prey on livestock, with reports of up to 30 percent of newborn lambs being taken in some areas. Foxes, however, may help suppress other pest animals in some areas, such as rabbits.

Control of European red foxes in priority areas in New South Wales is driven by the Fox Threat Abatement Plan, launched in 2001 by the NSW National Parks and Wildlife Service (NPWS), now part of the Department of Environment and Conservation, to effectively control foxes in 65 national parks and reserves. The plan identifies 73 priority sites in New South Wales, where 34 threatened species, – 11 mammals, 15 birds and eight reptiles – are at risk of predation by foxes.

Outside the abatement plan, the NPWS works with neighbours and other agencies on collaborative programs to reduce fox attacks on lambs, such as 'outfox the fox' in Central West and the Southern New England Landcare project.

The most common form of fox control in Australia is through strategic ground-baiting, alongside trapping and shooting.

Successful fox control programs include:

Yellow-footed rock-wallabies, Western New South Wales

One of the most successful programs in the Fox Threat Abatement Plan protects the endangered yellow-footed rock-wallabies in Mutawinji National Park and Nature Reserve. An intensive fox-baiting program that started in 1995 saw the wallaby population increase by 600 percent in the first four years. Researchers reported that numbers almost doubled between 2003 and 2004.

Malleefowl, Western New South Wales

Aerial baiting has been conducted in Yathong, Nombinnie and Round Hill nature reserves near Cobar to protect the endangered malleefowl. Special dried meat baits have been developed and a navigation system based on Global Positioning System technology helps monitor where baits go. The program has improved survival rates of malleefowl translocated to these reserves and all three are now virtually fox-free.

Shorebirds along the New South Wales coast

In summer 2004-2005, mortality rates due to fox predation for the little terns, pied oystercatchers, beach stone-curlews and hooded plovers at 22 important feeding sites were 7.6 percent, 10.5 percent, 25 percent and 4.2 percent respectively. This compared with mortalities of 100 percent at some colonies without fox control. In fact, during this season, there were no losses due to foxes at 90 percent of little tern breeding sites targeted by the Fox Threat Abatement Plan.

Bandicoots, Sydney

NPWS combined with 12 local councils, Taronga Zoo, Forest NSW and Macquarie University on a regional fox control program in Sydney's north in a program designed to protect the southern brown bandicoot and endangered population of long-nosed bandicoots on North Head. NPWS is also working with Warringah Council on research into fox behaviour and ecology in an urban environment.

Dr Clive Williams and Ellen Curtis

AWS scholarship

awarded for arid plant research

University of Technology Sydney School of the Environment PhD candidate Ellen Curtis is the inaugural recipient of a generous scholarship established by the Australian Wildlife Society (AWS), the country's oldest, and one of the most respected, conservation organisations.

The new research scholarship promotes the conservation of Australian wildlife and is open to UTS postgraduate research students to support projects with outcomes that will help conserve Australian native fauna and flora.

Ellen graduated with a Bachelor of Science (Honours) in Environmental Biology with First Class Honours in 2010 having completed a Bachelor of Science in Environmental Biology in 2009.

Under the primary supervision of Dr Andy Leigh, Ellen is continuing her passion for arid plant research, focusing on plant thermal tolerance and recovery at extremely high temperatures for her thesis titled 'Response to and recovery from heat stress – thermal tolerance of Australian arid-land vegetation'.

Ellen hopes that her PhD research will give insight into Australian desert plant vulnerability to high temperature extremes.

'We can apply our knowledge of how species cope with current conditions, including their ability to recover and acclimate in response to various thermal regimes, to better predict species distribution patterns under future climate scenarios. Ultimately, this information will help target conservation efforts towards those species that are most at risk. Whilst this is the main research goal of my study, I also hope to encourage in others a greater appreciation of the ecology of Australia's arid interior,' she said.

Ellen's field work with Dr Leigh, in conjunction with Port Augusta City Council, at the Arid Lands Botanic Garden at Port Augusta, South Australia has led to a recent trip to the California Polytechnic State University, San Luis Obispo, USA, where she spent time in the Sonoron and Mojave deserts accompanying Associate Professor Charles Knight and his students on a research expedition. Ellen was invited to California to teach Associate Professor Knight and his colleagues a protocol she has been developing for measuring plant thermal tolerance and recovery.

The AWS scholarship of $5,000 gives Ellen not only a substantial financial boost but also a personal fillip to continue along a research path in arid plant biology and conservation.

'The generous financial support awarded by the WPSA will help me to purchase additional equipment, which is necessary to expand the scope of my study. While recognising the fundamental importance of my research, I also have a love and appreciation of arid Australia that makes me particularly passionate about ensuring its conservation for the future. Receiving the scholarship reinforces the importance of my research, not just to me, but others so I am especially grateful to the WPSA for their encouragement and support.'

Ellen received her award at the Faculty of Science Annual Prize Ceremony on Friday 5 July.

Her co-supervisors are Dr Brad Murray (UTS) and Associate Professor Charles Knight (CPSU, USA).

Dr Clive Williams, Ellen Curtis and Dr David Murray

Prof Bruce Milthrop, Dr Clive Williams, Ellen Curtis and Dr David Murray

How will Australian desert plants survive the heat?

Ellen Curtis

Extremely high temperature events, such as heat waves, are predicted to increase in both frequency and magnitude[1], particularly in central and south-eastern arid Australia[2]. Although adapted to a particular climate regime, plants develop heat tolerance through gradual pre-exposure. Predicted climate change, in particular a seasonal heat wave event, could therefore have severe consequences for the health of our native vegetation. Of particular concern are species of deserts, where many already live at the upper limits of their thermal tolerance.

The broad goal of my research is to determine how Australian desert plant species respond to extremely high temperatures – this is an area in which, particularly within Australia, little focus has been directed. It is expected that this study will assist in refining our knowledge of species that are potentially most at risk during critical heat wave events. Currently, we have no ability to predict which species are likely to decline nor, by inference, how landscapes will shift in the future, both for Australia and globally. In addressing the question of species thermal tolerance in arid and semi-arid Australia, it is hoped that the present research will help target regions in need of managing for future preservation of plant diversity.

I am conducting my field studies at the Australian Arid Lands Botanic Garden (AALBG) in Port Augusta, South Australia, where a UTS research facility has recently been established with the support of the Port Augusta City Council. Since spring 2012 I have visited the AALBG every few weeks to conduct experiments designed to capture the seasonal variation in

Above: The Australian Arid Lands Botanic Garden in Port Augusta, South Australia. Black bluebush (*Maireana pyramidata*) dominates the chenopod plain seen in the foreground with western myall (*Acacia papyrocarpa)* scattered behind.

Close-up of the fruiting bodies and succulent leaves of black bluebush

species thermal tolerance to help understand the potential for species to acclimatise. I am very grateful to the Wildlife Preservation Society of Australia for their generous financial support, which is funding a key component of my study.

REFERENCES

1.Carter TR, Jones RN, Lu X, Bhadwal S, Conde C, Mearns LO, O'Neill BC, Roundsevel MDA, Zurek MB 2007. New Assessment Methods and the Characterisation of Future Conditions. In: M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, U.K.: Cambridge University Press, 133-171.

2.Hennessy K, Fitzharris B, Bates BC, Harvey N, Howden SM, Hughes L, Salinger J, Warrick R 2007. Australia and New Zealand. In: M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, U.K.: Cambridge University Press, 507-540.

Heat stress setup

Ellen cold when heat stressing leaves

2013 University Student Grants Scheme

The Australian Wildlife Society University Research Grants are scholarships offered to honours or postgraduate students at Australian universities. Each year, ten $1,000 grants are awarded.

These 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 the students are presenting their work.

The winners for 2013 are:

James Sadler, University of Queensland
Project: Establishing new, 'non-traditional', coral paleothermometers to reconstruct environmental conditions experienced in the southern Great Barrier Reef over the last 8,000 years.

Jessica Hacking, Flinders University
Project: Disease resistance and sexual selection in the tawny dragon: Utilising disease-resistance-genes in conservation biology and evolutionary theory.

Christopher Watson, University of Technology, Sydney
Project: Detecting ecosystem change in temperate Australian grasslands: remote sensing tools.

Giverny Rodgers, James Cook University
Project: Climate change in a stable thermal environment: effects on the performance and life history of a coral reef fish.

Kylie Soanes, University of Melbourne
Project: Evaluating the effectiveness of road mitigation measures for wildlife: how much monitoring is enough?

Madelon Willemsen, University of Technology, Sydney
Project: Can project management improve mammal conservation success in Australia?

Lachlan Fetterplace, University of Wollongong
Project: The vast unknown: assessing the conservation of soft sediment fish diversity.

Georgia Ward-Fear, Sydney University
Project: Mitigating the impact of an invasive species (cane toads) by decreasing naivety of a top order predator (goannas).

Stephen Griffiths, La Trobe University
Project: Investigating factors influencing occupancy of artificial nest boxes by tree-roosting bats.

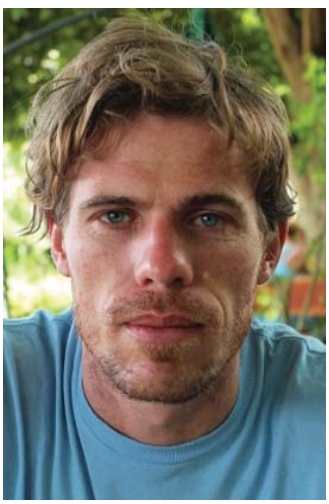
Hugh Davies, University of Melbourne
Project: Fire, cats and the Kimberley's declining mammals.

Stephen Griffiths and Hugh Davies' articles will appear in the Summer 2014 issue of Australian Wildlife










Establishing new, 'non-traditional' coral palaeothermometers to reconstruct environmental conditions experienced in the southern Great Barrier Reef over the last 8,000 years

James Sadler,
University of Queensland


Photo: Kevin Lew

One of the most commonly discussed environmental issues is the Earth's changing climate; or more specifically the impact of human activity on the natural climate system and the capacity of ecosystems to adapt to predicted changes. Of particular importance to both Australia and the international community is how the Great Barrier Reef (GBR) will react to changes in environmental conditions. Can the reef system cope with the scale of predicted change? Will 'reef migration' further south provide protection from predicted increases in sea surface temperatures? And finally, if the reef does stop growing, can it recover or will one of the seven wonders of the natural world be lost forever? Answers to these questions may be provided by looking back into the history of the reef. The current GBR has been around for 8,000 years, over which it is believed to have


Heron Island. Photo: Gregory Webb

experienced significant changes in climate from the termination of the last Ice Age to the current climate regime of increasing temperatures and declining pH likely induced by human activities. Quantifying these past conditions will help to constrain reef tolerance thresholds as well as improving the data available for modelling future climate and understanding exactly what influence we humans have had on the natural climate system.

Unfortunately, our knowledge of natural variations in climate is severely limited by a lack of instrumental records of temperature and precipitation prior to the latter half of the 20th century. Records of the marine environment are few and far between, with even less data representing the tropics and southern hemisphere. If we are to gain a full appreciation of natural climate variability we require an alternative means of acquiring chronological records of environmental conditions. This is where proxy records come in. Proxies are variables that we can measure to gain an indirect indication of an environmental condition, and are commonly measured in ice cores, tree rings, sediment cores and coral skeletons. Due to the lack of marine records representing the tropics and southern hemisphere, coral skeletons, such as those from the GBR, provide a particularly useful record of environmental proxies.

The chemistry of calcium carbonate skeletons precipitated by corals records several environmental proxies, including the ratio of stable oxygen isotopes (variations in the proportion of oxygen atoms of different atomic weights) and the ratio of strontium and magnesium ions against calcium in the lattice framework. These trace element ratios are related to the temperature of ambient seawater surrounding the coral, whereas the oxygen isotopes are controlled by both ambient temperature and salinity. Combining these records allows the calculation of a high resolution temperature and precipitation/salinity record through time, which can be used to provide a more accurate indication of past climatic conditions and the tolerance thresholds of reef ecosystems to those conditions.

Coral. Photo: Gregory Webb

Unfortunately the relationship between a proxy measurement and an environmental variable is complex and must be calibrated against modern instrumental records. Using the research grant awarded by the Australian Wildlife Society, I aim to calibrate coral proxy signals for the highly abundant branching corals *Acropora* and *Isopora* that dominate reefs in the southern GBR. Currently, coral-based reconstructions are largely based on individually targeted colonies of the coral *Porites*. However, this approach restricts reconstructions to the coral's lifespan, which typically only represent the last several hundreds of years. If we are to delve deeper into the Earth's climate history, which is required to understand natural climate cycles, we need to switch sampling method to collecting older samples from beneath the reef itself. In the southern GBR, the reef extends down approximately 15-20 metres, and contains 'dead' coral skeletons from the last 8,000 years. Whilst this storehouse of coral initially appears to be an ideal source of palaeoenvironmental data, reconstructions are currently limited to *Porites* colonies recovered from reef core. Hence, this research will vastly increase the environmental data recoverable from coral reef cores by allowing the use of *Acropora*, *Isopora* and *Porites* skeletons for reconstructions.

In order to complete this calibration of coral-based proxies, we will conduct fieldwork later this year at Heron Reef, southern GBR, using the facilities at the Heron Island Research Station run by the University of Queensland. We will collect coral samples from specifically selected colonies in the vicinity of the sensor network of the Great Barrier Reef Ocean Observing Network (GBROOS) and Australian Institute of Marine Science (AIMS). Geochemical signals of oxygen isotopes and trace elements can then be calibrated against the instrumental records to construct calibration curves for each coral type that relate the geochemical proxy to the environmental condition. This relationship can then be applied to fossil reef material increasing our understanding of natural climate variability and reef tolerance in the GBR.

Disease-resistance-gene diversity in the tawny dragon (*Ctenophorus decresii*)

Jessica Hacking,
Flinders University of South Australia
Supervisors: Dr Mike Gardner, Dr Mike Schwarz and Dr Devi Stuart-Fox

Genetic diversity acts as a buffer against disease. Species with depleted genetic diversity may be more vulnerable to pathogen assault and less able to resist disease, especially if lacking in genetic diversity at disease-resistance-genes. For example, the prevalence of cancerous facial tumours in the Tasmanian devil populations has been linked to low diversity at key disease-resistance-genes. Despite the importance of understanding the mechanisms surrounding disease in wildlife, insufficient attention has been paid to the role that disease, and the ability to resist disease, plays in wildlife endangerment and population decline. This is especially the case for some animal groups, such as reptiles, more so than others. In fact, this study will be the first investigation into dragon lizard (*Agamidae*) disease-resistance-gene diversity **worldwide**.

I started my PhD project this year and I'm really looking forward to the field season, which started in September. My field work involves collecting blood samples for both DNA analysis and pathogen identification, and cloacal swabs for pathogen identification, from tawny dragons (*Ctenophorus decresii*) throughout South Australia. One of my field sites is located right near the beach on Kangaroo Island – how lucky am I?! These samples will allow me to assess diversity at key disease-resistance-genes (which I am developing genetic markers for) and determine how past and present population demographics as well as pathogen diversity and distribution influence diversity at these genes. This information is essential for a better understanding of the mechanisms underlying disease resistance in wildlife.

Funds kindly provided by the Australian Wildlife Society will help cover costs associated with field work.

Male tawny dragon at study site

Detecting ecosystem change in temperate Australian grasslands: remote sensing tools

Chris Watson,
University of Technology, Sydney

The ecological integrity of grasslands throughout the world has suffered historically due to long-term coexistence with agricultural land use. In Australian temperate grasslands, this is particularly true, especially when combined with the addition of fertilizers to the landscape which favours exotic, weedy species at the expense of native grasses and forbs. When in good condition, these grasslands provide critical services such as carbon sequestration, erosion control, and provision of habitat for endangered and sensitive wildlife. However, native temperate grasslands are among the most disturbed and fragmented biomes in the country, with many communities occupying less than five percent of their pre-1788 range. In fact, over 30 grassy ecosystems are listed as endangered or critically endangered by Australian legislation. These ecosystems will face unprecedented threats under climate change scenarios, including increases in woody vegetation and invasive species, seasonal growth (phenology) changes, altered ecological dynamics, reduced water availability, habitat envelope shifts, and greater fragmentation. This has major ramifications for the conservation of grassland diversity and there is an acute need to identify high-quality grassland areas and to understand their ecosystem dynamics.

Themeda-dominated native temperate grassland on the outskirts of Canberra

Remote sensing, particularly through satellite imagery, has been used to identify different land use and vegetation types, spot outbreaks of invasive species, determine areas of foliar stress, to name just a few applications. As the technology used within these sensors develops, we are able to 'see' the ground at a smaller scale, obtain a greater frequency of repeat images, and separate the light signal into more discrete wavelengths. This increases our ability to separate one vegetation community from another, and also allows us to track how these communities are behaving over time. However, each vegetation type presents its own challenges: in Australian grasslands, this is exemplified by their highly dynamic nature, which can result in greatly different vegetation expression from season to season, and between years. Perennial grasses also tend to have a high proportion of dead vegetation retained on the plant, which can mask remotely sensed vegetation signals.

With the assistance of an Australian Wildlife Society Student Research Grant, my project is using a variety of novel remote sensing methods to determine the differences that species composition, climate variability (eg drought), management techniques, and have on remotely sensed vegetation signals. Through investigation of different spatial scales (ie ground-level, landscape-level and satellite-level) across seasons, we aim to improve the detectability of high-quality native grasslands, and to determine time-series markers of grassland ecosystem change. This will strengthen our understanding of grassland ecosystem dynamics and enable informed conservation and management priorities for these endangered communities into coming decades.

Climate change in a stable thermal environment: effects on the performance and life history of a coral reef fish

Giverny Rodgers,
James Cook University

Global climate change is one of the biggest threats to marine and terrestrial biodiversity. Coral reef ecosystems, particularly at lower latitudes, are likely to be significantly impacted by the large changes in sea surface temperatures associated with climate change and this is due to their narrow thermal ranges. In my study, I will examine how a near-equatorial population of damselfish (*Acanthochromis polyacanthus*) may respond to the chronic increases in water temperature predicted with climate change.

Past research has shown that elevated sea temperatures may influence reproductive output, growth rates and physiological performance of coral reef fishes; however, the majority of these studies have been undertaken on fishes from the middle and southern sections of Australia's Great Barrier Reef. Some fish species span large geographical ranges and would therefore naturally experience different local environmental conditions. These regional differences are important because populations are often adapted to their local conditions and this may limit generalised predictions relating to the impacts of climate change on marine organisms.

Physiological measures can provide a useful tool for assessing thermal sensitivity and determining an organism's performance over a range of temperatures. My research to date has examined physiological characteristics and survival in adult fish, collected from study locations in Torres Strait. The results have already shown that the predicted temperature increases associated with climate change could have a devastating effect on low-latitude coral reef fish populations. These findings, however, do not tell the full story. It is the capacity for acclimation and adaptation to a rapidly changing environment that will be crucial for coral reef fishes to persist. Southern populations of *A. polyacanthus* have demonstrated the potential for physiological and reproductive acclimation; the question that I hope to answer now is whether or not this ability also exists in near equatorial fish, for which the effects of increased temperature are much more severe.

To answer this, I will use newly hatched juveniles that will be collected from the Torres Strait. The potential for developmental (non-genetic) acclimation of *A. polyacanthus* will be tested by comparing the metabolic and life history attributes of these juveniles at various temperatures. The research conducted here will assist researchers in further understanding the environmental implications of predicted climate change and aid in the decision-making process when developing management and conservation strategies for the Great Barrier Reef.

Giverny Rodgers

Reducing the impacts of roads on high-flying wildlife

Kylie Soanes,
University of Melbourne

Roads can cause a lot of problems for wildlife. For many species wide, noisy roads are difficult (or impossible) to cross. This creates a barrier, restricting wildlife movement, dispersal and gene flow. Animals that do try to cross risk being killed by traffic.

In many countries, environmental regulations mean road agencies must reduce the impacts of roads on wildlife, particularly on threatened species. This is typically done using wildlife crossing structures, and millions of dollars are spent installing tunnels under roads, or bridges over them, to help wildlife cross safely. Given this is a pretty important task, you might be surprised to learn that we often don't know how well crossing structures work. This is because monitoring programs are usually too short or poorly designed, and studies directly evaluating population impacts are scarce.

So how well do they work? I'm attempting to find out for a threatened gliding mammal, the squirrel glider. Squirrel gliders move by gliding from tree to tree, but struggle to cross gaps in tree cover larger than 40 metres. This is where roads like the Hume Freeway in south-east Australia can cause problems. Previous research has shown that the 50 metre gap across the freeway is a barrier to glider movement (van der Ree et al. 2010) and that

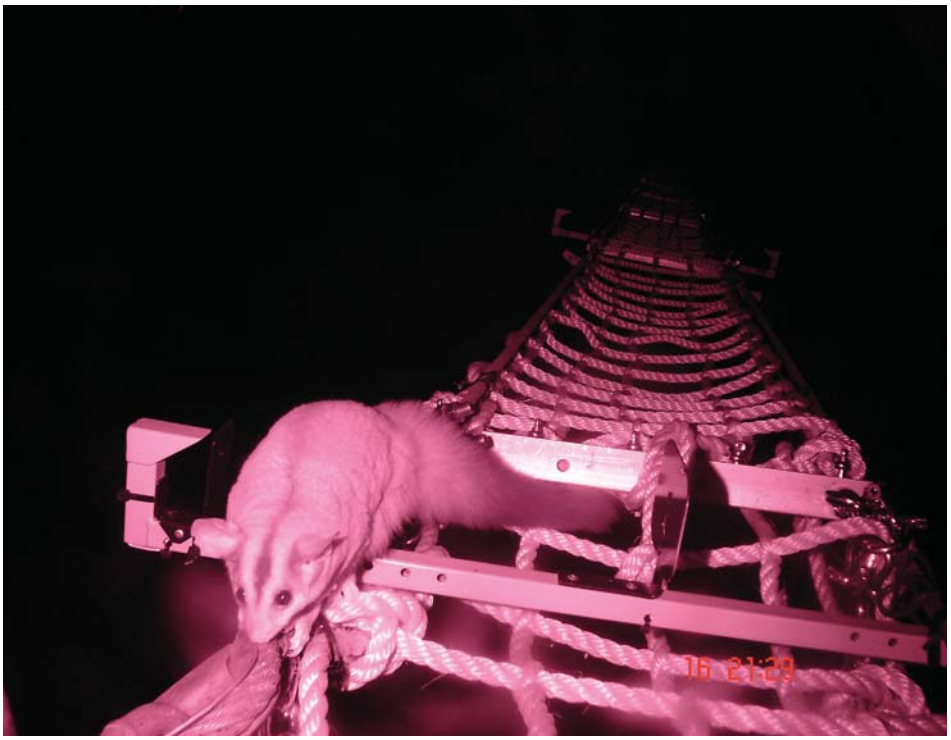
A goanna crosses a canopy bridge over the Hume Freeway in north-east Victoria

glider populations living adjacent to the freeway have a 60 percent lower survival rate than those living further away (McCall et al. 2010).

Three types of crossing structure have been trialled to reduce the impacts of the Hume Freeway on squirrel gliders. One is a kind of natural crossing structure called a 'vegetated median'. Tall trees are kept in the centre median as a stepping stone, allowing gliders to cross the freeway in a few short glides. Where that's not possible we can install glider poles – tall, wooden poles which act as fake trees to do the same job. The final option is to use canopy bridges, or rope ladders, to connect trees on either side of the road. I'm trying to find out whether squirrel gliders will use these structures to cross roads, and if these help preserve roadside populations.

I first looked at animal movement by placing motion-triggered cameras and microchip scanners on canopy bridges and glider poles. Cameras showed squirrel gliders were crossing, but they weren't alone. Common ringtail possums, common brushtail possums, sugar gliders, brush-tailed phascogales and even a goanna also crossed the freeway using our structures. The microchip scanners gave us even further insight. By recording the unique microchip of each squirrel glider crossing the canopy bridges, we can see that several gliders cross almost every night. This tells us they can now safely reach food, shelter and mates on both sides of the road – something they couldn't do before.

I also teamed up fellow student Melissa Carmody on a radio-tracking study. We found that all three crossing structure types increased the probability that a squirrel glider would cross the freeway, while sites with no structures remained a barrier (Soanes et al. 2013). However, movement across the freeway was lower than across control sites – quiet, narrow roads away from the freeway – so while having crossing structures is certainly better than doing nothing, it's not as good as not building a freeway in the first place.



A squirrel glider crosses a canopy bridge over the Hume Freeway in north-east Victoria

But does all this movement mean squirrel gliders are better off when crossing structures are installed? To find out, I'm now comparing data from surveys conducted before and after the crossing structures were installed, and including freeway sites with no structures and non-highway sites to act as comparisons. These surveys tell us how long gliders survive at different sites, and whether or not glider populations on opposite sides of the share genetic material. If sites with crossing structures help squirrel gliders survive longer, and promote gene flow across the road, we'll know that installing these structures is worthwhile.

References

McCall et al. 2010. Evidence that a highway reduces apparent survival rates of squirrel gliders. *Ecology and Society* 15.

Soanes et al. 2013. Movement re-established but not restored: Inferring the effectiveness of road-crossing mitigation for a gliding mammal by monitoring use. *Biological Conservation* 159, 434-441.

van der Ree et al. 2010. Large gaps in canopy reduce road crossing by a gliding mammal. *Ecology and Society* 15.

Canopy bridges and glider poles help squirrel gliders cross the Hume Freeway

Can project management improve mammal conservation success in Australia?

Madelon Willemsen,
University of Technology, Sydney

My research will focus on recovery projects. These are projects to save a species from extinction in its natural habitat through different measures and actions.

If you have been part of a recovery team or worked on implementing actions of a recovery plan, you know that recovery projects can be cumbersome, concern a wide range of different stakeholders and require joint action from different angles. Recovery projects are defined as complex projects for the above reasons and are, unfortunately, usually not all that successful for a host of different reasons.

With a background in conservation and project management, my research focuses on bringing these two disciplines together. We know commercial companies and multinationals can successfully run their projects. They plan, design, implement, monitor and phase out projects (these five phases are called the project lifecycle) successfully. Why is it so hard for conservation recovery projects to be successful? We know there could be a host of different reasons, such as threat status, budgets, and individual project management skills. But even though we have worked hard and continue to work hard to find the reasons behind our failing, we are not successful in slowing down this extinction wave.

I will use an inductive qualitative method and talk to people who have been involved with Australian and overseas recovery projects. The Grounded Theory method will be used to develop theories on the problems and successes of recovery projects. These theories will be the foundation on which I will build a project management framework, bringing together project management knowledge and experience. This framework is aimed to enhance the Australian Recovery project success. I also hope to provide a recovery project management handbook that will help recovery experts, practitioners, academics and others to slow down the Australian extinction wave.

The AWS grant I received will support me to travel and talk to recovery specialists at the IUCN Conservation Breeding Specialist Group Annual Meeting in Orlando, Florida, USA.

Eastern barred bandicoots were thought to be extinct until 1991 when a small population was found living at the Hamilton tip in western Victoria. Habitat destruction and introduced predators such as cats and foxes have significantly contributed to the decline in Eastern barred bandicoot numbers.

The vast unknown: assessing the conservation of soft-sediment fish diversity

Lachlan Fetterplace,
University of Wollongong

Sand. That grainy stuff that covers vast swathes of the ocean floor. Although perhaps to the casual observer this habitat isn't as exciting as coral reefs or seagrass meadows, delve a little deeper and you will discover that there is a whole lot happening out in the vast sandy stretches of the ocean. Sand or soft sediments underlie most of Australia's state and national waters and are heavily exploited by commercial and recreational fishing.

Surprisingly, there has been little research into fish ecology on these habitats, with most effort expended on assessing fish found on coral reefs, rocky reefs, estuaries and seagrass. For a habitat that is so heavily exploited, there is a serious and immediate need to determine the basic ecology of the fish species present, the effects of fishing and also to examine the success of conservation efforts in place. More than 70 percent of Australia's marine protected areas cover soft sediments, yet to my knowledge, both nationally and internationally, there have been no studies looking at the effectiveness of marine protected areas in conserving soft-sediment fish.

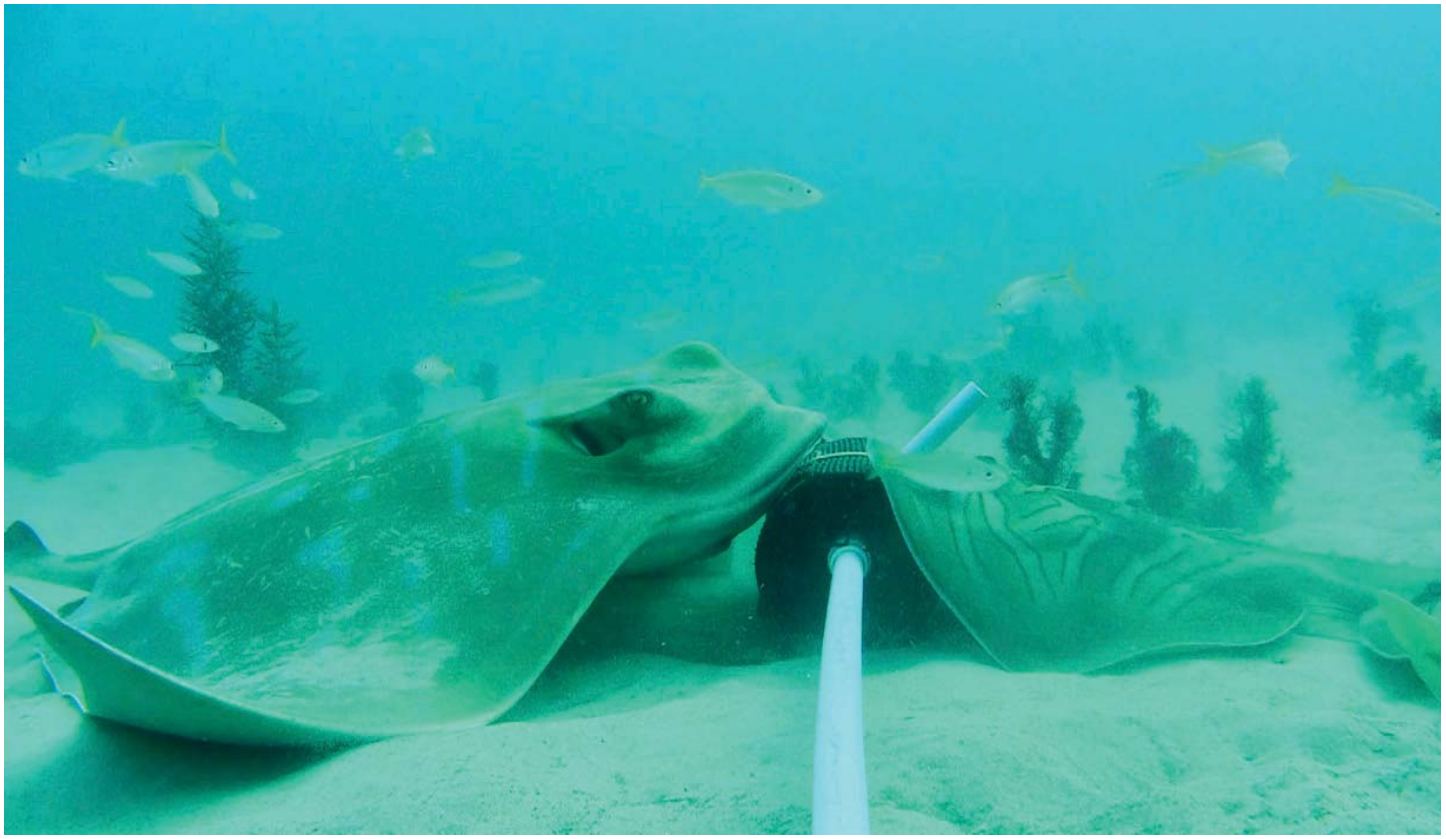
My PhD aims to examine the ecology and conservation of soft-sediment fish assemblages in temperate waters of south-eastern Australia. Baited remote underwater video (BRUVs) will be used to provide a clear assessment of fish communities found on soft sediments, including in NSW marine park sanctuary zones (no-take zones), habitat protection zones (recreational fishing allowed) and areas outside of the marine park (that are targeted by both recreational fishers and commercial fishing vessels). In addition, I would like to further investigate issues surrounding the movement patterns of some of the soft-sediment fishes in these assemblages using acoustic tracking.

Often it has been argued that spatial closures such as marine parks will be of little conservation value over soft sediments as the fish are thought to show little site attachment in this

A frame grab from baited underwater video footage showing a whaler shark (*Carcharhinus* sp.) followed by a yellow-tailed kingfish (*Seriola lalandi*) attracted to the bait

Blue-spotted flathead (*Platycephalus caeruleopunctatus*) ready for release after tagging

habitat type. It is fairly common to hear people say, "they'll just swim in and out of the reserve and we'll catch them on the outside", but is that really true? In contrast to this view, my initial research inside Jervis Bay suggests that blue-spotted flathead (one of the major commercially exploited species found on sand) move less than 500 metres within a 12-week period of acoustic tracking. Now that might sound like they aren't moving around much and over the short term that is true, however without longer-term data I can't yet rule out that they do roam much further for spawning movements or other seasonal migrations. The next stage of tracking over 18 months will allow me to determine whether or not these longer-range movements occur.



A frame grab from baited underwater video footage taken in Jervis Bay Marine Park showing a southern eagle ray (*Myliobatis australis*) and an eastern fiddler ray (*Trygonorrhina fasciata*) investigating the bait

Mitigating the impact of cane toads through land management and an innovative conservation strategy

Georgia Ward-Fear,
School of Biological Sciences,
Faculty of Science, University of Sydney

One of the greatest threats to biodiversity globally is the invasion of ecosystems by non-indigenous species. Such species can send a wave of destruction through ecological communities, via novel interactions that include competition, predation, parasitism or transmission of pathogens and disease to naïve native fauna. In turn, those direct impacts of the invader can set off far-reaching trophic cascades.

Many invaders are deliberately introduced; 30 percent of the world's ice-free land surface is utilised in livestock production. Large browsing herbivores can drastically alter vegetation structure, which has ramifications for entire ecosystems, affecting faunal and floral guild composition and landscape hydrology. In Australia, the link between livestock occupancy and the reduction of ground cover and loss of perennial grass in rangelands is well established. This phenomenon has subsequently been associated with general declines in vertebrate fauna diversity, specifically a reduction in mammal abundance. These conditions could potentially facilitate further biological invasions.

One invasive species is expanding its range westwards across northern Australia at a rate of 50 kilometres per year and has just breached the Kimberley: *Rhinella marinus*, the cane toad. This large toxic anuran, native to South America, was first introduced to Queensland in 1935 to control pest beetles of the sugar cane industry and has since rapidly spread. Because Australia has no native bufonids, cane toads (and their associated bufadienalide chemical defences) are a novel and deadly prey item to most Australian animals if consumed, particularly large predators such as quolls, goannas, and freshwater crocodiles. Removing this guild of apex predators may have far–reaching consequences for faunal populations of the tropical northern savannahs. For example, the resultant meso-predator release of cats may increase predation on already vulnerable small mammal and reptile populations.

A female yellow spotted floodplain monitor (*Varanus panoptes*) at a burrow in the Kimberley, caught on remote sensing camera

In species that are affected by cane toads, population declines typically occur immediately after the toads invade (eg flood plain monitor, blue-tongue lizard and death adder). Nonetheless, impacts vary geographically and across species. Research by the University of Sydney and the Department of Environment and Conservation in Western Australia has shown that several mammal and reptile species are at high risk from toads, whereas others have the capacity to learn not to eat toads (eg freshwater crocodiles, small dasyurid marsupials, and preliminary work on varanid and scincid lizards). The research has also suggested that we can exploit this 'conditioned taste aversion' (CTA) response by purposefully exposing toad-naïve predators to a sub-lethal dose of toad tissue. A native predator that eats a small toad will receive a sub-lethal dose of toad toxin, making it feel ill, but not killing it. Learning from this experience, animals like quolls exhibit a marked aversion to consuming toads thereafter. The problem for naïve native predators is that the first toads they are likely to encounter (those on the invasion front) will be large and hence, full of bufotoxin. Any predator that attempts to eat such a toad will die. If these predators had encountered small toads with sub-lethal doses of toxin *before* the main toad front arrived, they may have had an opportunity to learn to avoid subsequent larger toads (and hence, could survive even in the presence of toxic toads).

'CTA therapy' is currently being used

Above: Georgia Ward-Fear in the Kimberley with a magnificent tree frog (*Litoria splendida*). Photo: Andrew Morton

successfully in a program with quolls in the Northern Territory. CTA has not been trialled with the goanna species of northern Australia; if we could employ this technique we could potentially 'buffer' populations of these large predators populations that are rapidly vanishing.

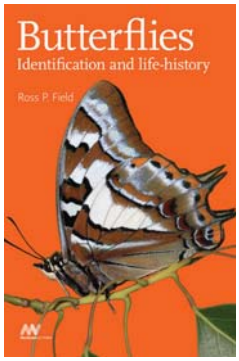
The idea of using 'teacher toads' to save native predator populations utilises the ability of native predators to learn not to eat toads. Predators that are strategically exposed to small live toads at the front of the advancing invasion have the opportunity to develop a 'toad taste aversion' prior to the arrival of the main invasion front. This method obviously cannot save all of the predators in an area, but it can save enough to allow for subsequent population recovery in surrounding areas.

For my PhD I will be trialling the teacher toad technique with populations of wild goannas in the remote Kimberley. The idea of bolstering defences of native animals by prior exposure to their oncoming enemy is an exciting and innovative approach to conservation. This strategy is well suited to incorporation into impact management plans. Thus the outcomes of this work have direct conservation management implications and would need to be acted on as soon as possible. Not only are my trials likely to save many goannas, but if successful, the methodology can be used elsewhere to buffer other populations ahead of the invasion front, to prevent the overall collapse of tropical goanna populations in the wild.

I will also be exploring the interactions between cane toads, goannas and feral stock in the Kimberley. I believe this will yield some interesting information about the context-dependent nature of invasion dynamics and the life history ecology of the goannas of northern Australia. These results could potentially aid conservation land management practices.

My work also has substantial social significance. The plight of these goannas strikes a chord with the traditional owners of the Kimberley. Goannas are very important to these people. For thousands of years these goannas have been a reliable source of bush-tucker, integral to complex hunting knowledge and indigenous theology; the presence of goannas is thereby important for maintaining traditional indigenous culture. The preservation of goanna populations also fulfils cultural obligations to 'care for country'. I will be working closely with indigenous groups throughout my PhD to achieve these conservation outcomes. The Kimberley is the last stronghold for many tropical species and the cane toad invasion represents an ominous threat to Australia's north western biodiversity. My work will gain explicit insight into the ecological interactions currently holding this fragile native guild together, including the potentially facilitative relationships between invasive species (livestock and cane toads). Ultimately my work aims to help maintain the faunal integrity of this unique and valuable ecosystem in light of the challenges it faces.

Book Reviews



Butterflies: identification and life history by Ross P Field

This fascinating book provides amateur naturalists, bushwalkers and interested readers with a comprehensive guide to butterflies found in Victoria and the east coast of Australia. Species descriptions are accompanied by stunning colour photographs of all the life stages of the butterfly, as well as their food, habitat and behaviour patterns. The anatomy of the butterfly is described in detail, using both line-art and photography, with the latest imaging technology used to capture the spectacular and diverse array of colours and forms in butterfly eggs. Maps, scientific and common name indexes are also included, along with a checklist of which species can be found in each state.

Unlike other books available, *Butterflies: identification and life history* illustrates the full life-cycle of these fascinating and beautiful insects, making it a must-have guide for naturalists and curious readers.

About the author

Ross Field has a PhD in entomology and has published more than 100 publications on interests such as insect ecology and the ecology, biology and conservation of butterflies. Ross had worked as an entomologist in the Victorian Public Service for the majority of his career.

RRP: $29.95 | Distributor: NewSouth Books

The Art of Science: remarkable natural history illustrations from Museum Victoria By John Kean

Whether they fly, swim, crawl, wiggle or walk, we are endlessly fascinated and inspired by the creatures of our world. *The Art of Science* showcases the uncommon beauty produced from 300 years of exacting scientific observation and illustration. It is a big beautiful book with 204 pages of stunning full colour illustrations, mostly full size. The pictures are so exquisite, and the production values of this book are so good, it is like having an art gallery in your own home.

As exploration and science have expanded our horizons across time and space, the ability to capture and communicate the truths held in nature have become increasingly important. Scientific artwork is as important and astonishing today as it was in the 18th century.

In this exquisite exhibition Museum Victoria presents the development of scientific art from the State museum's seldom seen collection of artworks and rare books, and stunning images produced with microscopes, macro-lenses, and computers.

RRP: $50.00 | Distributor: NewSouth Books

Visit the Australian Wildlife Society website at www.aws.org.au to find out the latest on what is happening in our fight to preserve Australia's unique wildlife

Be a part of the Australian Wildlife Society's conservation future






To commit to being a part of our future, please complete this form. You may cancel your donation subscription at any time by notifying the national office.

Australian Wildlife Society
PO Box 42
Brighton Le Sands NSW 2216
Tel: (02) 9556 1537
Fax: (02) 9599 0000
Email: info@wpsa.org.au

You may also commit by visiting www.wpsa.org.au and registering online

All donations of $2 or more are tax deductible.

Australian Wildlife Society
Conserving Australia's Wildlife since 1909

Your Details

Name: Dr / Mr / Ms / Mrs / Miss

Address:

State: Postcode:

Phone: Home Work

Email:

☐ I want to join the Friends of WPSA and give by automatic deduction each month to help protect our unique native wildlife and its important habitat

I will give via: Credit Card (please complete authority form below)

Credit Card Payments

I am paying by: Visa ☐ MasterCard ☐ Card Security Code (CSC) __ __ __ __

Card No. __/__/__/__/ __/__/__/__/ __/__/__/__/ __/__/__/__/ Expiry date ___ /___

Name on card Signature

I will give:

☐ $10 per month ☐ $15 per month ☐ $25 per month ☐ $50 per month

☐ My choice of $ per month

Signature Date

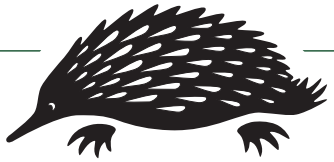
This authorisation is to remain in force until cancelled by the donor and in accordance with the terms described in the Agreement below.

Deduction will be made on 15th of each month.

CREDIT CARD AUTHORITY

1. The Donor will be advised 14 days in advance of any changes to the Credit Card Authority arrangements. 2. For all arrangements relating to the Credit Card Authority arrangements, the Donor will need to call AWS on (02) 9556 1537 or write to PO Box 42, Brighton Le Sands NSW 2216 or email info@wpsa.org.au. 3. Account details should be checked against a recent statement from your Financial Institution. 4. It is the donor's responsibility to ensure sufficient funds are available when the payments are due to be drawn. 5. If the due date for payment falls on a non-working day or public holiday, the payment will be processed on the next working day. 6. For returned unpaid transactions, the following procedure will apply: AWS will advise the Donor of the unpaid transaction and request alternative arrangements to be made for payment if possible. 7. All Donor records and account details will be kept private and confidential to be disclosed only at the request of the donor or Financial Institution in connection with a claim made to an alleged incorrect or wrongful debit. 8. This authorisation is to remain in force until cancelled by the Donor.

Membership Form



AUSTRALIAN WILDLIFE SOCIETY

PO Box 42 Brighton Le Sands NSW 2216

Membership

Become a member of the Australian Wildlife Society
Simply fill out this form.

Name:.....

Address:.....

City/Suburb:..... Postcode: .....

Telephone:..... Fax: .....

Email: .....

Membership category (please tick)

- ☐ Individual: $55
- ☐ Family: $70
- ☐ Concession (pensioner/student/child): $50
- ☐ E-mag (emailed as PDF, no hardcopy will be sent): $30
- ☐ Associate (library, school, conservation groups): $85
- ☐ Corporate: $125
- ☐ Life: $1,000

(Includes postage within Australia. Add $40 for overseas postage)

Three year membership (please tick)

- ☐ Individual: $150
- ☐ Family: $190
- ☐ Concession (pensioner/student/child): $135
- ☐ E-mag (emailed as PDF, no hardcopy will be sent): $81
- ☐ Associate (library, school, conservation groups): $230
- ☐ Corporate: $340

(Includes postage within Australia. Add $60 for overseas postage)

Payment details (please tick)

☐ Cheque ☐ Money Order ☐ Mastercard ☐ Visa Card Security Code (CSC) __ __ __ __

Card Number: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|

Amount $.....

Name on Card: .....Expiry:..... Donation $.....

Signature:..... **Total** $.....

Mail to the: **Australian Wildlife Society**
PO Box 42, Brighton Le Sands NSW 2216.
Email: info@wpsa.org.au Website: www.wpsa.org.au

Consider - A Bequest

Another way which you can support the work of the Wildlife Preservation Society of Australia (Australian Wildlife Society) is to remember us in your will.

If you would like to make a bequest, add the following codicil to your Will:

I bequeath the sum of $..... to the Wildlife Preservation Society of Australia for its general purposes and declare that the receipt of the Treasurer for the time being of the Society shall be complete discharge to my Executors in respect of any sum paid to the Wildlife Preservation Society of Australia Limited.

"The challenge to the present adult generation is to reduce the increasing pressures on the Earth and its resources - and to provide youth with an education that will prepare them emotionally and intellectually for the task ahead.

SUZANNE MEDWAY AM
President

OPEN DAY AT THE AUSTRALIAN MUSEUM (SYDNEY)