

# Science for saving species

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## Editorial...

# Rethinking private land to save species

Our national reserve system is magnificent and works to preserve some of the world’s most spectacular and unique places, but on its own it is not enough to prevent species extinctions in Australia. **Professor Brendan Wintle** takes a look at why our conservation strategies need to think beyond conservation reserves and some of the work already happening in this area.

Around 20% of Australia’s land area is under a form of conservation management that meets the IUCN definition of a “protected area”. Our national parks and conservation reserves serve the needs of some of our most threatened species and ecosystems well, but on their own are not enough for all species.

### Indigenous contribution

Indigenous people own and manage 42% of Australia’s land area, and almost 60% of all threatened species have all or part of their current distribution on Indigenous-managed land.

Indigenous Protected Areas are not technically counted in the private land conservation statistics. However, Healthy Country plans and other community-based planning and management are wonderful examples of local land governance, of communities doing what’s best for nature and people on their land using their own knowledge and expertise, but also collaborating with scientists and other partners. These are key ingredients for successful private land conservation.

We have been working with over 40 Indigenous groups to support right-way science toward the conservation of culturally and environmentally significant species on Indigenous lands. Threatened species that are benefiting include the night parrot, Byron Bay orchid, mankarr (greater bilby), brush-tailed rabbit-rat, far eastern curlew, malleefowl and many others.

### Private land conservancies

Private land conservancies serve as the backbone of the rapidly growing private land conservation movement. Although collectively they manage only slightly more than 1% of Australia’s total land area, they are making a hugely important contribution to the conservation of Australia’s threatened species and ecosystems.

For example, the fenced areas of Australian Wildlife Conservancy, Arid Recovery and Mt Rothwell are home to species such as bettongs, woylies, nail-tail wallabies and bandicoots that are vulnerable to feral predators and could not survive without the protection of their fences. They also play a vital role in Australia’s captive breeding programs, while Bush Heritage Australia’s reserves, which are also home to iconic and endangered species such as the elusive night parrot, conserve ecosystems and vast iconic landscapes in close working relationships with Traditional Owners. Our hub is proud to be working closely with each of these and many other non-government conservation groups, to undertake research that supports their efforts and that will also benefit other conservation managers.

### Rethinking agricultural landscapes

While the national reserve system, Indigenous managed land and private land conservancies are crucial for nature conservation, they cannot secure all of our most imperilled species. Many of our threatened species and ecosystems rely wholly or partly on other

private land for their survival. For example, Endangered mountain pygmy possums in the Australian alps rely on the migration of bogong moths, a crucial food source, from farm paddocks in western New South Wales and Queensland.

Over half of Australia’s land area is grazed and about 5% is used for cropping or other agriculture. Everything we do on private land impacts directly or indirectly on species and ecosystems. Therefore, everything that is done on private land that contributes positively to the conservation of species should be recognised, acknowledged and encouraged.

The old “Land for Wildlife” scheme was a terrific example of how the contributions of private landholders toward species



IMAGE: NICOLAS RAKOTOPARE  
Brendan Wintle on Kangaroo Island in February 2020 to support a bushfire recovery planning meeting which brought together a wide range of land managers.

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National Environmental Science Programme

conservation could be acknowledged and supported by the broader community. Land stewardship programs are a wonderful initiative that normalise conservation thinking and outcomes in agricultural communities. The time for expanding these sorts of programs for the benefit of both nature and people is now, and the emergence of the Agriculture Biodiversity Stewardship Program is a very positive development. As a hub, we have been delivering research to support these types of programs, such as on factors that influence program participation and better monitoring.

### Sustainable farms

Supporting threatened species in productive agricultural landscapes is possible, as evidenced by the hugely successful Bitterns in Rice program (see p8), and the benefits do not only flow to the environment. Such programs often also have strong social and economic benefits, such as creating new marketing opportunities and improved farmer mental health.

These triple benefits are part of what we are exploring in our collaboration with the Sustainable Farms initiative at The Australian National University (see p10). Multidisciplinary teams of ecologists, economists, psychologists and farm extension officers are working closely with farmers in the sheep-wheat belt of south-eastern Australian to look at how improved biodiversity can support healthy farms, healthy farmers and healthy profits.

### Engaging the finance sector

Improving how biodiversity is managed in agricultural landscapes also means transforming the way biodiversity is invested in and valued.

Australia's banks and investors are looking to move towards integrating sustainability measures into their core business (see p6). Natural capital accounting and environmental decision tools and measures can support these sectors to make decisions that better recognise the contribution that biodiversity makes to long-term landscape health.

We have been bringing new evidence-based knowledge to support decision-making in this space. For example, the accounts we have completed for the Victorian Central Highlands and that are underway for box gum grassy woodlands (see p14) will provide vital quantified evidence to decision-makers about the values of the ecosystem services in these regions.

### Diverse species in diverse settings

Other land types can also be vital to threatened species. For example, some commercial ports are very important to the far eastern curlew (see p4). Thirty-nine threatened species, such as the western ringtail possum, have all or part of their distribution in urban areas and the contribution that the community can make to these species is huge. To this end a hub project has been mobilising the community to participate in monitoring and conservation actions for this Critically Endangered possum, even engaging wineries in their plight (see p23).

### A vision

Bringing the best possible threatened species conservation science directly to private land holders and supporting government and lead organisations to secure positive outcomes for species and ecosystems on private land remains a key challenge for Australia and our research group.



IMAGE: MATT HERRING

ABOVE: About 60% of Australia's Endangered Australasian bitterns call rice crops home, making rice growers a key custodian of the species.

The role that private land holders play will arguably be the most important determinant of success or failure for threatened species conservation in this country over the next decade. If we cannot achieve strong conservation outcomes for threatened species on a diverse array of lands, we cannot hope to hang on to all of our native species – but we also need to explore the social and economic impacts and benefits of programs. Only then can we achieve programs that have long-term sustainability and community support.

Brendan Wintle  
The University of Melbourne  
b.wintle@unimelb.edu.au

BELOW: Australian Wildlife Conservancy is the largest private owner of land for conservation in Australia, protecting endangered wildlife across more than 6.5 million hectares. Shown here is the feral predator-proof fence surrounding Mt Gibson Station in Western Australia.

IMAGE: W LAWLER / AUSTRALIAN WILDLIFE CONSERVANCY



Shorebirds flee from people walking their dog on a Darwin beach.



# Migratory shorebirds and artificial roosts

Many “working coastal wetlands”, including ports, commercial salt works and wastewater treatment plants, host important habitat for threatened migratory shorebirds. Although artificially created, these areas can be attractive high tide roost sites for migratory shorebirds, particularly when the area is closed to the public. **Amanda Lilleyman** from Charles Darwin University and **Micha Jackson** from The University of Queensland tell us about why disturbance on public beaches can be a real problem for shorebirds and why some industrial sites are very important to species like the Critically Endangered far eastern curlew.

Migratory shorebirds, which undertake some of the most incredible migrations on earth, are in serious decline globally. An analysis of monitoring data spanning 1973 to 2014 showed population decreases in 12 of 19 migratory shorebird species in Australia. Further, the Threatened Species Index (TSX; <https://tsx.org.au>) has shown an average decline of over 60% in the population sizes of 11 species of migratory shorebirds since 1980, the most concerning finding for any group of birds.

Within this group, the far eastern curlew has experienced one of the most acute declines of any Australian shorebird species. An analysis of Australian and New Zealand monitoring data showed that its annual rate of decline has been 5.8%; if this trend persists, the global population will fall to 10% of its 1993 abundance by 2035. Around three-quarters of the global population is thought to spend the non-breeding season in Australia.

We are part of a Threatened Species Recovery Hub project which is undertaking research to help support the recovery of the far eastern curlew, and which is expected to also benefit many other shorebird species.

## A disturbing business

Around the world, multiple threats are impacting migratory shorebirds throughout their lifecycles. One of the most significant threats in Australia is disturbance – especially at high tide roosts. A common cause of disturbance is people and their dogs using beaches for recreation.

Disturbance causes shorebirds to expend extra energy keeping watch and fleeing by walking or flying instead of just resting or feeding. The consequences are often underappreciated, but can be significant, resulting in reduced weight gain – weight that is vital to enable birds to complete long migrations back to their northern hemisphere breeding grounds.

## Alarming results

Lee Point is a long stretch of natural beach and adjoining mudflats just north of Darwin. Expansive, backed by natural vegetation and free from any development, the area would be considered ideal high tide roosting habitat except for one factor: the area is a very popular place for people and dog walking – much of which is off-lead.

Amanda led a study on the impact of alarm flights on migratory shorebirds at Lee Point. She found that the energy spent as a result of 10 alarm flights per day could have serious consequences such as reducing reproductive success or even survival.

A lack of roosts that are safe from disturbance may even constrain the number of shorebirds that a given region can support. Another study led by Madeleine Stigner at The University of Queensland within a protected area in Brisbane’s Moreton Bay found that the recreational use of foreshores, particularly with dogs, consistently reduced the occupancy and abundance of shorebirds.

The study was undertaken in areas that were designated as dog-on-lead, but found that many people still allowed their dogs off-lead. They also found that strategic zoning could be used effectively to accommodate both migratory shorebirds and recreational use; well-located dog off-lead beaches could reduce the impact of dogs on migratory shorebirds in other areas.

## Artificial refuges

In Australia there are several very important migratory shorebird roosting sites that have been artificially, usually unintentionally, created.

While these sites should not be considered a replacement for natural habitat, a number of studies have shown that artificial habitats can provide attractive high tide roosts, particularly when they are shielded from disturbance. They can also provide foraging opportunities for some species.

Artificial sites used by shorebirds in Australia are generally associated with commercial salt production, ports, wastewater treatment and, in some cases, specifically constructed roosts. Some notable examples of shorebirds using artificial habitats in Australia include:

- Constructed evaporation ponds within several commercial salt operations in the Gulf St Vincent, South Australia, which have consistently held over 15,000 shorebirds during counts over the past several decades.
- Constructed wastewater treatment ponds at the Western Treatment Plant, Victoria, which consistently hold internationally important numbers (more than 1% of the global population) of multiple shorebird species. The ponds are used throughout the tidal cycle for roosting and foraging by different species.
- Reclamation areas generally consisting of dredge spoil ponds within multiple ports, including the Port of Brisbane, Gladstone Port, Port of Newcastle, Broome Port and Darwin Port. In some cases, a significant proportion of the local shorebird population uses roost habitat within a port at high tide.

A common characteristic of the sites above is their relative inaccessibility to the public, meaning that birds can roost with little disturbance.

### Darwin Port

On the other side of Darwin from Lee Point are the East Arm Wharf settling ponds. Although artificially created, and part of the busy commercial Darwin Port, the ponds are a very important roosting site for the far eastern curlew, sometimes holding close to 1% of the global population. As such, managers of the port are important custodians of the species, and take pride in this responsibility. Darwin Port is also a partner in the hub research project and is contributing funding to the research.



IMAGE: MICHAEL LAWRENCE-TAYLOR

ABOVE: A lack of disturbance by people and dogs can make sites like the East Arm Wharf settling ponds in Darwin Port valuable roosting sites for migratory shorebirds.

The East Arm Wharf ponds provide roosting habitat at all tide heights (high tide heights in Darwin can vary from about 5.5 metres to over 8 metres) and surveys have found consistently large numbers of roosting far eastern curlews. The abundance of this species, and others at the site, has increased over the past nine years despite global declines over the same period.

Far eastern curlews are also not the only species benefiting from the East Arm Wharf ponds; surveys by the project team have found 27 species of shorebird roosting at the site at high tide when surrounding mudflat feeding habitats are inundated.

In contrast to Lee Point, a large part of the attractiveness of East Arm Wharf to migratory shorebirds is believed to be the lack of disturbance from people and dogs. In addition, it is close to suitable foraging habitat on intertidal mudflats. In combination, the short travel distances and lack of disturbance mean that birds can minimise their energy expenditure, so more of the energy they get from foraging can go into very important weight gains.

### Finding space

The shorebirds of our region inhabit and migrate along the most heavily developed and densely populated coasts in the world. Their survival is threatened by severe habitat pressures that occur throughout their non-breeding range.

Population recovery of declining shorebird species partially depends on us finding new ways to accommodate them in areas dominated by human activity.

*This Threatened Species Recovery Hub project is led by Charles Darwin University and The University of Queensland in partnership with the Larrakia Traditional Owners and Darwin Port.*

### Further reading

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### For further information

Amanda Lilleyman  
Amanda.Lilleyman@cdu.edu.au  
Micha Jackson  
M.Jackson@uq.net.au



The shoreline at Lee Point, just north of Darwin, would be ideal roosting habitat for migratory shorebirds if not for frequent disturbance by people and their dogs.

IMAGE: AMANDA LILLEYMAN

# Natural capital brings biodiversity to business

RIGHT: More than 2 million tourists visit the Blue Mountains in New South Wales each year to admire its natural values. Tourism is one of the most important employers in the Blue Mountains Local Government Area, where it directly contributes almost \$200 million annually to the Gross Regional Product of the region, according to 2011 Census data.



IMAGE: JAANA DIELENBERG

Environmental risks are increasingly recognised as risks to business. While climate change, water and waste top the list of concerns across the private sector, there is growing awareness among business leaders of the essential contribution of biodiversity to economic and social prosperity. **Natasha Cadenhead** and **Rachel Morgain** explore how natural capital is making its way into the boardroom, and how hub research can help businesses make better decisions.

As a global community, we have agreed to strive for a better and more sustainable future for all, through the signing of international conventions like the UN Sustainable Development Goals, the Paris Agreement on climate change, and the Aichi biodiversity targets. Given the scale of these goals and the amount of money required to achieve just the first two (US\$6.9 trillion, according to the UN and World Bank Group), governments alone cannot enact these changes.

There is growing recognition that working across sectors is vital to creating a sustainable future, and that private industry can play a critical leadership role.

For the private sector, reducing environmental impacts and undertaking positive environmental measures have three powerful drivers. Inaction carries potential reputational costs, financial risks and risks of legal liability. As consumers become more active in demanding environmentally and socially

responsible products and services, businesses worldwide are increasingly interested in, and pressured to act on, sustainable practices. No longer can environmental strategies merely sit on top of business-as-usual. Increasingly, this entails developing the measures and tools to integrate environmental and social considerations across every aspect of a business. Nor is this primarily driven by brand differentiation or even reputation.

The World Economic Forum has consistently named climate change as the most likely and potentially most costly risk to business globally. Biodiversity loss now follows close behind, among the top 5 globally significant risks to businesses. This goes well beyond nature-based tourism. From pollination, to fisheries, and soil and water regulation to flood and fire mitigation, biodiversity and biodiverse ecosystems provide critical and often under-recognised ecosystem services to our entire economy.

Legal and policy instruments such as the global Taskforce on Climate-related Financial Disclosures are driving the rapid integration

LEFT: Leaders from the Australian and New Zealand finance sectors at the conference that launched the Australian Sustainable Finance Initiative in July 2018.



IMAGE: RACHEL MORGAIN

of climate-related risks and impacts into business decisions. Accounting for the vital contribution of biodiversity and ecosystems to business is a greater challenge, but the inception of the Natural Capital Protocol in 2016 offers a decision-making framework that helps businesses identify and value their impacts and dependencies on nature.

Natural capital is the world's stocks of natural assets – including geology, soil, air, water and biodiversity – from which humans derive a wide range of benefits that make human life and society possible. The services that natural capital provisions to the global economy are valued at almost twice the global GDP (~\$125 trillion/year compared to \$75 trillion/year of GDP). Natural capital accounting helps businesses integrate this knowledge into decisions about where their activities and investments should be directed – for example, where nature is enhancing the value of assets for investors, or reducing risks assessed by insurers.

Hub research in the montane ash forests in the Central Highlands of Victoria highlights the interplay of natural capital across a biodiverse ecosystem. Environmental accounts identified tourism, for which these forests are a drawcard, as contributing 20 times more value to the economy than logging. These tall trees, and the wildlife they support, are thus worth much more when left in place than the timber they would yield if logged. But more than this, there is evidence that intact ecosystems that support rich biodiversity can also deliver more ecosystem services. Water catchments in these forests support 5 million people in Melbourne, with a value of over \$300m per year, and deliver clean water to farmlands through the Goulburn-Broken system. Human disturbance from logging is increasing pressure on these catchments. Logging in the Thomson catchment alone has reduced water yields to Melbourne by an amount equivalent to the consumption of 250,000 people. Natural capital accounting highlights these economic dependencies on services provided by intact ecosystems, generating incentives for investors to protect these systems and their biodiversity.

Of course, as businesses take steps to mitigate their exposure to climate risk, they are increasingly understanding that biodiversity risk is also intimately related. The recent fires in south-eastern Australia are a stark reminder of the risks. In the Central Highlands, the consequences of fire across these landscapes – for humans and wildlife alike – were already seen to devastating effect in 2009. This risk of fire is growing, as climate change leads to hotter, drier conditions. Logging compounds this vulnerability, with fires spreading more rapidly and burning hotter in disturbed and young regrowth forests. Fire and logging in turn accelerate the loss of carbon from the system. Older, intact parts of the forest,

which support more of the forest's ancient trees and unique wildlife, are thus also more resilient to fire risk.

Predictive systems can model how human disturbance and climate variability interact in such ecosystems, with vital consequences for human life and wellbeing, but also for business decisions. Business leaders, insurers and investors seeking to mitigate these risks are beginning to integrate a better understanding of these dynamics into their decision systems. In 2018, leaders from Australia's finance sector agreed to launch the Australian Sustainable Finance Initiative, an industry collective of banks, super funds, insurance companies, peak bodies and academics working to create a roadmap for sustainability in finance. This could be a game-changer, with decisions underpinning how investments flow and how risks are managed across every other sector.

By accounting for their impacts on nature and how they rely on nature for prosperity, natural capital and sustainability measures encourage business decision-makers to value the true wealth that nature brings to their business. But the biggest barrier businesses report in seeking to integrate biodiversity into their decisions is access to appropriate tools, data and knowledge. Biodiversity research is thus vital in enabling the implementation of these measures. This role for research is only likely to grow, as more industries seek to integrate nature into their fundamental decision-making.

#### **For further information**

Natasha Cadenhead  
natasha.cadenhead@unimelb.edu.au

BELOW: A previously logged area of mountain ash forest following Black Saturday fires in 2009. Areas subject to human disturbance were more vulnerable to the fires.

## Business-Biodiversity Research Webinars

Building on our hub's Conservation Opportunities event in 2017 and the growing interest across the private sector in biodiversity tools for business decisions, the Threatened Species Recovery Hub will be holding a Business-Biodiversity Research webinar series in July 2020. This will bring together industry speakers and researchers to discuss key developments in integrating biodiversity into business decisions.

The webinars will feature perspectives from Australian industry leaders who are integrating natural capital and sustainability thinking into Australian business. Speakers will explore the nature of biodiversity and ecosystem risks to businesses, natural capital accounting, tools for measuring and assessing impacts, and forecasting biodiversity risks and opportunities.

But biodiversity research is not just about managing risk. The full value of nature for business is only just beginning to be recognised. From biodiverse carbon to ecotourism, nature is increasingly being seen as one of our greatest assets for achieving prosperity. Biodiversity is being integrated with production for more resilient landscapes. The series will also look at new opportunities for integrating biodiversity and economic prosperity.

#### **For more information or to attend the summit:**

Rachel Morgain  
rachel.morgain@anu.edu.au



# Bitten by the bittern bug

## Rice farmers rally around Endangered waterbird



IMAGE: MATT HERRING

When people think about threatened species conservation in agricultural landscapes it's usually the most intact remnants of native vegetation – the patches least affected by farming – that come to mind. But what about the novel habitats that farming creates? In the Riverina region of southern New South Wales, rice fields are providing a conservation opportunity where food production and threatened species can be managed concurrently. Hub researchers from Charles Darwin University **Matt Herring, Kerstin Zander** and **Stephen Garnett** report on their work with rice growers and the Endangered Australasian bittern, a cryptic waterbird that breeds in these agricultural wetlands.

Australia's wetlands emit a wonderful array of strange sounds: croaks, groans, squelches, honks, trills and growls. One of the finest is the deep, booming call from the Australasian bittern. So captivating is this sound that for thousands of years people have credited it to the bunyip, that fearsome, mythical creature. It's a sound now familiar to hundreds of Riverina rice growers.

BELOW: Young bitten in rice field.



IMAGE: MATT HERRING

At first glance, irrigated agriculture and waterbird conservation may seem like strange bedfellows in the Murray-Darling Basin. But our research is looking at how water can be managed in a more integrated way, challenging the polarised debate of farming versus the environment. Since the establishment of the Bitterns in Rice Project in 2012, the rice industry has gradually embraced this peculiar bird, and bittern-friendly rice growing is now a well-recognised concept. One grower from near Leeton, Milton Hoysted, recently said, "We're tweaking the crop to better accommodate the bitterns. People chat about it with a bit of pride. I've got the birds, you haven't. It's turning into a bit of a competition."

### Global stronghold

One of our first challenges was to determine how many bitterns were using the rice fields. Given their cryptic nature, this involved some serious bittern-sleuthing. After hundreds of surveys across randomly selected farms we crunched the numbers and the results were remarkable. We found that in most rice seasons about 500 to 1000 bitterns make the crops their home. That's about 60% of the national population and 40% of the

global population, making rice growers a key custodian of the species, alongside managers of natural wetlands. It turns out that the way rice is grown provides conditions similar to the shallow swamps with which the bitterns are familiar. The rice season starts with bare paddocks that are sown and flooded, and then two or three months later, once there are sufficient cover and prey, one of the world's most threatened waterbirds is nesting. The rice fields essentially function as ephemeral wetlands where the early successional stage is restarted each year because of drying and harvest, sowing and flooding.

### Successful breeding

The window for bitterns to breed successfully before harvest can, however, be tight. Most nesting commences in the rice field from mid-December to mid-January, and from there it's almost three months before the chicks fledge, with harvest usually peaking around mid-April. Growers are under pressure due to considerations of water-use efficiency to contract the period when the fields have ponded water. New shorter-season varieties have been bred, and a trend is growing to delay the commencement of ponding.





IMAGE: MATT HERRING

ABOVE: Satellite tracking of bitterns revealed that at harvest time many disperse to coastal wetlands, while others stay local, seeking out habitats like vegetated channels and storage dams.

What we've found is that if growers can flood their fields in October, and provide at least 130 days of ponding, then the chicks are able to fledge before harvest. Fortunately, Riverina Local Land Services, through funding from the Australian Government's National Landcare Program, have begun offering financial incentives for bittern-friendly rice growing, drawing on the results of our research.

The focus is on getting the birds nesting as early as possible and maximising breeding success. Small patches in the crop, where additional urea fertiliser has been used, create taller, thicker rice and encourage earlier nesting, while the management of adjacent wetland refuges, such as vegetated channels and storage dams, complement the rice fields and provide habitat beyond the rice season. Maintaining grassy banks provides roaming chicks with cover from predators, and control programs for foxes and cats are being planned.

### Buying bittern-friendly rice

Once the proof of concept is clear and the incentive program is fully developed, we hope it will ultimately be the consumer who is able to pay a premium for bittern-friendly rice at the supermarket, with the funds returned to growers to offset their costs for meeting the criteria.

We recently surveyed over 1500 Australian consumers about the value they put on bittern-friendly rice and, while we're still crunching the numbers, a substantial proportion of them were willing to pay extra for their rice to help support bitterns. For some consumers, combining bittern-friendly rice with organic certification or endorsement from environmental organisations was important. SunRice® and the Ricegrowers' Association of Australia are keen to use this information to create viable products that "boost the bittern yield". While the money is helpful, many rice growers have said that recognition of the habitat values of rice fields by the wider Australian public is a key motivation for their participation.

BELOW: Scott Williams, one of the first bittern-friendly rice growers through Riverina Local Land Services' incentive program. He has ponded his water in October, planning for 150 days of inundation, with nesting patches and adjacent habitat.



IMAGE: MATT HERRING

The bitterns and their use of rice fields highlight how novel habitats can be overlooked, but also that there are hidden opportunities to work together for threatened species conservation on private land.

### For further information

Matt Herring  
mherring@murraywildlife.com.au

Kerstin Zander  
Kerstin.Zander@cdu.edu.au

Stephen Garnett  
Stephen.Garnett@cdu.edu.au

Bitterns in Rice Project  
www.bitternsinrice.com.au

### Further reading

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Bittern-friendly rice growing aims to maximise breeding success.

IMAGE: MATT HERRING



# Sustainable Farms

## Bringing people together to support healthy farms, farmers and profits

The Threatened Species Recovery Hub is working with a new, interdisciplinary research and extension initiative at The Australian National University, Sustainable Farms. The initiative has its foundations in a long-term biodiversity data set collected by **Professor David Lindenmayer's team** over 20+ years in the south-east Australian sheep-wheat belt. Sustainable Farms is exploring how enhanced biodiversity underpins productivity, and supports better farmer mental health. Sustainable Farms is bringing together farmers, researchers from finance, health and ecology, NRM agencies, agricultural service providers and many others. **Jaana Dielenberg** reports.

ABOVE: Fencing this dam has allowed regeneration of fringing vegetation, which helps to filter nutrients from paddock run-off, shade the water and increase biodiversity both in and around the dam. Stock can get to the dam via a single access point, reducing fouling and pugging of the dam. Sustainable Farms is currently undertaking research to investigate the biodiversity and productivity benefits of improving farm dams.

Since European settlement, over 90% of box gum grassy woodland has been cleared from agricultural regions in south-eastern Australia. This has had disastrous impacts on biodiversity, especially woodland birds. For a number of threatened species in this area, their prime habitat is within the agricultural zone. Examples include the squirrel glider, southern bell frog and superb parrot.

Organisations such as Landcare groups, Local Land Services, Catchment Management Authorities and Greening Australia have been actively engaged in tree-planting programs in the box gum grassy woodlands for the past three decades in a bid to address habitat loss (and other problems such as salinity). This has resulted in substantial increases in native vegetation cover in some regions. Alongside this on-ground work by a range of groups and individuals, David Lindenmayer and his team at ANU have been conducting on-farm research for more than 20 years, monitoring biodiversity and ecological values from northern Victoria through to south-east Queensland.

Long-term monitoring has created a unique data set: demonstrating changes in biodiversity outcomes over two decades on agricultural land. In doing so, the research has also been able to demonstrate the impact of planting design on biodiversity – showing that the plantings that support the most bird species, including birds of conservation concern, are larger in size, block-shaped, connected to other plantings or have patches of remnant vegetation nearby, located in gullies, support an understorey, and are established around large old paddock trees.

The field ecologists engaged in this work have had thousands of conversations with hundreds of farmers which, over time, revealed something else: that not only does farm management influence biodiversity, but that farmers who worked to protect natural assets on their farm noticed a positive impact on productivity. And for many, healthy biodiversity on farms appeared to correlate with good mental health, wellbeing and resilience during tough times.

From 20 years of solid ecological data as well as these vital seeds of observation and anecdote from farmers, Sustainable Farms was born: a multi-disciplinary project where three key areas overlap – healthy farms (ecology research), healthy farmers (mental health research) and healthy profits (finance research).

BELOW: Sustainable Farms Research and Extension Officers Daniel Florance and Dave Smith with farmer Ged Fulwood. Ged's property, located near Orange, New South Wales, is part of the Sustainable Farms long-term grazing study.



IMAGE: ALEX CRAIG

Burnbank Farm, near Wagga Wagga and owned by Rick and Pam Martin, is a prime example. Following a fire 35 years ago there was hardly any native vegetation on the farm; less than 2% was treed. The farm had major problems with soil erosion, salinity, rising water tables, low productivity pastures and poor crop yields.

When Rick and Pam took over management of the property, they started a revegetation program, adding woodlots and replanting shelterbelts throughout the property. They also enhanced habitat features like rocky outcrops. ANU researchers have now been monitoring the farm for nearly 20 years throughout the period of work undertaken by Rick and Pam, and have documented transformative landscape-scale changes.

Tree cover is now about 14% of the property. As the planted vegetation at Burnbank has matured, biodiversity levels have steadily increased. The ecological monitoring work undertaken shows that plantings at Burnbank now support over 90 species of woodland birds, including a range of species of conservation concern, such as the flame robin, speckled warbler and crested shrike-tit. Some of these species are breeding on the property, despite being in decline in the surrounding region.

But Rick and Pam noticed benefits that extended beyond native species. They saw a reduction of ecological problems like salinity and an increase in farm productivity. The family has great satisfaction in what they have achieved and derive many positive well-being benefits from experiencing the ever-increasing natural values on their property.

And it's these links between enhanced natural assets and other benefits – productivity and wellbeing – that Sustainable Farms aims to explore. The links between healthy farms, healthy farmers and healthy profits has huge potential for the ability of rural communities and wider society to work together to maintain and support natural assets on farms.

One of the great strengths of the Sustainable Farms initiative is that the team's field-based ecologists live and work in regional towns and are part of those communities, and have been throughout the ANU's long-term monitoring work. Recently, the team expanded to include engagement staff, also regionally based, who work directly with farmers and the Landcare network.

The engagement team strengthens the connection between farmers and researchers, ensuring that farmers' questions are addressed through the interdisciplinary research that Sustainable Farms undertakes. In turn, the engagement team enables the dissemination of research outcomes to farmers and to the Landcare and NRM community – by supporting a network of



IMAGE: BINDI VANZELLA

ABOVE: This unfenced dam in the south-eastern sheep wheat belt will be vulnerable to silt and nutrient build-up, as well as fouling by faeces and pugging.



IMAGE: CLARE CRANE

ABOVE: Rick and Pam Martin have undertaken significant planting at their property Burnbank, increasing tree cover from 2% to 14% of the property and supporting over 90 species of woodland birds. This fenced established planting has provided drought refuge for yellow-faced honeyeaters, which visited from more arid western parts of the state in winter 2018.

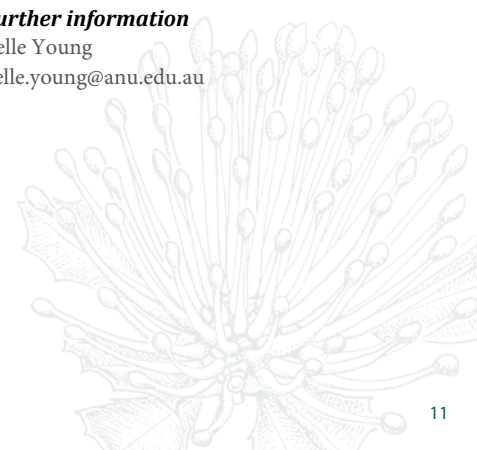
farmers, creating new tools and resources, organising field days and setting up peer-to-peer training.


A new Sustainable Farms research project is comparing improved and unimproved farm dams. Improved dams are fenced to limit stock access to one location, avoiding fouling of the dam, and banks are planted with a wide band of grass, trees and other vegetation to filter paddock run-off, shade the water, increase aquatic plants to enhance water quality, and improve biodiversity both within and surrounding the dam. The interdisciplinary research will look at the biodiversity outcomes of improved farm dams, but also whether they improve water quality and subsequently livestock health – a key question for many farmers.

With growing climate volatility and other pressures on the agricultural sector, it is increasingly important for people to work together across sectors, disciplines and regions, and this is what the Sustainable Farms initiative is about.

**For further information**

Michelle Young  
michelle.young@anu.edu.au





# FoxNet:

## A game changer for fox control

Red foxes (*Vulpes vulpes*) are one of the greatest threats to Australian mammals. They also pose a major risk to livestock and host numerous diseases that can affect humans. To combat these problems, Australia spends more than \$16 million per year on fox control, with much of that money directed to poison baiting. When programs aren't strategic, however, fox numbers can recover quickly from control. To help land managers get the best outcomes from their fox control investments, a collaborative project funded by the Threatened Species Recovery Hub and Victorian government agencies has developed a new fox population modelling tool. **Dr Bronwyn Hradsky** of The University of Melbourne led the project and is now working with agencies to apply the tool across Victoria. Here we discuss FoxNet and its applications.

ABOVE: A long-nosed potoroo.

When controlling foxes for biodiversity conservation, the aim is not to kill foxes but to protect native wildlife. Therefore, fox control programs need to be as strategic, effective and efficient as possible. Small-scale, patchy or one-off fox control programs will kill individual foxes but may have little effect on overall fox density, as new individuals move into the area to replace those that have been killed and can reproduce rapidly – a pair of foxes may have four or more offspring each year.

In some cases, fox activity or numbers may even increase following low-intensity control due to a compensatory increase in litter size.

### Outfoxing foxes

To plan fox control programs that effectively reduce fox densities, land managers need tools to help them understand how fox populations grow and behave and how these populations can best be managed. To meet this need, Bronwyn's team collaborated with the Victorian Government's Department of Environment, Land, Water and Planning and Parks Victoria to create a computer-based modelling tool called FoxNet.

FoxNet simulates fox populations across realistic landscapes, with different habitat types. It incorporates the foxes' territorial behaviour, seasonal breeding cycles and dispersal movements, and can be customised to local conditions by altering inputs such as fox home range size and the average number of offspring. Land managers can use FoxNet to model fox populations in landscapes without fox control, and to test

the effects of different bait station layouts, frequencies and timings on fox density. FoxNet can also be used to estimate the costs of these control programs, and so answer questions about optimal predator control designs at scales that are relevant to policy and on-ground management. FoxNet has been tested against real-life data on fox populations from landscapes as varied as English suburbs to Australia's

BELOW: A red fox (*Vulpes vulpes*) in the Otways.



IMAGE: MARK LE PLA

arid rangelands, with the aim of making it widely useful for conservation managers.

### Practical applications of FoxNet

FoxNet is now being used by government and non-government agencies to evaluate and plan fox management programs for conservation across Victoria. Applications for fox management in New South Wales are also being discussed. As Dr John Wright, Manager of Terrestrial Ecosystem Science at Parks Victoria, says, "This research collaboration will help us make sure our predator control efforts are designed to be put in the right places at the right times."

For example, FoxNet is being used by the Department of Environment, Land, Water and Planning through the Arthur Rylah Institute for Environmental Research (ARI) to analyse the efficacy of state-funded fox control programs. The analysis aims to provide insight into how fox control programs at different spatial and temporal scales affect fox density and identify how future programs could be designed to ensure the greatest conservation outcome from state investment.

Similarly, the Conservation Ecology Centre, ARI and Parks Victoria are using FoxNet to help develop best-practice cross-tenure fox control in the Otway Ranges. They have used the software to design an expansion of the Otway Ark, a 100,000-ha landscape-scale fox control program. The expansion will increase the size of the Ark by 20% across strategically selected public, private and state forest, helping protect threatened species such as long-nosed potoroos, southern brown bandicoots and dusky antechinuses from fox predation.

The FoxNet modelling framework has the potential to explore the effects of disturbances such as fire on fox populations. Future versions could also include competitor or prey species to predict complex responses to management. The researchers are currently in the process of adapting FoxNet to other invasive predators, such as feral cats.

### For further information

Bronwyn Hradsky  
bronwyn.hradsky@unimelb.edu.au

### Further reading

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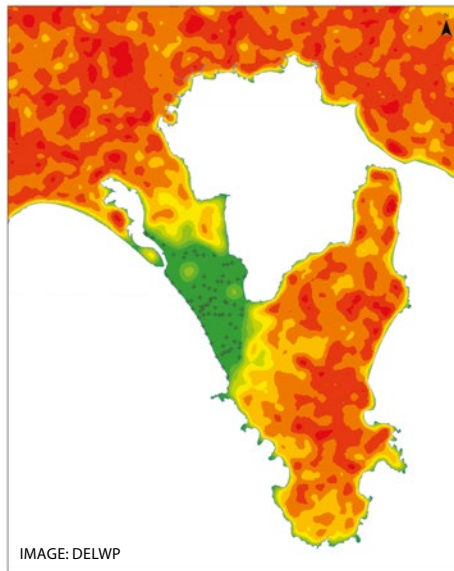


IMAGE: DELWP



IMAGE: LAUREN HALSTEAD

ABOVE: Conservation Ecology Centre ecologist Mark Le Pla handling a southern brown bandicoot.

LEFT: A map of predicted fox density for an area (red is high density, green is low) in response to a possible baiting strategy (crosses are bait stations).

BELOW: Camera trap image of a red fox in the Otways.



IMAGE: BRONWYN HRADSKY

Box gum grassy woodlands at Huon Hill in Wodonga, Victoria.

# Ecosystem accounting in agricultural landscapes

The box gum grassy woodlands once stretched across south-eastern Australia, but have been reduced to less than 5% of their former extent. Most of these woodlands now survive as small patches in agricultural landscapes, providing vital ecosystem services for both biodiversity and humans. Holly Vuong speaks with **Ann Kristin Raymer** and **Heather Keith** of The Australian National University (ANU) about their new research, part of ANU's Sustainable Farms, on developing ecosystem accounts for the woodlands to understand why this threatened ecological community is so valuable.

## The importance of woodlands in Australia's agricultural landscapes

Before the arrival of European settlers, south-eastern Australia was home to rolling landscapes of box gum grassy woodland, supporting a mix of yellow box, white box, and Blakely's red gum canopy trees, with shrubs, grasses and herbs in the understorey. This vegetation supported a plethora of birds, lizards, mammals and other wildlife. But historical land clearing for cropping and livestock led to the decline of this community. Coupled with processes such as intensive grazing, these changes have vastly reduced the extent of the woodlands and altered the ecosystem dramatically, leading to the loss of ecosystem condition and services. Environmental plantings and natural regeneration have the potential to restore ecosystem condition and services, but over a long time period.

These woodland remnants provide vital ecosystem services on farms, for example, improving water quality and water retention, minimising soil erosion, limiting flood damage, and boosting carbon storage. During periods of drought and hot weather, woodland patches also provide a refuge for wildlife.

Recent research shows this is especially important in cooler, wetter areas, where local species rely on shaded refuges during hot, dry weather – shade that is also critical for farm animals. As Australia's climate becomes hotter and drier, these woodland patches become increasingly important.

Creating incentives and opportunities that enable farmers to invest in woodland conservation and restoration is vital if we want to sustain agricultural production and conserve biodiversity. This requires mechanisms to quantify the extent, condition and value of woodland ecosystems to agricultural production as well as to broader human needs across the whole landscape.

## Accounting for our ecosystems

Ecosystem accounting provides a way to demonstrate how the environment is integral to our economy – both in the ecosystem services provided, and in the economic values they help deliver. Ecosystem accounts help show the range of values across a system and reveal the interactions between them. Using the globally recognised System of Environmental and Economic Accounting, these accounts will provide information that



IMAGE: LORRAINE OLIVER FLICKR CC BY-SA 2.0

Black-eyed Susan.

will help farmers, land-use planners, policy-makers, and agricultural investors make the decisions on how to balance environmental outcomes with the need for food production.

This research, conducted in partnership with The Australian National University's Sustainable Farms, aims to show the

economic contribution to agriculture from woodlands across the different types of land cover, land use and land tenure, and their interactions. These accounts will assess the extent and quality of remaining woodlands in terms of habitat for threatened species, and the ecosystem services related to climate regulation (e.g., carbon storage) and water supply. They will provide context for private landholders, natural resource managers, Landcare groups, communities and investors to better understand how retaining or restoring biodiversity can help support their goals, and when necessary make trade-offs between competing goals. Accounts for land cover and land use integrate a wide array of spatial and economic data from four states and territories.

Further investigation is aimed at distinguishing young regrowth and plantings from old growth remnant woodlands to help assess where gains and losses are occurring.

Protected native woodlands are important for carbon storage. Remnant woodlands with abundant large trees can store as much as 200 tonnes/ha while ecosystems with few large trees have limited carbon storage. Preliminary results on above-ground carbon from environmental plantings in the South West Slopes of New South Wales show an average of 43 tonnes/ha of stored carbon for plantings on ridges and upper slopes and 64 tonnes/ha on lower slopes and flats, where more water is available. Carbon stored in root systems and soils would add further to these estimates.

### How accounts can make for better business

Growing numbers of individual farm enterprises are integrating woodland conservation and vegetation restoration into their farming practices.



IMAGE: ALEX CRAIG

ABOVE: ANU field staff conducting a biodiversity survey on a pastoral property. Deploying sheet metal and railway sleepers aids the detection of reptiles and amphibians.

Ecosystem accounting can help quantify how these changes are contributing economically across whole landscapes. These accounts could help guide regulations and incentive schemes within policy and industry bodies, and inform how investors, banks and insurance companies direct their investments.

For example, current investment tools frequently exclude areas of retained vegetation when estimating the value of properties. Ecosystem accounts can help demonstrate how areas of woodland function as landscape assets, boosting the resilience of ecosystem processes to farm businesses.

Investors and financial institutions increasingly look to natural capital accounting to inform investment decisions, loan conditions, and insurance calculators. Ecosystem accounts can play a vital role in ensuring these decisions better reflect the biodiversity and the essential ecosystem services provided by woodlands.

### For further information

Michael Vardon  
michael.vardon@anu.edu.au

# Supporting land managers to help end extinction

## Private land manager profile

### Tell us about your organisation

I started Odonata in 2016 to find business-based solutions for protecting biodiversity. At that time we knew that we were fulfilling an important need but we are happily surprised at the way things have taken off.

Odonata designs and manages numerous successful threatened species recovery programs, often integrating them on productive farms. We select programs to apply business, efficiency and investment models to deliver financially sustainable long-term outcomes.

The programs and their models can take many different forms. One example is Tiverton, a 1000 ha working sheep property in western Victoria surrounded by a 6-foot-high feral-proof fence. Foxes, cats, hares and rabbits are now almost completely eradicated inside the fence. Once complete, threatened species such as the eastern barred bandicoot and eastern quoll will be introduced. While still operating as a commercial wool property it will contribute greatly to threatened species conservation by becoming Victoria's largest feral predator-free fenced conservation reserve.

### What Threatened Species Recovery Hub research have you been involved in?

The cornerstone and heart of our work is at Mt Rothwell Conservation Centre. This is a

## Nigel Sharp

Founder and Chair of Board  
Odonata Foundation

470 ha predator-proof sanctuary dedicated to protecting and restoring some of Australia's most endangered species populations, including through captive breeding programs.

A Threatened Species Recovery Hub project is supporting us to maximise the health and fitness of our threatened species through genetic management and profiling of populations, which is undertaken by scientists at The University of Melbourne.

Through the collaboration we have been working with Professor Ary Hoffman and Dr Andrew Weeks to undertake a genetic rescue program to improve the genetic diversity of mainland eastern barred bandicoots. The mainland animals had a small genetic pool and consequentially many genetic defects. An analysis determined that Tasmanian populations were genetically close enough to be integrated into the mainland population while also unique enough to diversify the mainland populations. The program has resulted in new and healthier bandicoots at Mt Rothwell that will be integrated into sanctuaries across Victoria, including at Tiverton.

Working with The University of Melbourne we have also established genetic markers for genotyping eastern quolls on the mainland. This new knowledge is guiding us in sourcing integral founding family lines and has resulted

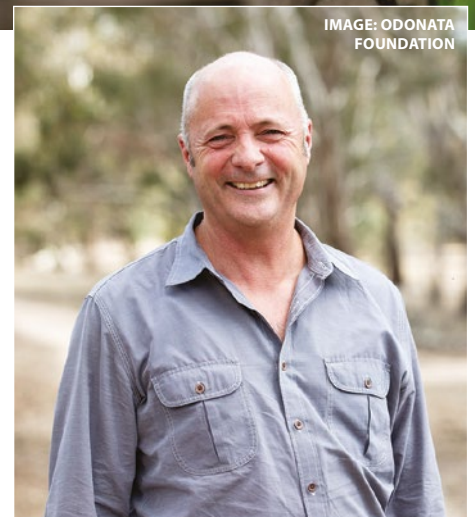


IMAGE: ODONATA FOUNDATION

Biodiversity entrepreneur Nigel Sharp.

in a significant expansion of the population into new introduction sites.

### Benefits of the collaboration

The partnership with the hub has been key to creating world-leading innovative solutions for our threatened species. Our joint focus is firmly on using our properties as research centres where Odonata and research partners can learn how to build the population size and health of our threatened species and landscapes both inside and outside the fence.

It gives us confidence that our captive breeding programs are producing the fittest and healthiest animals possible. It's this genetic diversity and health that are the foundation for successful reintroduction programs. Our collaboration with the hub has greatly increased the chance of these populations surviving and thriving.



## Private land manager profile

### Dr Alex Kutt

Senior Ecologist North Australia  
Bush Heritage Australia

#### Tell us about your organisation

Bush Heritage Australia is a national not-for-profit organisation committed to protecting Australia's natural environment. We own and manage 1.2 million hectares of private conservation reserves, and partner with Aboriginal people across a further 5 million hectares. Our network supports the conservation of over 200 species that are listed as rare or threatened under state or Commonwealth law.

Some of our largest reserves are in south-west Queensland, including our two Simpson Desert red sand jewels, and Pullen Pullen Reserve, arid braided Channel Country badlands home to the recently rediscovered and very rare night parrot.



ABOVE: A night parrot photographed at Pullen Pullen Reserve.

#### What Threatened Species Recovery Hub research have you been involved in?

We have been working with hub scientists to better understand and manage feral cats at Pullen Pullen in order to protect the night parrot, as cats are considered the main threat to the species.

Pullen Pullen is 56,000 ha. Controlling cats across such a vast landscape is extremely hard. Gains made by shooting, trapping and removing cats can quickly be undone as cats breed quickly and can travel far. Cat control is resource-intensive, so we need to be strategic.

A key part of the collaboration with the hub is focused on understanding patterns of feral cat activity around night parrot habitat. Since 2016 we have been monitoring feral cats with camera traps and sand plots. This revealed the significance of drainage lines for cat movement. Last year we began GPS-tracking feral cats, which is providing detailed knowledge about habitat use and distances travelled. The monitoring is enabling us to measure the effectiveness of different control strategies. We are collaborating with Professor James Watson, Dr Steve Murphy and PhD students Nick Leseberg and Stephen Kearney at The University of Queensland on this work.

A second part of the project is exploring a novel low-cost concept for reducing feral impacts. Some scientists believe that if dingoes are more prevalent they can mute cat activity. Working with Dr Tom Newsome and PhD student Emma Spencer from The University of Sydney at Ethabuka Reserve (away from the night parrot population)



IMAGE: BRIAN CASSEY

ABOVE: Dr Alex Kutt at Bush Heritage Australia's Yourka Reserve on Cape York.

they have been testing if carrion (dead kangaroos) can be placed to attract dingoes to an area and if that will in turn reduce feral cat activity.

#### Benefits of the collaboration

The importance of this work to Bush Heritage Australia cannot be underestimated. Science is vital to our conservation management and the partnership with the hub allows us to undertake applied and innovative science with leading Australian scientists.

Fundamentally, it is delivering practical science to support effective on-ground reserve management. Our feral predator management will now be more cost-effective and targeted, focused on the pinch-points of cat activity.

It has also given us the chance to properly test a promising-looking novel approach. We now know that using carrion to try and manipulate ecosystem processes conceptually looks neat but practically has flaws.

These research partnerships give us confidence, especially in this isolated new world where smart decisions using scarce resources will become more urgent and pressing.

IMAGE: RODNEY DEKKER

A view across part of Pullen Pullen Reserve, which is home to one of only three remaining known populations of the night parrot.

## Indigenous land manager profile

# Kanyirninpa Jukurrpa and Martu people

### Tell us about your organisation

Martu people have native title rights to over 13.6 million hectares of the Western Desert. Kanyirninpa Jukurrpa (KJ) is a Martu organisation that was established in 2005 to work with Martu to build strong, sustainable communities.

Our country programs manage the conservation of the natural and cultural assets on Martu country through the employment of nearly 300 Martu as Indigenous rangers working out of four communities.

### What Threatened Species Recovery Hub research have you been involved in?

Mankarr (greater bilbies) are important to Martu people and the Martu Determination is a stronghold for this species. KJ ranger teams worked closely with Anja Skroblin from The University of Melbourne to co-design a mankarr (bilby) monitoring program. The method uses Martu knowledge of mankarr ecology and traditional skills such as tracking. The data collected will enable ranger teams to detect changes to populations over time and will tell us about distribution and habitat health.

### How are you using the research?

The project has now finished but ranger teams are continuing to monitor the health of mankarr populations using the “Mantu mankarr search method”. Ranger teams have been doing the surveys since 2017 and the findings are already informing fire management in mankarr habitat.

We also collect feral animal information with the method, including cats and foxes,



IMAGE: ANJA SKROBLIN AND KJ

ABOVE: Jigalong women rangers point out a burrow.

and can use the data to decide if control is needed. Rangers using the survey method are finding active signs of mankarr right across Martu country. In addition, the ranger teams have been using motion sensor cameras to capture footage of the animals, allowing many younger Martu rangers to “see” a mankarr in the wild for the first time.

### What has been good about the collaboration?

Early on in this project, it was identified that a strong partnership with Martu needed to be created, where Indigenous interests and priorities were central.

This enabled Martu in all four communities to be active participants in the design of this monitoring program.

Important relationships were built with Martu throughout the project, as time to visit country to listen, learn and share was factored into the planning. KJ was also very fortunate that Anja understood the mutual benefits of Traditional Knowledge, in that it needs to be valued as equal to science, and there was a genuine exchange of this “two way learning”, which has created a more holistic approach in designing a mankarr monitoring program.

IMAGE: BERNARD DUPONT CC BY-SA 2.0



ABOVE: Mankarr (greater bilby).

IMAGE: ANJA SKROBLIN AND KJ



RIGHT: Mankarr tracks.

## Indigenous land manager profile

### Braedan Taylor

Karajarri Head Ranger  
Karajarri Indigenous Protected Area and Karajarri Rangers

#### Tell us about your organisation

I work for the Karajarri Rangers, who are directed by the Karajarri Traditional Lands Association. The Karajarri Indigenous Protected Area covers more than 32,000 square kilometres of jurarr (coastal areas) and pirra (inland areas). Our work is directed by our cultural leaders and Traditional Owners.

#### What Threatened Species Recovery Hub research have you been involved in?

Our Indigenous Protected Area is huge and access from the ground is hard, so we have been using aerial burning to manage fire over large areas. We want to see if this is helping wildlife, if the country is in good shape and if the fire management is working. This hub project helped us to work with partners to set up a monitoring program for pirra (desert shrublands) and marangurru (spinifex country). We have had two monitoring trips in 2019 so far. Unfortunately, we had to put our April trip on hold this year due to the coronavirus, but we are hoping to complete both monitoring trips later in the year.

#### How is this useful to Karajarri?

The monitoring work is showing us that as we get fire under control, and stop the big desert wildfires, there will be more grass cover and leaf litter on the ground, and also more small mammals and reptiles. We plan to do this monitoring work twice a year, at Edgars and Kulgara, for a few years, to really understand what fire does to the wildlife and to help us manage fire to keep country healthy.

#### What has been good about the collaboration?

For me it has been good to learn more about the bush tucker plants and to hear stories from Jacko, Karajarri's Head Woman Ranger. Also learning about reptiles and mammals from the scientists and ecologists working with us in the field. It's helping me to better understand the reasons in white fella way for us to do that burning we do. We also have reasons for burning culturally and that's why we as rangers are working with our old people and through that working with our partners to help us get out to remote pirra country for fire burning.



IMAGE: NICOLAS RAKOTOPARE

ABOVE: Braedan Taylor.

BELOW: Karajarri Head Woman Ranger Jackie Shoveller shared cultural knowledge about important plants such as nyaminyari (billygoat plum).



IMAGE: KARAJARRI IPA

BELOW: The monitoring is showing Karajarri Rangers that as they get fire under control, and stop the big desert wildfires, there will be more grass cover and leaf litter on the ground, and also more small mammals and reptiles.

IMAGE: SARAH LEGGE AND KARAJARRI



## Private land manager profile

### Tim Allard

CEO  
Australian Wildlife Conservancy (AWC)

#### Tell us about your organisation

AWC is a national not-for-profit organisation, with a mission to effectively conserve Australian wildlife and their habitats. We currently manage – alone or in partnership – 6.6 million hectares across 30 locations. In addition to employing a large ecological and land management team, we also collaborate with a range of government agencies, Indigenous groups and other conservation groups to deliver our mission.

We are leading the reintroduction of threatened mammals to sites within their former ranges, with active programs at 10 sites, including seven fenced feral predator-free areas and one island. These sites currently support a dozen nationally threatened mammals, with additional species to be added to our network in the next few years.

While we own most properties we manage, we also deliver land management, reintroductions and science programs for other groups, such as the Department of Defence and national parks agencies. We have also partnered with Dambimangari and Wilonggin Aboriginal Corporations to conduct joint land management and science programs in the Kimberley.

We collaborate with other conservation NGOs through the Australia Land Conservation Alliance and in on-ground work.



IMAGE: WAYNE LAWLER/AWC  
ABOVE: Tim Allard at the feral predator-proof fence built in the Pilliga Conservation Area in a partnership between AWC and the New South Wales Government.

#### What Threatened Species Recovery Hub research have you been involved in?

I am a member of the hub Steering Committee, helping provide oversight to the research program. AWC is also a formal partner in the hub, the only non-university partner, reflecting our significant science capacity.

A key feature of AWC is our investment in science – at present, we employ 60 qualified ecologists to provide the information base to inform conservation management on our properties. Our ecologists work with our land managers to deliver conservation programs, helping design, implement and report on fire management, weed and feral animal control, and reintroduction and restoration projects.

Australia’s wildlife is part of our national identity, important to all of us, with a particular meaning for our Indigenous people. It is critical that, as a nation, we reverse the tide of extinctions that has affected our wildlife. This requires developing our understanding of the factors that drive species decline and ways to mitigate these threats. AWC’s research projects in the hub aim to provide information to improve the

outcomes of reintroductions, and to improve control of feral cats and foxes, with the ultimate goal of allowing reintroduction of threatened species outside fenced areas into the wider landscape.

We also host a number of other hub researchers studying threatened species across our site network.

#### Benefits of the collaboration

While AWC invests heavily in science, we are nevertheless constrained by our capacity in relation to the size of the challenge. Reversing the tide of extinctions requires a massive national effort, partnering high-quality science with dedicated conservation management. AWC’s involvement in the hub has given us access to a diversity of expertise in many fields relevant to conservation, from genetics and statistics through to thermoregulation and drones with thermal cameras. It has also been valuable for our ecologists to collaborate on research projects with the broader scientific community, while focused on the common objective of saving Australia’s wildlife.



IMAGE: WAYNE LAWLER/AWC  
ABOVE: Tim Allard and Grace Hornstra releasing a bilby.



A numbat.

IMAGE: WAYNE LAWLER/AWC

## Private land manager profile

### Mark Robb

Environmental Compliance and Biodiversity Officer  
Coleambally Irrigation Cooperative Limited

#### Tell us about your organisation

Coleambally Irrigation Cooperative Limited (CICL) is a member-owned cooperative which supplies irrigation and corporate services to our 295 members and other customers.

We provide irrigation and drainage services to nearly 500 farms in the Murrumbidgee Valley in the Riverina region of New South Wales. Collectively these farms equate to around 450,000 ha of land owned by 350 businesses.

Our cooperative holds a number of water access licences with the New South Wales Government and accesses a regulated surface water supply from the Murrumbidgee River upstream of Gogeldrie Weir. We manage over 1200 km of water supply and drainage channels in the region, and help organise and facilitate the delivery of environmental water to significant wetlands.

Our irrigators grow a mixture of summer and winter irrigated crops with cotton, rice and corn being the main summer crops. I've been with CICL for over 25 years.

#### What Threatened Species Recovery Hub research have you been involved in?

CICL is a donor and partner of the Bitterns in Rice Project. The project is a joint effort between rice farmers and conservation scientists to help the strange and Endangered Australasian bittern. Each year between 500 and 1000 bitterns descend on the rice crops in Coleambally and other parts of the Riverina to breed. This is remarkable as it is around half of Australia's total population of the species and it is estimated that there are only 1500-4000 remaining in the world. CICL has been working with the Bitterns in Rice team to monitor bittern breeding in our area and to help develop recommendations for bittern-friendly rice farming.

#### What has been good about the collaboration?

It has definitely been an amazing learning experience and a great journey for me. I also believe it has opened many eyes in the local and wider community by highlighting the vital yet simple role that rice growers



IMAGE: MATT HERRING

Mark Robb with an Australasian bittern.

and irrigators can play in providing critically important habitat requirements on-farm for a threatened species.

#### What has it changed?

I've found this ecological research has changed the topics of discussion when I meet with local farmers these days. While the water price or water allocation are the highest priority, most will have something to say about bitterns or frogs and various other wildlife on their farm. It's definitely a much more interesting conversation than it was 20 years ago. My involvement in the project has now given me added confidence in promoting it and I look forward to the next phase.

BELOW: Australasian bittern chicks in a rice field.

IMAGE: MATT HERRING



## Researcher profile

# Matt Herring

## Seeking common ground for water

More than 60% of Australia's land mass is managed by farmers, and they are custodians for thousands of natural and agricultural wetlands. Working on private land offers a challenging but rewarding career for a researcher.

My journey with threatened species conservation on private land began in the late 1990s. Living in Albury-Wodonga, I became deeply interested in the broilga population to the west and ended up doing my honours on them at Charles Sturt University. It was a positive and formative experience, and taught me how landholders can be vital for wildlife conservation and that we need to work together. Previously, I'd thought conservation was all about national parks and that farmers were the enemy. I was still in my early twenties and apparently an expert in waterbirds and wetland conservation. I remember thinking at the time that if I'm already considered an expert then the state of our knowledge and capacity for conservation needs some serious attention. Landcare groups and government agencies began asking me to do research and community engagement, and so I was nudged into starting my own consultancy.

### Community wildlife surveys

I spent much of the next decade coordinating community wildlife surveys across the Murray catchment. These focused on engaging farmers and raising awareness about local biodiversity, as well as getting new information on wildlife distribution and habitat associations. I got a real kick out of showing a landholder their first squirrel glider and revealing they had a rare gecko down the back, or that their wetland supported six different bat species and the near-mythical Australian painted snipe. Witnessing their new appreciation of fallen timber, shrubs or farm dams was immensely rewarding. I surveyed hundreds of farms, and conducted more field days than I can remember. I made the classic error of young professionals, in taking on too much.



IMAGE: CHRIS PURNELL

Matt Herring looking for Australasian bitterns in a rice crop.

I was beginning to burn out, and then came the final throes of the millennium drought. It was depressing. I was living and working out near Barham, mapping wetlands for environmental water prioritisation, and meeting with landholders who were at their wits' end. I was acutely aware of the increasing tension between irrigators and environmentalists. The divisive public debate pained me.

### Bitterns in Rice

In 2012, an opportunity arose for targeted work on one of my favourite birds, the Endangered Australasian bittern, on rice farms. I ran with it and the Bitterns in Rice Project began to epitomise my ideals of ecologists working alongside farmers to simultaneously produce food and conserve biodiversity. At times I've felt I'm in training for an imaginary profession: the ecological agronomist. After about four years, I was lured into doing a PhD on bittern-friendly rice-growing with Charles Darwin University, supported by the Threatened Species Recovery Hub. I've enjoyed broadening my horizons, formally embracing social science and economics. Another key motivation was to address my terrible track record of getting papers written up.

The narrative of a false dichotomy between farming and the environment lingers, but we are demonstrating ways of finding common ground, even with something as contentious and polarising as water resource management. I now have a few grey hairs, and soon I'll work on my 1000th farm. Reflecting on this imminent milestone, I wonder how many gates I've opened and shut, and how many cups of tea I've had against my will. (I don't like tea.) But the warm hospitality of the farmers I work with is something I'll always treasure, and I'm learning just as much from them as they are from me.

### For further information

Matt Herring  
mherring@murraywildlife.com.au



# Wineries for ringtails

RIGHT: Passel Estate winery is actively contributing to conservation for the western ringtail possum.

INSET: Western ringtail possum.



The home of the western ringtail possum is also home to one of Australia's most iconic wine regions – the Margaret River Region of south-west Western Australia. Winery businesses in Margaret River are combining their passion for wine-making with an appreciation of the local natural values and throwing their support behind a Threatened Species Recovery Hub project that seeks to harness citizen science for the protection of a local threatened species, the western ringtail possum. Project leader **Rochelle Steven** raises a toast to these citizen science pioneers.

This hub research project based in the south-west of Western Australia has been demonstrating that the private sector can and does have a significant role to play in direct actions for threatened species like the western ringtail possum. The kinds of direct actions are varied and worthy, and can include providing habitat, raising public awareness and supporting citizen science initiatives to acquire new knowledge about the species.

The vineyard and winery region of Margaret River is scenic and expansive, with grapevines lining many of the highways and main roads. The landscape is vastly different to what it would have been before European arrival, yet it is still picturesque. Additionally, there is a general ethos among the community of how important it is to conserve the natural values that draw tourists to the region.

## Wineries and citizen science

Two wineries in the Margaret River Region, Passel Estate and Wills Domain, are actively contributing to this possum conservation project.

Passel Estate has designated the creek-line habitat that runs through their property as a conservation sanctuary, while Wills Domain aims to connect two patches of habitat on their property that also follow a natural waterway. Once connected, this corridor will provide a large tract of habitat for the ringtail, as well as for many other native species.

These two family-owned operations in the Margaret River Region are leading the way in raising awareness among their patrons about the importance of the natural environment for their business and for the possums.

Indeed, Passel Estate will soon commence interpretive tours in their conservation sanctuary to share information about the ringtails and other species that call the property home.

Raising awareness of the western ringtail possum and encouraging people to contribute to citizen science for the species are just the beginning of what private business can do for the conservation of our unique fauna. Conservation and business can go hand-in-hand and, as these two innovative wine-making families have shown, they can even enhance each other's existence.

## Get involved

Another way that people and businesses in the region can help the western ringtail possum is through submitting sightings of the western ringtail and other possums through the CAUL Urban Wildlife App: <https://nespurban.edu.au/platforms/caul-urban-wildlife-app/> and by raising awareness of the app.

*The Threatened Species Recovery Hub acknowledges Wills Domain, Passel Estate and South West Catchments Council for their contribution to this project.*

## For further information

Rochelle Steven  
r.steven@uq.edu.au

LEFT: Suzanne Strapp from FAWNA Inc. with Rochelle Steven at Wills Domain, after planting new western ringtail possum habitat plants.



Clare with an eastern long-necked turtle caught in a farm dam during sampling

# Clare Crane

## Where farming meets conservation

Clare is a Biodiversity Field Officer with the Australian National University's Sustainable Farms project. She tells us how she came to this role after an early life on farms in the UK, some bullet-dodging and globe-trotting.



IMAGE: MASON CRANE

I grew up on small livestock farms in England and Scotland surrounded by animals, which sparked my love of nature and passion for its conservation.

After an Honours degree in zoology at University College London, my ecological career started at an outdoor centre. There, I took students out to study the flora and fauna living in and around the somewhat fragrant intertidal mudflats and freshwater ponds near Portsmouth, England. After a Masters in Conservation Management I worked as an ecologist on the UK army training areas. My research thesis field work involved evenings and early mornings rapidly clearing small mammal traps in lowland heath before live-firing commenced on the range.

Since then my successful bullet-dodging and rather nomadic existence has led me to follow opportunities around the world. I have worked as a wildlife statutory consultee in Scotland, a conservation volunteer in the UK, Cyprus and Victoria, and an ecological consultant in England and Melbourne. I first came to Australia as a volunteer with Parks Victoria in 2005, when my curiosity for marsupials and Australia got the better of me. I was rewarded by working with some fantastic people and researchers who conserve and monitor native wildlife all over Victoria.

### From wildlife to sustainable farming

I am now a Biodiversity Field Officer with the Australian National University's Sustainable Farms project (see p10) based in the Riverina Local Land Services Office in Wagga Wagga, and it could not be further from my early beginnings as an ecologist muttering profanities beneath tables while grabbing shorecrab bucket-escapes in Portsmouth.

I manage three of Professor David Lindenmayer's long-term woodland farm monitoring projects. The South West Slopes Restoration Study monitors and compares the effects of planted, regenerating and remnant native woodlands on farm biodiversity. The Nanangroe Natural Experiment investigates how farmland conversion to pine plantations affects former woodland biodiversity. The Adjungbilly Creek Project studies riparian woodland biodiversity on farms, with a particular emphasis on the Endangered booroolong frog (*Litoria booroolensis*).

The farm dams cross-sectional pilot study is looking at water quality and associated macroinvertebrates. It is really encouraging to see how many farmers are keen to be involved.

I enjoy this work and the opportunities it gives me to meet a wide range of farmers, agri-stakeholders and researchers, and to learn about their approaches and aspirations for farming and conservation. Working with Sustainable Farms has introduced me to farming practices I was not even aware of, and our field days attract all kinds of people with interesting stories and learnt experiences.

Our farm woodland projects monitor arboreal mammals, herpetofauna, birds and vegetation over time on a landscape scale and are a great way for me to use and share my skills in flora and fauna identification and ecology, and learn from highly experienced colleagues and farmers. It is never tiring to find any animal through active searching, rare or not, and I get to talk to passionate land managers and admire the views from their farms at sunrise and sunset.

I have been submerged in farming and nature for most of my life and realise that this is where I feel most at home and animated, irrespective of climate and continent.

### For further information

Clare Crane  
clare.crane@anu.edu.au

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[www.nespthreatenedspecies.edu.au](http://www.nespthreatenedspecies.edu.au)

COVER IMAGE: AN AUSTRALASIAN BITTERN.  
(SEE PAGE 8 FOR THE FULL STORY.) IMAGE: MATT HERRING

### Science for saving species

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Editor: Jaana Dielenberg  
j.dielenberg@uq.edu.au

Science Communication Officer: Kate Donnelly

Graphic Designer: Mary Cryan

