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Bringing back the Northern Bettong

Contents

- 4 Homecoming planned for endangered Northern Bettongs
- 8 Developing a robust climate change strategy to meet our future conservation challenges
- 12 The road to recovery: supporting wildlife in the wake of the megafires
- 16 “Give us the tools and we’ll finish the job.” It’s war on cats and foxes at Mt Gibson Wildlife Sanctuary
- 22 Biodiversity bonanza at Bullo River Station
- 24 15 years of research reveals secrets of rare Purple-crowned Fairywrens
- 26 Effectively managing fire in Australia’s wild north east
- 28 Triumphs and challenges at NSW national parks
- 30 Celebrating a decade of conservation partnership at North Head
- 32 Future-proofing conservation in Australia: training the next generation of conservation scientists
- 34 Harnessing Artificial Intelligence to deliver more effective conservation

For reference lists see online articles
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Cover image:
Endangered Northern Bettong *Wayne Lawler/AWC*

Australian Wildlife Conservancy

PO Box 8070
Subiaco East WA 6008
Ph: +61 8 9380 9633
www.australianwildlife.org



The mission of Australian Wildlife Conservancy (AWC) is the *effective* conservation of all Australian animal species and the habitats in which they live.

To achieve this mission our actions are focused on:

- Establishing a network of sanctuaries which protect threatened wildlife and ecosystems. AWC now owns, manages or works in partnership across 30 locations, spanning more than 6.5 million hectares (16.1 million acres).
- Implementing practical, on-ground conservation programs to protect wildlife. These programs include feral animal control, fire management, weed eradication and the translocation of threatened species.
- Conducting (either alone or in collaboration with other organisations) scientific research that will help address the key threats to our native wildlife.
- Hosting visitor programs at our sanctuaries for the purposes of education and promoting awareness about the plight of Australia’s wildlife.

About AWC

AWC is an independent, not-for-profit organisation with its head office in Perth, Western Australia. Donations to AWC are tax deductible.

Over the last 10 years, around 86 per cent of AWC’s total expenditure was incurred on conservation programs, including land acquisition, while only 14 per cent was allocated to development (fundraising) and administration combined.





CEO MESSAGE

As 2020 draws to a close, we reflect on what a tumultuous year it has been. Australia is a land of extremes: large-scale, catastrophic bushfires; drought conditions over large parts of the country; floods and severe weather conditions elsewhere. While fire, floods and drought are part of the rhythm of the Australian landscape, the additional impact of COVID-19 has tested the resolve and resilience of us all.

Like every other organisation in Australia, AWC had to assess the impact and challenges of COVID-19. I'm proud to say, the AWC team has faced them head-on. We pre-empted Government-mandated restrictions and made some tough decisions to ensure AWC's sanctuaries were safe, secure and sufficiently resourced to see out the lockdown period and continue the important work of science-informed land management.

We mobilised helicopters, staff, Indigenous rangers and supplies to our Charnley River Sanctuary in the Kimberley where the team remained in isolation for eight weeks in order to successfully deliver prescribed burning across 6 million hectares.

We implemented protocols that saw Mala safely translocated from Scotia Wildlife Sanctuary in western NSW to the Newhaven Stage 1 (9,450 hectare) feral-free enclosure in the Northern Territory.

In a mammoth effort, we achieved feral predator-free status for the 9,570 hectare Mallee Cliffs National Park enclosure, creating the largest such refuge on mainland Australia, and triggering an ambitious program of reintroductions that will see a suite of regionally-extinct species like Numbats, Bettongs, Quolls and Red-tailed Phascogales restored here.

Across the continent, AWC's land managers and ecologists have also managed fire, feral animals and weeds, maintained infrastructure, conducted research and monitoring programs and, excitingly, developed innovative technology solutions to support our field ecology programs.

COVID-19 has reminded us that our mission – the effective conservation of all Australian wildlife and the habitats in which they live – has never been more important. AWC's work is critical for ensuring the survival of many of our threatened species. While the near future is uncertain for all of us, at AWC we remain steadfastly focused on achieving our mission.

We also look forward to 2021 when we will celebrate 30 years of AWC's journey, which traverses the inspiring legacy of our founder, Martin Copley, who first established Karakamia Wildlife Sanctuary on the outskirts of Perth, to our status as one of the world's largest conservation organisations, delivering science-informed land management across more than 6.5 million hectares on land we own or manage in partnership.

I consider AWC to be a family, and I hope that you, through your support and connection with AWC, feel as much a part of the family as I do.

Have a safe and merry Christmas – and thank you for your support during one of the most tumultuous years in generations.

Tim Allard
Chief Executive



AWC has restored crucial habitat in preparation for the return of the Northern Bettong to Mount Zero-Taravale Wildlife Sanctuary. *Joey Clarke/AWC*



Homecoming planned for endangered Northern Bettongs

By Dr Alexander Watson, North-east Regional Ecologist

The survival of Australia's Northern Bettong (*Bettongia tropica*), a tiny, nocturnal macropod, hangs in the balance. Its population once extended from central Queensland to the Wet Tropics, but since European colonisation, its distribution has collapsed. The species is confined to a narrow band of tall, fire-dependent eucalypt forests and woodlands adjacent to the rainforests in North Queensland. Only two small populations remain – estimated at fewer than 1,000 individuals in the Lamb Range area, and as few as 100 on the Mount Carbine Tableland. Sadly, the Northern Bettong has made it into the list of Australia's 20 mammal species at greatest risk of extinction.

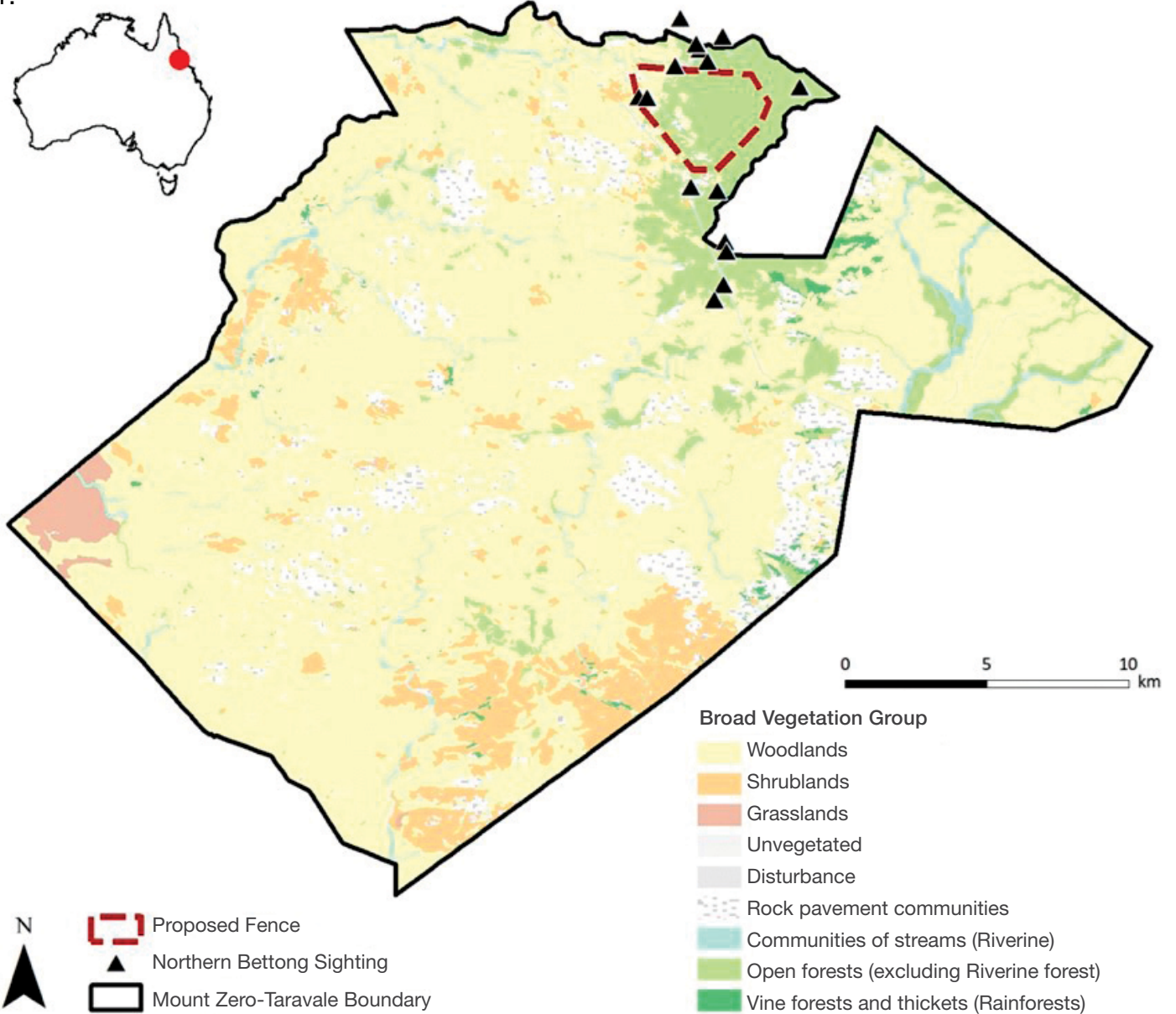
The loss of the Northern Bettong would be a tragedy for conservation and may have long-term negative consequences for the ecological communities of which they are a part. The bettongs eat a diversity of ectomycorrhizal fungi that form symbiotic relationships with eucalypts and other tree species, dispersing the spores and delivering an important ecosystem service.

Key threats to survival

It is hard to imagine that the success of rainforest plants invading neighbouring eucalypt forests and woodlands is contributing to the loss of the Northern Bettong and to Australian biodiversity in general. Yet, in parts of North Queensland, the lack of regular fire leads to a transition from open eucalypt forests to rainforest. In the new ecosystems, many species, such as the predatory Northern Masked Owls (*Tyto novaehollandiae kimberli*), and arboreal mammals such as Yellow-bellied Gliders (*Petaurus australis*) that rely on the eucalypts, will eventually decline and disappear.

The plight of ground-dwelling species such as the Northern Bettong is particularly dire in these open eucalypt forests. This is not only due to rainforest invasion but also predation by feral cats and, potentially competition with feral cattle.

1.



Please help save the endangered Northern Bettong from extinction.

\$100 will buy one fence strainer.

\$350 will buy materials for 10 metres of electrified, feral-proof fencing.

\$1,000 will buy 10 special traps for catching Northern Bettongs.

Images

1. Map showing the proposed feral predator-free fenced area and sightings of Northern Bettongs before the species went locally extinct in 2003.

2. The endangered Northern Bettong will be restored to its former home at Mount Zero-Taravale. To re-establish the population, AWC will draw on knowledge gained in the delivery of Australia's most extensive wildlife reintroduction program. *Wayne Lawler/AWC*



2.

Northern Bettong Recovery Team

Australian Wildlife Conservancy is taking action to conserve the species. AWC is a long-standing member of the Northern Bettong Recovery Team, working with Traditional Owners and Rangers from Wadjanbarra Tableland Yidinji Aboriginal Corporation, Gugu Badhun Aboriginal Corporation, Western Yalanji Aboriginal Corporation, Djabugay Aboriginal Corporation and Giringun Aboriginal Corporation, as well as Queensland Parks and Wildlife Service representatives, scientists from the Wet Tropics Management Authority, and local landholders. Together, we have developed a bold plan to re-establish a population of the species at AWC's Mount Zero-Taravale Wildlife Sanctuary, north-west of Townsville.

Establishing a safe haven at Mount Zero-Taravale

Northern Bettongs were once found at Mount Zero-Taravale but are thought to have disappeared from the property around the time it was acquired by AWC in 2002-03. As part of the land management program implemented over the last 18 years, AWC has removed grazing animals, controlled weeds, and re-established appropriate fire regimes. The open grassy understorey of the tall eucalypt forests, key habitat for the Northern Bettong, is making a positive recovery through these efforts, as well as through a targeted program aimed at reducing 'woody thickening' and rainforest invasion.

To secure the future of the species, AWC will build a feral predator-proof fence around 950 hectares of this key habitat to create a safe haven for the Northern

Bettong, as well as a suite of other native species at risk of predation by feral cats.

Delivering a great ecological 'return' on investment

The overarching conservation outcome for the project is the re-establishment of a secure, genetically viable population of Northern Bettongs. This project is expected to generate a significant ecological 'return' on investment: based on AWC's experience with similar species, we expect that the founding population (predicted to be 30-50 individuals) will increase to more than 500 individuals over five years within the fenced area. This represents a 50 per cent increase to the total global population of the species. Such a population boom can occur because Northern Bettongs are non-seasonal breeders, capable of producing up to three young per year when conditions are favourable.

Re-establishing these animals will help to restore ecological processes, particularly dispersal of ectomycorrhizal fungi. AWC will undertake research to assess how the Northern Bettong influences the ecology of the broader open eucalypt forest ecosystem.

Through the generosity of AWC supporters and a grant from the NSW Wildlife Information Rescue and Education Service (WIRES), we plan to bring Northern Bettongs back to the tall open forests of Mount Zero-Taravale next year. Significantly, this will be the first time AWC has extended its network of feral predator-free areas and endangered mammal reintroduction program into northern Australia.



AWC is a national leader in translocations and the implementation of ecological monitoring, making us uniquely placed to act rapidly when wildlife is threatened. *Colin Leonhardt/AWC*

Developing a robust climate change strategy to meet our future conservation challenges

By Dr John Kanowski, Chief Science Officer, and Dr Michael Smith, South-west Regional Ecologist

As a conservation organisation, Australian Wildlife Conservancy's mission is to protect Australia's wildlife and their habitats. We do this by acquiring land and managing threats with a focus on wildfire, feral animals and weeds. Where a property has experienced environmental degradation, we aim to restore plant and animal assemblages and long-standing ecological processes, such as the fire regime.

The word 'conserve' comes from the Latin 'to keep', but what do we do when the fundamental ecological drivers associated with ecosystems and species on a property themselves undergo change? This is the challenging issue we face as climate change exerts its influence on the species and places for which we are responsible.

Although the scientific basis for climate change has been largely established for decades, societal acceptance of the importance of the issue and the urgency for action has been delayed. As a result, emissions of greenhouse gases have continued to increase, making it likely that average global temperatures will rise 1.5 degrees Celsius above pre-industrial levels by as early as 2025 (World Meteorological Organisation, United in Science report). Ongoing changes in temperature, rainfall and evaporation will fundamentally alter the suitability of ecosystems for component species. More dramatically, changes in average conditions greatly increase the likelihood of extreme events, such as the drought and heatwaves that contributed to the 2019-20 wildfires in south-eastern Australia, with severe consequences for conservation.

Modelling impacts of climate change in south-west Western Australia

AWC manages four properties in south-west Western Australia: Karakamia, Paruna, Mt Gibson and Faure Island. The region is one of the most sensitive in Australia to climate change. Over the last century, average temperatures have increased by one degree

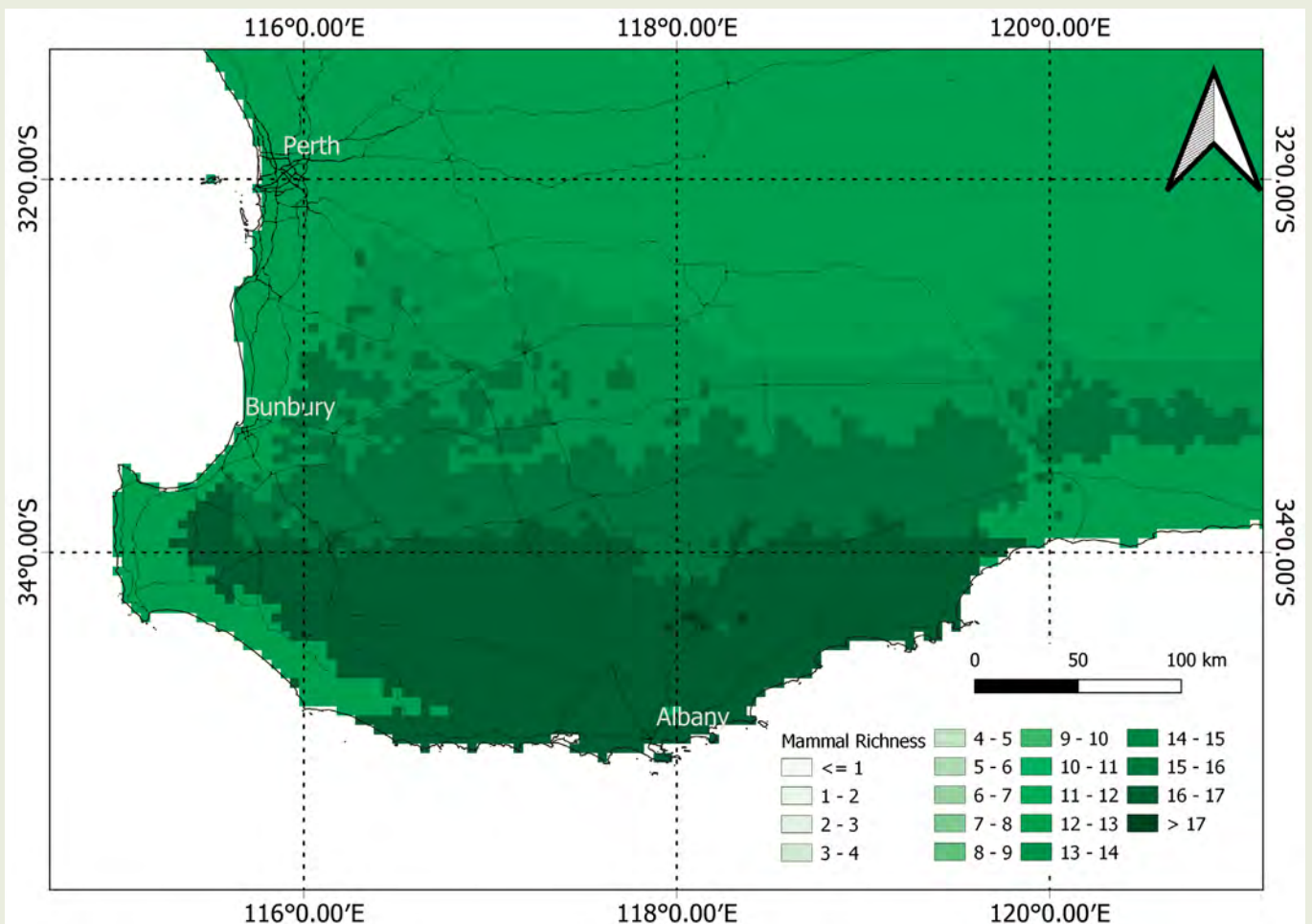
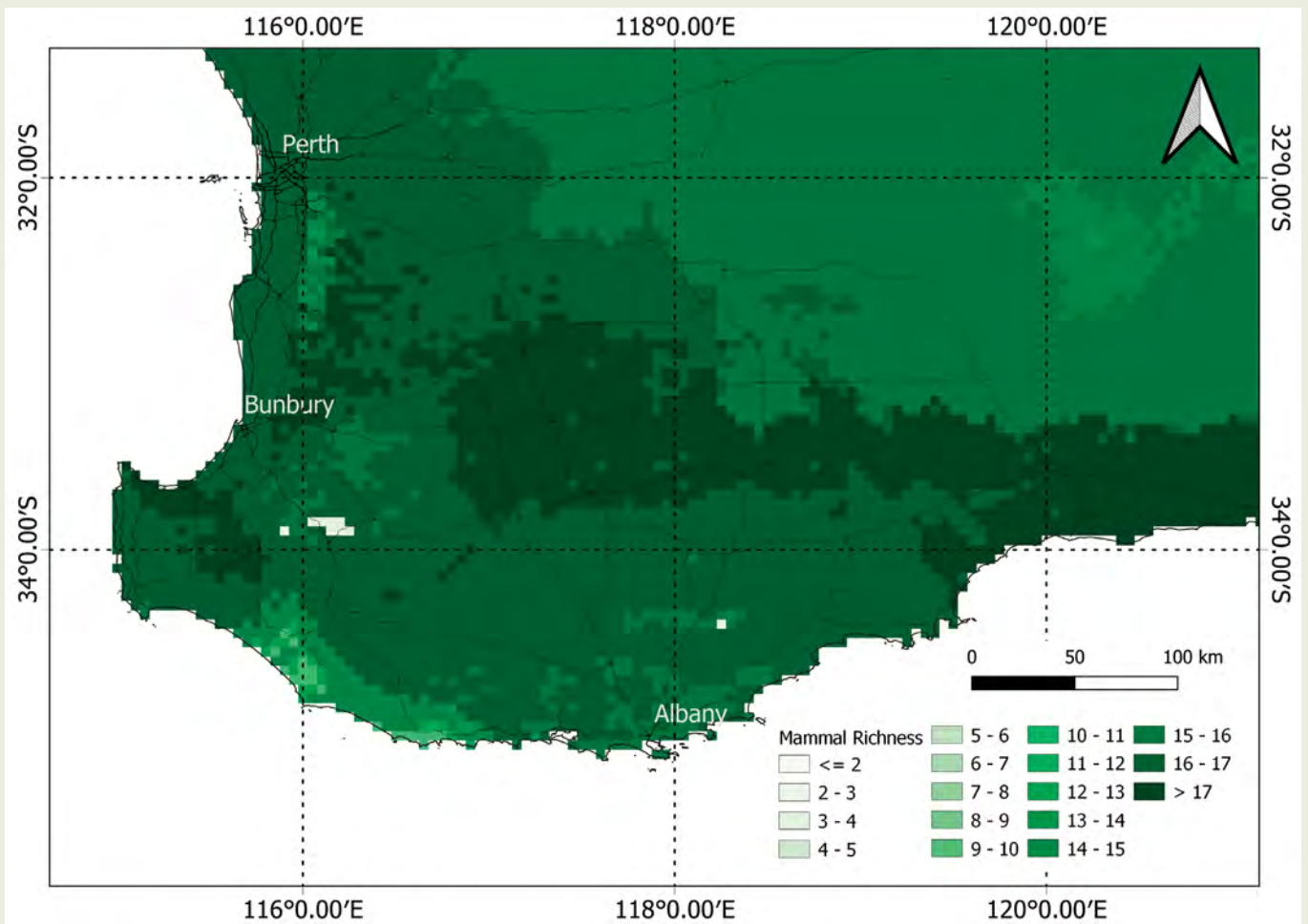
Celsius, rainfall decreased by up to 20 per cent and streamflow dropped by 85 per cent in the region (Climate trends in Western Australia, WA Department of Primary Industries and Regional Development). Rainfall zones have moved towards the coast; inland areas have become progressively drier (see map on page 11). These trends are predicted to accelerate in coming decades.

As rainfall and temperature are fundamental aspects of habitat, we can expect these changes to reduce the suitability of south-west Western Australia for species that prefer mesic (wetter and cooler) conditions, while favouring arid-adapted species. As many species are endemic to the mesic south-west, the net result is a predicted decline in species richness. For example, the maps on page 10 show habitat suitability for threatened mammals is predicted to contract to the far south-west of the region by 2070. Mesic-adapted species such as Gilbert's Potoroo are predicted to lose all their current habitat in a future climate.

What can AWC do to respond to climate change?

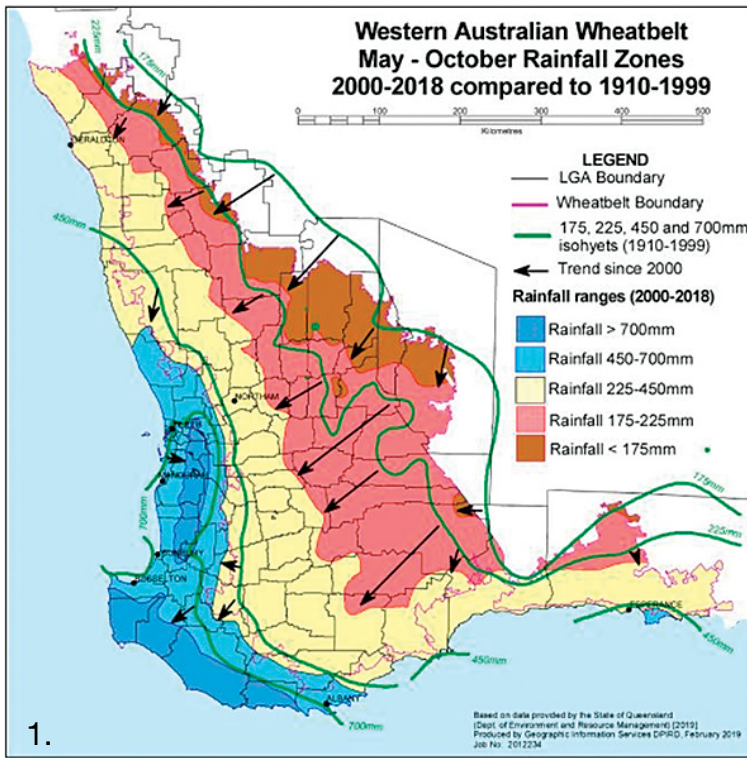
AWC scientists are increasingly aware that we need to develop a robust climate change strategy to meet the challenges of conservation in the 21st century. While we have just started on this journey, we envisage the strategy will consider the following issues:

- Understanding the impacts of climate change on our current properties, their species and ecosystems, and major projects such as reintroductions. One example of the work required is the climate modelling presented on page 10. A more comprehensive reckoning requires understanding how climate change may directly and indirectly impact the distribution, abundance, dynamics and interactions of species and ecosystems. This task is challenging, because we know so little of the ecology of most of our native wildlife.



Maps of predicted species richness of threatened mammals in south-west Western Australia: Top – early 1900s; bottom – in 2070.

Species climate envelopes modelled from data presented in Woinarski et al. (2014) using average rainfall and average minimum and maximum temperatures 1911-40; 2070 climate modelled under the RCP8.5 emissions scenario and the CESM1-CAM5 model: see <https://www.climatechangeinaustralia.gov.au/en/climate-projections/explore-data/map-explorer>. Data analysis and mapping by Michael Smith.



1.



Department of
Primary Industries and
Regional Development

© Government of Western Australia, 2019



2.

Images

1. Migration of rainfall zones in south-west Western Australia in 21st century. Source: <https://www.agric.wa.gov.au/climate-change/climate-trends-western-australia>.

2. As the climate and environment change, robust ecological monitoring will be of vital importance for wildlife conservation. *Wayne Lawler/AWC*

- Incorporating climate change predictions in evaluations of new projects. For example, if we want to implement a project to protect a particular species, we need to understand how climate change might affect the distribution of that species. Again, the challenge lies in having sufficient understanding of the ecology of species to make detailed predictions of impacts.
- Given the above, we need to plan and implement mitigation measures to conserve our species and ecosystems through the changing climate.

What are we doing now?

While we work on developing our strategy, we can still implement the conservation actions we know will help our native wildlife, such as good fire management and feral animal and weed control. These actions help build populations, maintain genetic diversity and, hence, adaptive potential in our native species. However, whether this will be enough is unknown; for some species, the environmental conditions in their current location may simply become uninhabitable under climate change. In these cases, translocation of species to a cooler or wetter climate may be required.

As a national leader in reintroductions, AWC is well placed to undertake translocation projects and provide advice to others in the conservation community, as

this need arises. AWC is also a national leader in the implementation of ecological monitoring on our conservation estate, with our Ecohealth program tracking the status and trends of key conservation assets and threats on our properties.

As climate change starts to bite, ecological monitoring will become increasingly important, providing information on how species are tracking in response to changed conditions, and early warning to managers on when to act.

Doing our bit

Recently, AWC's Science Coordinator, Dr Fay Lewis, worked with Chief Finance Officer, Andre van Boheemen, to audit our carbon footprint. In summary, we estimate that AWC activities generate 2,000 tonnes CO₂-e per annum, predominantly due to transport. However, the fire programs we implement across northern Australia conservatively abate 100,000 tonnes CO₂-e per annum through the reduction in wildfire. Additional sequestration is achieved through revegetation programs on Karakamia, Paruna and Dakalanta, and additional abatement through the removal of feral herbivores from large parts of our estate. Based on this analysis, AWC programs make a substantial direct contribution to mitigating climate change.



AWC wildlife ecologist Dr Manuela Fischer at Kewilpa, a conservation property in north-east NSW owned by the South Endeavour Trust. AWC's strong focus on ecological monitoring enabled the team to respond rapidly in the wake of the megafires, undertaking urgent targeted surveys and providing strategic advice. *Wayne Lawler/AWC*



The road to recovery: supporting wildlife in the wake of the megafires

By Dr Viyanna Leo, Wildlife Ecologist, and Dr Hannah Sheppard-Brennand, Science Communicator

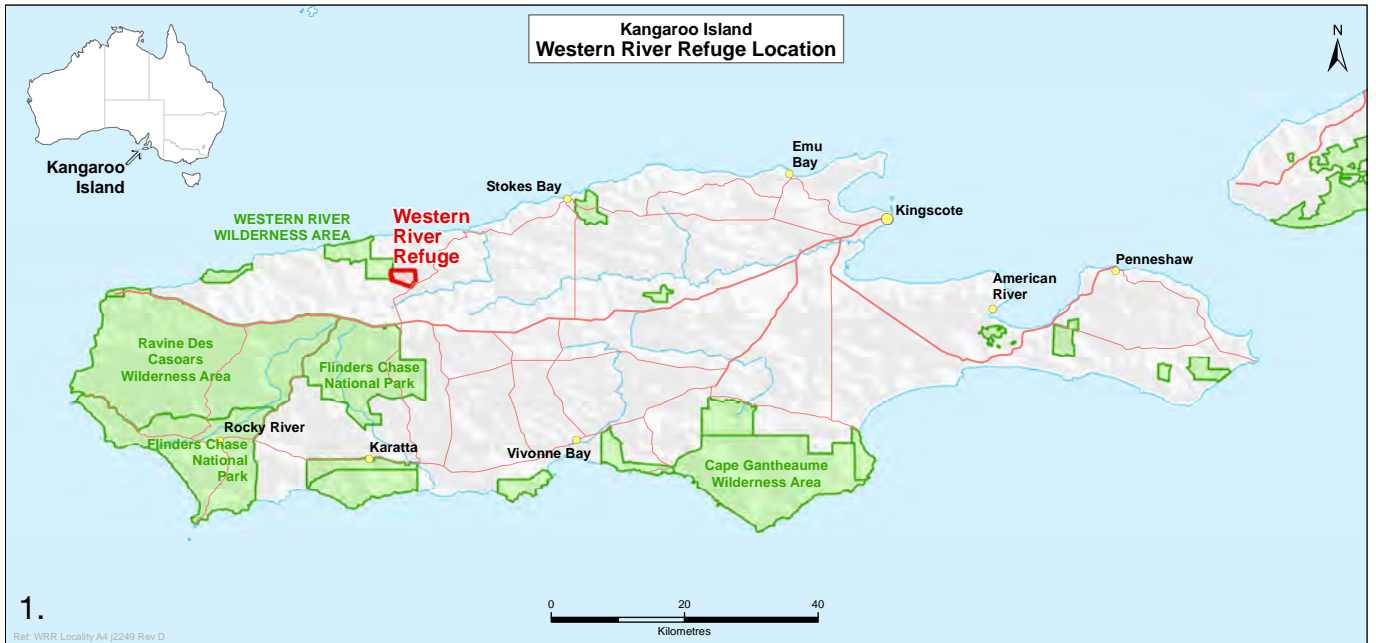
Nearly three billion animals were displaced or perished in the devastating megafires that swept across south-eastern Australia last summer (2019-2020). The fires were unprecedented in extent and intensity, burning through approximately 12.6 million hectares of the landscape (larger than the size of Tasmania). The damage is sobering, particularly when viewed in the context of the worsening effects of climate change. But the fires have also compelled conservationists to come together with renewed focus, working to improve our land management practices and develop methods to assist ecosystems to recover after intense wildfire.

To support native wildlife and habitats on the road to recovery, Australian Wildlife Conservancy is working in partnership with governments, private landholders, conservation organisations, scientists and supporters, and continuing to assess the environmental impacts of the megafires.

Progress on Kangaroo Island spells new hope

The wildfires blazed across nearly half of Kangaroo Island (KI) – around 200,000 hectares – razing up to 95 per cent of the known range of the KI Dunnart (*Sminthopsis aitkeni*) and catapulting this little marsupial to the top of Australia's most endangered mammal list. To urgently protect the dunnart and other fire-affected species, AWC, Kangaroo Island Land for Wildlife and local landholders, the Doube family, with the assistance of the Australian Army, established a 13.8-hectare feral predator-free critical refuge in just 10 days in February 2020. Now, construction of the conservation fence to protect a further 370 hectares – the Western River Refuge (Stage 2) – has commenced. This important project is not only supporting post-fire recovery but also building a secure, long-term refuge for the island's threatened wildlife.

AWC's feral predator ecology research has demonstrated that cats pose a particularly significant threat to wildlife after large fires, preferentially hunting in fire scars where shelter is scarce. To reduce this threat, daily feral predator control is being undertaken in Stage 2, on private land and within the newly-formed North West Conservation Alliance. A camera trap grid has also been established across Stage 2, allowing for targeted control of individual cats. More than 40 cats have been removed to date, and more are being removed every week.



Images

1. Map of Kangaroo Island showing the location of the Western River Refuge.
2. The critically endangered Kangaroo Island Dunnart. *Brad Leue/AWC*
3. AWC is looking to acquire strategically-positioned land in order to protect key Koala habitat and the future of the species as a whole. *Brad Leue/AWC*

4. The Western River Refuge will protect a suite of threatened species, including the Kangaroo Island Echidna, from feral cats. *Brad Leue/AWC*
5. The 13.8-hectare critical refuge was constructed in record time. Construction of the Stage 2 fence to create a 370-hectare feral predator-free area is now well underway. *Joseph Schofield/AWC*

Ongoing wildlife monitoring is underway across the project area. Encouragingly, a suite of threatened species – including the KI Dunnart, Southern Brown Bandicoot (*Isodon obesulus*), Southern Emu-wren (*Stipiturus malachurus halmaturinus*), Western Whipbird (*Psophodes nigrogularis lashamri*), Bassian Thrush (*Zoothera lunulata*), Heath Goanna (*Varanus rosenbergi*) and KI Echidna (*Tachyglossus aculeatus multiaculeatus*) – are regularly detected at monitoring sites. Fauna surveys are planned within the Stage 2 refuge area in Spring 2020.

Conserving the Koala

The megafires are estimated to have destroyed or impacted 24 per cent of Koala (*Phascolarctos cinereus*) habitat on public land across New South Wales. In June 2020, a parliamentary inquiry into Koala populations found that the species is on track to become extinct in NSW within the next 30 years and highlighted the urgent need to prioritise the protection of Koala habitat. In response, AWC is actively investigating acquisition of one or more properties to contribute to the conservation of the Koala.

AWC is seeking to acquire land in strategic locations that can have a significant positive impact on the future of the species as a whole, so stay tuned. AWC is also participating in workshops on Koala conservation across the State and looking to contribute to projects that might restore Koala habitat to cleared land.

Ecological assessments crucial for recovery planning: Wollombi Valley

Prior to the megafires, Wollombi Valley – a gateway to the Hunter Valley in NSW – was home to a variety of threatened species, including the Koala, Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Spotted-tailed Quoll (*Dasyurus maculatus*), Squirrel Glider (*Petaurus norfolcensis*) and the Regent Honeyeater (*Anthochaera phrygia*). During the 2019-2020 fire season, multiple fires scorched large swathes of Hunter Valley habitat leaving surviving wildlife with limited available refuge and an increased risk of extinction.

In collaboration with Wollombi Landcare and with generous support from WIRES, the Commonwealth Bank and others, AWC is assessing the impacts of the bushfires across at least 17 private properties in the

Wollombi Valley. Equipment acquisition and initial surveys have already been completed, and a second round of surveys (including call playback for owls and spotlighting for arboreal mammals, diurnal bird surveys, amphibian surveys and camera trap surveys for small mammals and feral predators) kicked off in September.

These ecological surveys will provide crucial information on the impacts of the fires. Importantly, they will also provide post-fire baseline data on the presence, relative abundance and species richness of mammals, birds and amphibians across a range of vegetation communities. These data will inform restoration planning and enable the success of future land management actions to be measured, including the deployment of artificial refuges, ground cover, nest boxes and watering stations to assist the surviving wildlife while habitat and resources replenish. In collaboration with the University of Sydney, AWC will investigate the use of artificial refuges in the post-fire recovery of small mammal populations.

Promising results: Kewilpa Reserve

South Endeavour Trust's Kewilpa conservation reserve in northern NSW was severely impacted by the bushfires. In the immediate aftermath, AWC was invited to conduct post-fire surveys to assess the state of surviving wildlife. The results are promising, confirming the survival of three locally threatened species: Barking Owl (*Ninox connivens*), Brown Treecreeper (*Climacteris picumnus victoriae*) and Little Lorikeet (*Parvipsitta pusilla*). Eight bird surveys, four spotlight surveys and 3,335 camera trap nights recorded a total of 17 mammals, 46 birds, 12 amphibians and five reptiles, providing crucial baseline data for the reserve and a template for future surveys on the property.

AWC is committed to effective conservation and supporting Australia's ecosystems on the road to recovery. Bushfire recovery priorities identified by the government – protecting refuge habitat, controlling feral animals and reintroducing threatened species – are already integral components of AWC's innovative conservation model being implemented across our 30 sanctuaries and partnership sites. Australia's wildlife needs effective conservation action and AWC's practical, collaborative approach is helping to restore the country's native species and natural assets.



“Give us the tools and we’ll finish the job.” It’s war on cats and foxes at Mt Gibson Wildlife Sanctuary

*By Dr Michael Smith, South-west Regional Ecologist
Photographer Wayne Lawler/AWC*

Recording the GPS coordinates of tracks in the sand allows staff to monitor feral predator movements outside the Mt Gibson enclosure.
Wayne Lawler/AWC



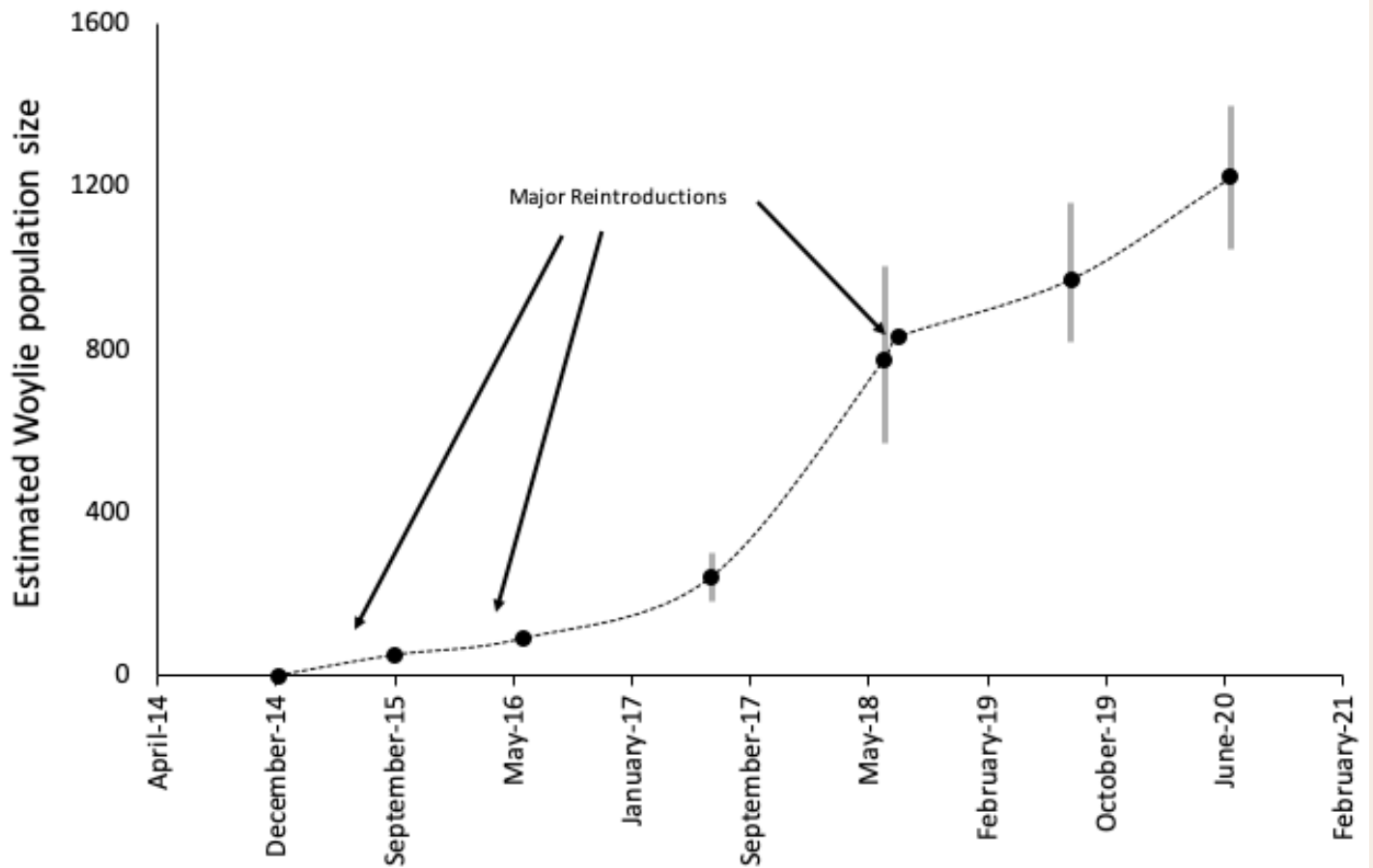


Fig. 1.

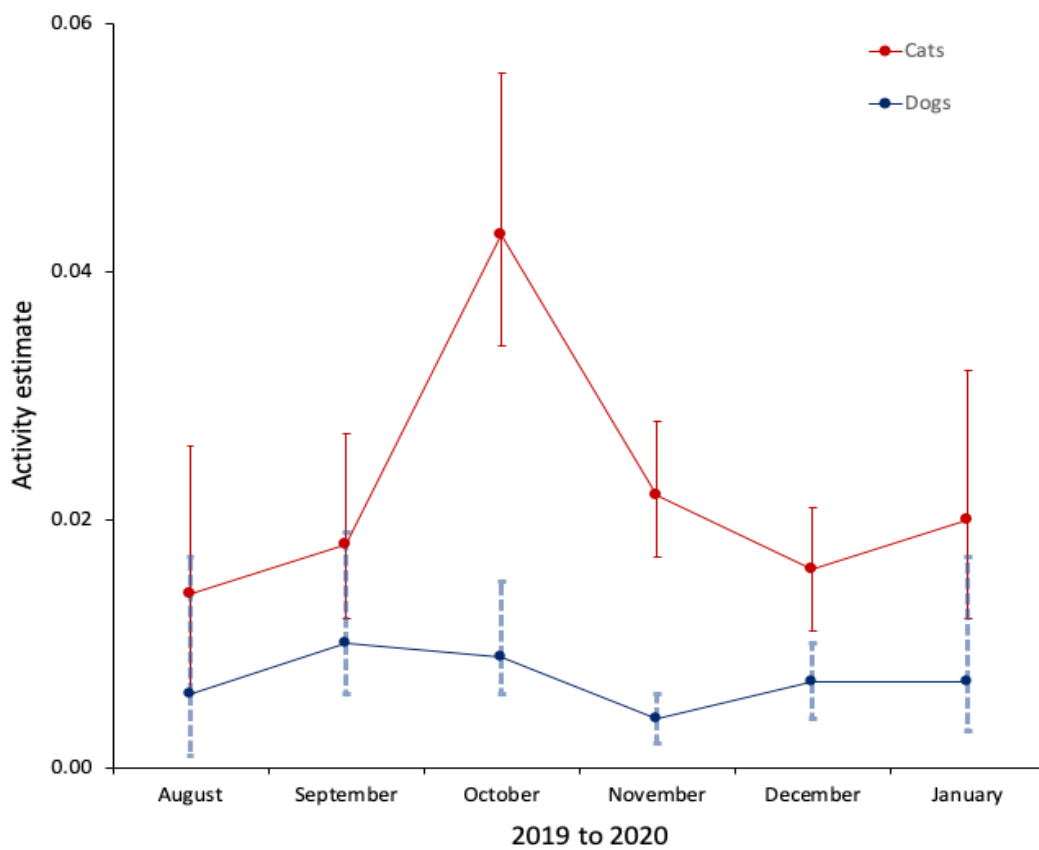


Fig. 2.

Images

Fig 1. Brush-tailed Bettong (Woylie) population size at Mt Gibson Wildlife Sanctuary, estimated from capture-mark-release data collected from live-trapping surveys.

Fig 2. Activity estimates for cats and dogs in the treatment area at Mt Gibson from August 2019 to January 2020, before baiting.

1. (Opposite page) Eight mammal species, including the Woylie, have been reintroduced to Mt Gibson Wildlife Sanctuary. *Wayne Lawler/AWC*



1.

When cats and foxes were introduced to Australia, the fate of more than 20 mammal species was cast and extinction was inevitable. Feral cats alone are estimated to kill more than six million animals every night across Australia. For many species (mammals, birds and reptiles alike) declines are occurring, leaving the biodiversity of this unique continent worse off.

People value wildlife for many different reasons, but ultimately our wellbeing is reliant on our flora and fauna. Whether it is for health and recreational benefits, aesthetic beauty, provision of resources or cultural and educational significance, we can all derive substantial wellbeing from our natural world.

Conserving and restoring Australia's native wildlife is important, and the primary objective of Australian Wildlife Conservancy. Enter Mt Gibson. This 132,000-hectare wildlife sanctuary was once a hotspot for

small native mammals — believed to be a consequence of its position in a transition zone between two major biomes, the wetter south-west and the more arid north. With the introduction of feral predators, many of the small mammal species disappeared from the area, leaving a comparatively depauperate fauna.

A great conservation success story

As a national leader in translocations, AWC set to work restoring the mammal fauna of Mt Gibson. A large 7,800-hectare safe haven was established, from which all cats and foxes were removed by 2015. Eight mammal species have since been reintroduced into the area: Brush-tailed Bettongs (Woylies, *Bettongia penicillata*), Greater Bilbies (*Macrotis lagotis*), Numbats (*Myrmecobius fasciatus*), Red-tailed Phascogales (*Phascogale calura*), Western Barred or Shark Bay Bandicoots (*Perameles bougainville*), Shark Bay Mice (*Pseudomys fieldi*),

Greater Stick-nest Rats (*Leporillus conditor*) and Banded Hare-wallabies (*Lagostrophus fasciatus*).

Five years on from the removal of the last cat, and with additional funding from the Northern Agricultural Catchments Council and the National Landcare Program, seven of these species are breeding and spreading across the safe haven (the Shark Bay Mouse is proving more cryptic), even though the project is still in its early days. This is an internationally significant conservation success story and represents the first time that any Australian organisation has restored eight threatened mammals to a single site.

Looking beyond the fence

Two more locally extinct species are set to be reintroduced over the next few years, Chuditch (Western Quoll, *Dasyurus geoffroyi*) and Brushtail Possums (*Trichosurus vulpecula*). Chuditch are a wide-ranging predator and are therefore



Images

1. The objective of this project is ultimately to release Chuditch and Brushtail Possums outside the fence at Mt Gibson. *Wayne Lawler/AWC*
2. AWC has reintroduced 8 mammal species to the Mt Gibson feral predator-free area. *Brad Leue/AWC*
3. Endangered Chuditch (Western Quoll). *Jiri Lochman/Lochman LT*
4. Camera traps are a vital tool for determining feral predator numbers outside the fence. *Wayne Lawler/AWC*



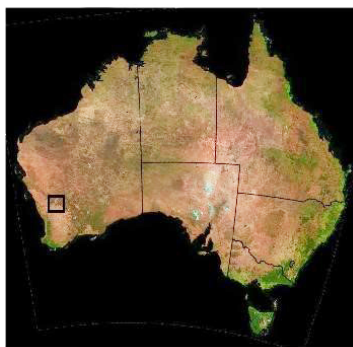
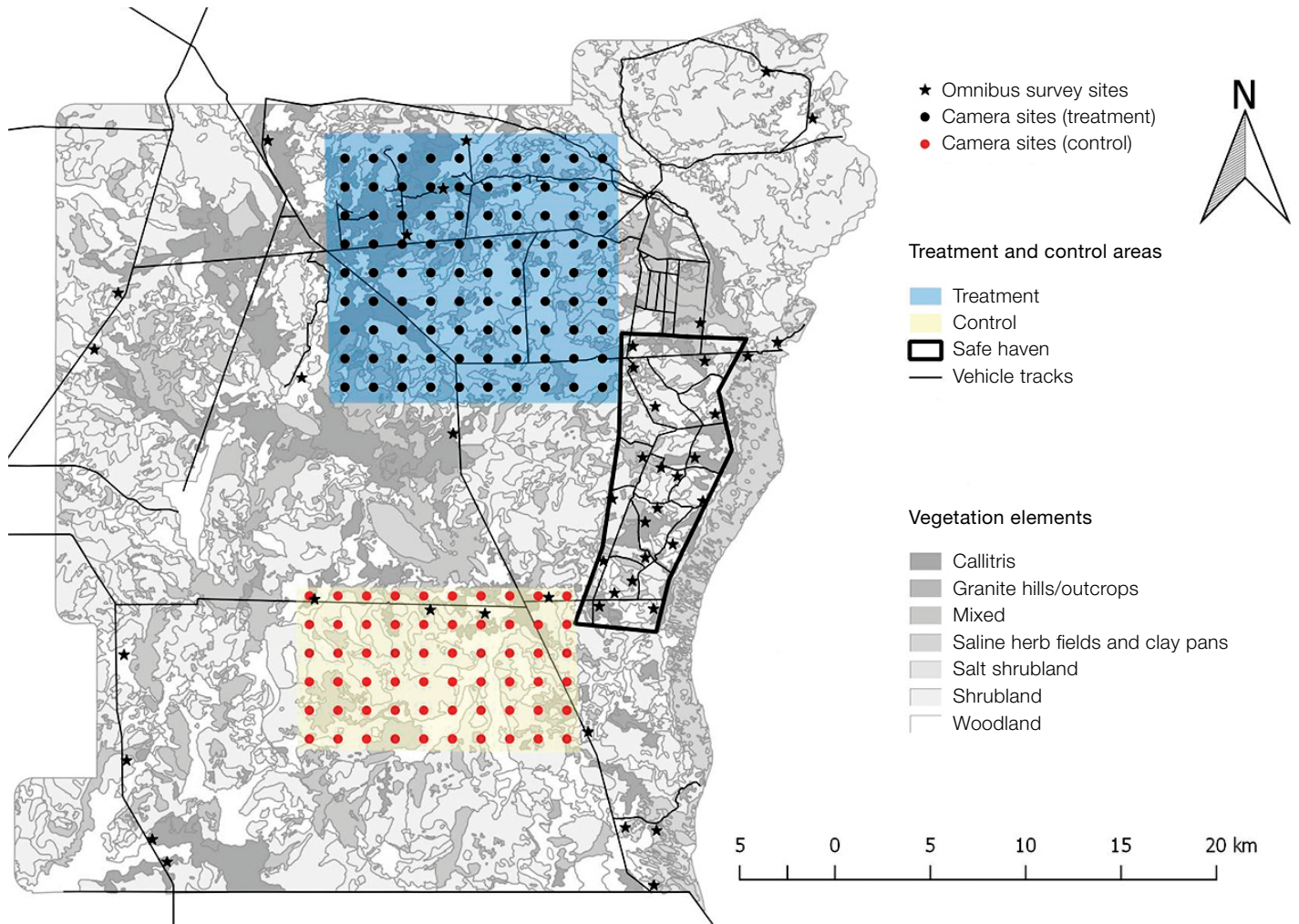


Fig 3.

Image

Fig 3. The map shows the treatment area (blue) outside the fence at Mt Gibson where cat, fox and dog activity will be monitored pre and post control efforts. Results in the treatment area will be compared with similar information from the 'control' area (yellow).

better suited to release outside of the fence. Brushtail Possums are better able to withstand predation by cats and foxes than many other species and we plan to release them inside and outside the fenced area.

AWC is preparing a 'beyond the fence' strategy that, if successful, will see the re-establishment of Chuditch and Brushtail Possums into the larger sanctuary outside the conservation fence. This is incredibly important work that will eventually allow the species re-established in the safe haven to disperse and persist in the broader sanctuary. A large array of 90 cameras has been established across 20,000 hectares outside of the safe haven and will be used as the initial cat and fox management area.

A second array of 30 cameras has been installed across a 6,000-hectare area, which will be used as an untreated 'comparison'

site. The cameras provide us with a detailed understanding of the existing native fauna. We are already collecting valuable data on species such as Brush-tailed Bettongs and Malleefowl (*Leipoa ocellata*). The cameras will allow us to estimate the activity levels of cats, foxes, dogs and other species. After 10 months of initial monitoring in the treatment site, an aerial cat baiting program was conducted in June 2020 (no foxes were detected in the treatment area). Later in 2020, cat and fox activity will be assessed post-baiting. This information will be used to adaptively manage our cat and fox control efforts with a view to releasing radio-collared Chuditch and Brushtail Possums in 2021-22.

This is a major management program that, if successful, will be a huge step towards re-establishing a significant component of Western Australia's Wheatbelt mammal fauna.



Bullo River Station is home to an impressive array of bird species including the endangered Gouldian Finch and Double-barred Finch. *R Slobodan/AWC*

Biodiversity bonanza at Bullo River Station

By Dr Eridani Mulder, Senior Wildlife Ecologist, North-east Region

For nearly two years, AWC ecologists and land managers have been working with The Landsmith Collection at Bullo River Station, a 165,000 hectare property in the remote Northern Territory. This innovative partnership is the first of its kind in Australia and proof that conservation and pastoral activities can successfully co-exist. Since AWC started conducting fauna surveys here in November 2018 – the first ever for the property – we have been rewarded with the gradual reveal of a stunning treasure-trove of biodiversity.

AWC's science program at Bullo River Station comprises both inventory – identifying and mapping the presence of fauna and flora – and ecological health monitoring – developing a long-term monitoring program to measure ecosystem change in response to environmental drivers and conservation management. AWC is also delivering a comprehensive fire, feral animal and weed control program to support conservation and sustainability at Bullo River Station. This program draws on knowledge gained from long-term projects in northern Australia, such as Wongalara and Mornington Wildlife Sanctuaries, properties that AWC has managed for conservation for 13 and 15 years respectively.

Intensive effort delivers rewards

Over the last year, teams of AWC ecologists have conducted more than 9,000 camera trap nights, 2,000 live trapping nights, over 70 standardised bird surveys and numerous nocturnal and diurnal searches for fauna across Bullo River Station. This intensive effort has resulted in over 1,500 sightings of nearly 80 bird species and brought the number of finches known to occur on the station to an impressive list of 11 species, including the endangered Gouldian Finch (*Chloebia gouldiae*) and threatened Star Finch (*Bathilda ruficauda*).

A biodiversity bonanza

An extensive camera trap survey of rocky gorges and outcrops during the summer wet season of 2019-2020 revealed multiple sites inhabited by the enigmatic Wyulda (Scaly-tailed Possum, *Wyulda squamicaudata*), and highlighted the importance of sheltered, wet forest pockets in the gorges. Victoria River Short-eared Rock-wallabies (*Petrogale brachyotis victoriae*) and Common Rock Rats (*Zygomys argurus*) are abundant throughout the ranges

and were detected at almost all of the 70 sites. For the first time, Ningbing Pseudantechinus (*Pseudantechinus ningbing*) – a small carnivorous marsupial and relative of the quolls – were detected at many sites, as well as Echidnas (*Tachyglossus aculeatus*), White-quilled Rock Pigeons (*Petrophassa albipennis*), Sandstone Shrike-thrushes (*Colluricincla woodwardi*) and a suite of reptiles and amphibians, including the Magnificent Tree Frog (*Litoria splendida*), Kimberley Rock Monitor (*Varanus glauerti*) and cryptic Chameleon Dragon (*Chelosania brunnea*).

This work highlights the impressive conservation values of the property, and brings the current wildlife inventory to 28 mammal, 43 reptile, 18 frog and 172 bird species.

Delivering effective conservation land management

AWC's land management actions at Bullo River Station have two objectives:

1. To improve ecological health; and
2. To improve the sustainability of land use for the commercial cattle operation.

This year alone we've flown nearly 1,200 kilometres by helicopter to deliver early dry season fire management and tackle 3,000 individual weed plants across many hundreds of hectares. Priority actions now include progressive destocking of feral buffalo and cattle, and continued removal of feral pigs and donkeys. These actions are complemented by riparian and wetland fencing that Bullo River Station staff are undertaking in the cattle production area. Removing feral animals from environmentally sensitive spring and wetland areas will help improve ground cover and water quality, providing small animals with critical cover to hide from feral cats.

CEO of The Landsmith Collection, Chris Furtado said: "While still young, our innovative partnership with AWC is revealing the ecological treasures we always hoped to find at Bullo River Station. We are incredibly proud of our active partnership which demonstrates that collaboration between conservation, commercial pastoral and ecotourism operations can deliver strong, positive outcomes for Australia's precious biodiversity values."



Coloured leg bands help identify individual Purple-crowned Fairywrens by giving each bird a unique name. This male is '-L-B' as he has a lime (L) band on his left leg and a blue (B) band on his right leg. He is the only fairywren in the population with this particular combination of colour bands, allowing him to be recognised in the field. *Niki Teunissen/AWC*

15 years of research reveals secrets of rare Purple-crowned Fairywrens

By Dr Niki Teunissen, Postdoctoral Research Fellow, Monash University, and Dr Anne Peters, Associate Professor, Monash University, in collaboration with AWC ecologists

Fairywrens have fascinated researchers for a long time, and for good reason – males tend to display striking seasonal breeding plumages, and wrens live in social groups that breed cooperatively, seemingly going against the evolutionary principle that individuals should be selfish and only care for their own progeny.

With its stunning purple head and perky blue tail, the Purple-crowned Fairywren represents an iconic species of the Kimberley. It is a riparian habitat specialist occurring only along waterways in northern Australia. The western subspecies, *Malurus coronatus coronatus*, is endangered because its riparian habitat, specifically *Pandanus aquaticus* vegetation, is suffering from habitat degradation due to feral herbivores and fire.

Purple-crowned Fairywrens at Mornington

To better understand the species and how we might help conserve it, Associate Professor Anne Peters, from Monash University, in collaboration with AWC, set up a long-term research project in 2005 to study Purple-crowned Fairywrens at AWC's Mornington Wildlife Sanctuary. Still ongoing, the project involves close monitoring of a population along 15 kilometres of Annie Creek and Adcock River.

Here, AWC's destocking efforts and implementation of the EcoFire program have allowed the riparian vegetation to regenerate, and the fairywren population to thrive. In fact, the Purple-crowned Fairywren population at Mornington has the highest density in its range.

All fairywrens in the population have been fitted with small, uniquely coloured leg bands. The researchers have followed individuals throughout

their lives and know exactly where and when each local bird was born, where it moved to, which bird it mated with, how many offspring it had, and ultimately, when it died.

Research findings

This research has yielded some exciting insights into the life of Purple-crowned Fairywrens. For example, unlike other fairywrens that are renowned for their promiscuity, Purple-crowned Fairywrens are very faithful. Possibly, this is because their territories are arranged linearly along the creek rather than as a mosaic, so there are fewer neighbours to potentially cheat with.

In other species, the males' bright plumage functions to attract females to cheat on their partner. Since Purple-crowned Fairywrens are faithful, their purple plumage serves a different function – to make males more competitive with other males for fiercely contested breeding positions.

The researchers have learned a lot about the social behaviour of the wrens, too. The breeding pair works together with 'helpers' in the group to raise young and defend against predators such as goannas, snakes and goshawks. Our research reveals these helpers are not acting purely altruistically but are, in fact, calculated accountants. They only help young likely to return the favour in the future, and they only help birds they might breed with in the future, or breeders that are relatives.

Our understanding of breeding success has also improved. We know now that rainfall triggers breeding; females lay eggs in the first few weeks after rain so the peak in insect (i.e., food) abundance coincides with the presence of dependent fledglings. Most important for breeding success is high quality riparian habitat.

Pairs living on territories with dense pandanus are less likely to have their nest depredated or washed away by floods. High temperatures, on the other hand, limit breeding success; chicks growing up in hot temperatures show evidence of damage to their chromosomes (DNA) and this may reduce lifespan and fitness. Since temperatures are rising with climate change, we are focusing our research on the effect of heat stress on the birds and whether the quality of riparian habitat may buffer its effect.

Looking forward

Following AWC's destocking of the property, regeneration of riparian habitat has been paired with a steady population increase, from 2005 to 2017. The last two years, however, have been challenging for the species, with the population declining by 51 per cent – most likely owing to two severely dry years causing poor breeding success, combined with the impacts of fire. With more than 100 birds still in the population and AWC's management of key threats, we are optimistic numbers will soon recover. In August, many birds on Annie Creek were observed to have bred successfully. Breeding is very unusual at this time of year and this success is testament to the flexibility of the wren's breeding schedule. Close monitoring of the population will help track population health, provide important data on how the wrens recover after drought and fire, and inform AWC's ongoing management to safeguard the future of the species. Happily, in August-September 75 per cent of breeding pairs have managed to breed successfully or are still actively breeding.



AWC's fire management program is reducing the extent of wildfires and restoring ecologically appropriate fire regimes. *Joey Clarke/AWC*

Effectively managing fire in Australia's wild north east

By Tim White, Regional Operations Manager, and Peter Stanton, Ecologist – Fire and Vegetation

Northern Australia hosts some of the last great wild places on the planet. While parts of the landscape have been highly modified, Australian Wildlife Conservancy has the responsibility for managing some of the most intact remaining areas at our sanctuaries in north-eastern Australia. These include Wongalara, Pungalina-Seven Emu, Piccaninny Plains, Brooklyn and Mount Zero-Taravale Wildlife Sanctuaries – covering a total area of more than three quarters of a million hectares.

Fire management is integral to maintaining the ecological health of these environments. Aboriginal people traditionally survived in a fire-dependent landscape by meticulously using fire for many purposes, such as hunting and to travel through country, but above all, for the management of the fuel load around them. Conservation in the current era has many additional challenges, but in relation to fire management, AWC believes we should pay attention to the principles that have guided Aboriginal land management for tens of thousands of years, as well as to the insights of contemporary science and conservation practice.

The appropriateness of these principles was dramatically demonstrated during the summer of 2019-2020, when massive wildfires erupted across south-eastern Australia. They were of a scale beyond human memory and defied efforts at suppression. The loss of lives and the destruction of homes, habitats and wildlife was inestimable.

During the same period, at the height of the northern dry season, lightning ignited fires on four AWC sanctuaries in north-eastern Australia. Fortunately, they caused relatively little concern for managers, and apart from some efforts to halt their progress in strategically important areas, they eventually extinguished themselves. While differences in vegetation and the severity of fire weather contribute to these contrasting outcomes, AWC's fire management program also played an important part.

Context is key

AWC's fire management is directed towards ensuring that the movement patterns of fire across the landscape are controlled through careful management and not by the capricious passage of wildfires. Beginning early in the year, numerous small fires are progressively lit to create a mosaic, denying wildfires large areas of long unburnt fuel and the ability to burn on long fronts. Our fire management is complex and varies according to the particular needs of habitat management and wildlife conservation at each sanctuary.

On Pungalina-Seven Emu Wildlife Sanctuary, in the remote Gulf of Carpentaria, the climate is dominated by long months of dry winds that originate from Australia's arid inland. Here, the emphasis is on burning during conditions of high soil moisture, beginning with the first seasonal storms. This technique is also being trialled for the maintenance of native grasslands on Piccaninny Plains and in areas of wet sclerophyll forest on Brooklyn and Mount Zero-Taravale.

There is also a need to restore habitats threatened by the long exclusion of fire and weed invasion. This involves hot fires to control developing understories which, left unchecked, could eventually prevent regeneration of canopy species, such as in the wet sclerophyll forests of Mount Zero-Taravale and Brooklyn. Repetitive controlled burning is another important tool AWC uses for eliminating exotic species such as lantana and rubber vine. This fire program has been a critical component of the habitat restoration work undertaken by AWC to facilitate the reintroduction of the endangered Northern Bettong (*Bettongia tropica*) to Mount Zero-Taravale.

Outstanding outcomes highlight effectiveness of AWC's approach

Across all our northern properties, AWC's fire program has greatly reduced the incidence of late dry season wildfire. The extent of wildfire has been reduced by 44 per cent on Mount Zero-Taravale, 36 per cent on Brooklyn, 64 per cent on Piccaninny Plains, 66 per cent on Pungalina-Seven Emu, and an incredible 90 per cent on Wongalara.

Since 2013, AWC has also worked with neighbouring landholders (involving multiple tenures) to plan and implement a regional fire management program across 600,000 hectares in the Upper Mitchell catchment, coordinated out of Brooklyn Wildlife Sanctuary. Highlighting the program's success, wildfire has been reduced by 43 per cent across the region and the maximum area burnt in the late dry season in any one year has more than halved.

The fire programs at all AWC sanctuaries are subject to detailed plans that are regularly refined in accordance with our experience of landscape-scale controlled burning, robust measurement of fire patterns and our increasing knowledge acquired from plot-based monitoring. AWC is at the forefront of best-practice fire management across northern Australia, helping to reduce the extent and frequency of destructive wildfires and conserve Australia's precious biodiversity.



SAVING OUR SPECIES



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Locally extinct Greater Stick-nest Rats are being restored to Mallee Cliffs National Park, as part of AWC's historic partnership with the NSW Government. *Wayne Lawler/AWC*

Triumphs and challenges at NSW national parks

By Dr Greg Holland, NSW Regional Ecologist, Tim White, Regional Operations Manager, and Hannah Thomas, Field Ecologist

Embarking on a large-scale, ground-breaking new project can bring great rewards, while also providing plenty of challenges and learning opportunities. Such is the case at Mallee Cliffs National Park and Pilliga State Conservation Area, AWC's project sites under its historic partnership program with the NSW National Parks and Wildlife Service (NPWS) as part of the NSW Government's *Saving our Species* program.

Feral Animal Control

At each site, AWC is establishing large, feral predator-free fenced areas to facilitate reintroductions of regionally extinct mammals. The Mallee Cliffs fence – protecting 9,570 hectares – was completed in August 2019 and within just 10 months all feral animals were removed from this vast landscape. Intensive monitoring was undertaken over several months and the area was formally declared feral predator free in September 2020, making Mallee Cliffs home to the largest feral predator-free area on mainland Australia – a project milestone and major achievement for conservation in Australia.

In the Pilliga project area, just one wily fox remains within the fenced area (5,800 hectares). Thick forest makes tracking this animal extremely difficult. An array of proven and cutting-edge techniques – including new technologies such as drones equipped with thermal cameras – have been deployed in this war against feral predators, but so far, the team has been outfoxed. Determined not to be outdone, the Pilliga team have redoubled their efforts and we look forward to reporting our success to you.

Reintroductions of regionally extinct mammals

At Mallee Cliffs, Greater Bilbies (*Macrotis lagotis*) were reintroduced into a feral predator-free 'breeding area' (480 hectares) in October 2019 and this new Bilby population is thriving. Recent trapping found all animals to be in very good condition, with half of all adult females carrying pouch young. Current estimates suggest the Greater Bilby population at Mallee Cliffs has doubled in size in just nine months.

Greater Bilbies are also doing well in the Pilliga breeding area (680 hectares), following reintroduction in 2018, with 75 per cent of females found to be carrying pouch young in the most recent survey. Trapping of the Pilliga population of Bridled Nailtail Wallabies (*Onychogalea*

fraenata), 12 months after reintroduction, revealed all captured adult females to be carrying pouch young, and showed the population is increasing in size.

Reintroductions on the horizon

Excitingly, a series of reintroductions at Mallee Cliffs are imminent. Nationally threatened Greater Stick-nest Rats (*Leporillus conditor*), sourced from Franklin Island (SA) and captive-bred for 12 months, have been released in the first of a multi-stage process. Preparations are also underway for the reintroduction of Mitchell's Hopping-mouse (*Notomys mitchellii*) and Numbats (*Myrmecobius fasciatus*). All of these species are listed as extinct in NSW and their return will mark another important milestone for conservation.

Further reintroductions in the Pilliga are dependent on the removal of the last known fox from the 5,800-hectare area. Once this has been achieved, Brush-tailed Bettongs (Woylie, *Bettongia penicillata*) and Western Barred Bandicoots (*Perameles bougainville*) will be the next species to be returned here.

Ultimately, the project will see up to 11 locally extinct mammals restored to these two NSW national parks.

Operations bases – embedding the AWC model

Strategic planning for operations bases at both parks is well advanced, including residential accommodation, operations and scientific research facilities for the AWC field team. This is a vital step that will provide AWC with a permanent boots-on-the-ground presence and ensure AWC's template for restoring biodiversity is effectively delivered and embedded in each park. On-site headquarters will also enable visitation from supporters, key stakeholders and others, allowing people to experience the amazing conservation outcomes of the project first-hand. Establishment of the operations bases therefore represents a high priority for the delivery of this project.

AWC and NPWS are working closely to ensure plans comply with necessary specifications and regulations. Most buildings will be prefabricated off-site incorporating sustainable and environmentally conscious designs that blend with the natural environment. Design and planning continue apace, with on-ground works to commence soon.



Images

1. Dr Vyanna Leo and Mareshell Wauchope checking funnel traps at North Head. AWC's science program is enhancing the conservation values of the headland and helping to rebuild small mammal populations, vital for native plant pollination. *Charles Thomas/AWC*

2. AWC's ecological monitoring program helps to protect North Head's isolated Long-nosed Bandicoots from feral predators and vehicles. *Dr Jennifer Anson/AWC*

Celebrating a decade of conservation partnership at North Head

By Dr Viyanna Leo, Wildlife Ecologist, and Dr Jennifer Anson, Senior Ecologist

Australian Wildlife Conservancy entered into its first trailblazing partnership to enhance conservation outcomes on public land right on Sydney's doorstep – at iconic North Head Sanctuary. AWC has had a presence at the sanctuary since 2009 and we are proud to mark a decade of effective conservation and leadership in the development of public-private partnership.

North Head is ecologically important as it protects a significant remnant (more than 60 per cent) of the critically endangered Eastern Suburbs Banksia Scrub and a threatened population of Long-nosed Bandicoots (*Perameles nasuta*). AWC's engagement by the Harbour Trust, which manages North Head Sanctuary, ensures the delivery of science projects focusing on the conservation of extant species, the reintroduction of locally extinct species and predator monitoring.

AWC has implemented our Ecohealth program, designed to monitor the resident wildlife populations and ecological health of the headland. Monitoring of Long-nosed Bandicoot population has led to the implementation of traffic control measures at North Head, considerably reducing the number of road-kill mortalities.

As part of the Ecohealth program, the first formal headland-wide bat survey was undertaken. Nine microbat species were identified, including two listed as threatened in New South Wales – Little Bent-wing Bat (*Miniopterus australis*) and Large Bent-wing Bat (*Miniopterus orianae oceanensis*) – and one federally listed threatened species, Large-eared Pied Bat (*Chalinolobus dwyeri*). These three species were previously unrecorded at North Head.

Native Bush Rats win war against invasive black rats

The native Bush Rat (*Rattus fuscipes*) was reintroduced to North Head by AWC from 2014-2016 in conjunction with the control of the introduced black rat (*Rattus rattus*). Our monitoring confirms the outstanding success of this reintroduction; at all sites across the headland Bush Rats now significantly outnumber the previously dominant black rat, indicating that Bush Rats are able to defend territories and outcompete the invasive species. The population has now successfully expanded from the original 15-hectare release site to more than 200 hectares. This is one of only a handful of examples in the world where a native mammal species has been used to successfully control a competing invasive species.

Reintroducing key pollinators: The Eastern Pygmy Possum

The tiny Eastern Pygmy Possum (*Cercartetus nanus*) is an important pollinator of banksias and other native plants. It is locally extinct at North Head and listed as threatened in NSW due to habitat loss, predation by foxes and feral cats and changed fire patterns. From 2016 to 2019, AWC released 31 Eastern Pygmy Possums into the sanctuary.

Over the last 12 months, capture rates of Eastern Pygmy Possums have more than doubled. More than 35 Pygmy Possums were detected in nest box checks across the headland – most were new individuals, including females with pouch young. To bolster genetic diversity, AWC will supplement the population with an additional 30 individuals over the next year. The new possums, sourced from various nearby populations, will

help establish a genetically robust North Head population.

Reintroducing key pollinators: The Brown Antechinus

The Brown Antechinus (*Antechinus stuartii*), a small marsupial carnivore and important pollinator, has also been reintroduced to North Head. AWC released 44 Brown Antechinus on to the headland from 2017-2019.

Despite being notoriously difficult to detect in monitoring surveys, Brown Antechinus have been identified at multiple locations around the headland, and camera trap videos show them feeding on Banksia inflorescences and entering nestboxes. The Brown Antechinus has a high-stakes breeding strategy, with all males in a population (and many females) dying off post-breeding, so they will require additional assistance to establish the population. AWC will continue to supplement this population throughout 2020 and into 2021.

Through the reintroduction of these three species, AWC has increased the native mammal assemblage on the headland from five to eight species. Prior to this work, no native mammals smaller than approximately 700 grams persisted. These reintroductions are helping to reconstruct the ecological role of small mammal pollinators on North Head, particularly in the endangered Eastern Suburbs Banksia Scrub ecological community.

The Harbour Trust-AWC partnership is unique and we are proud of what has been achieved at North Head in just 10 years of collaboration.



AWC intern Amelia Catterick-Stoll releases a Brush-tailed Bettong during targeted surveys at Mt Gibson Wildlife Sanctuary. *Jane Palmer/AWC*

Please support the next generation of Australia's conservation leaders.

\$3,200 will support an AWC intern for one month, including all travel, administration, accommodation expenses and a modest living stipend.

To request an AWC internship program prospectus, please email intern@australianwildlife.org

Future-proofing conservation in Australia: training the next generation of conservation scientists

By Dr Hannah Sheppard-Brennand, Science Communicator

Australian Wildlife Conservancy is committed to the long-term delivery of science-based conservation. In 2008, armed with a vision to train the next generation of talented conservation scientists and crucial seed funding from a generous AWC supporter, Ross Knowles, AWC established a scientific internship program.

Twelve years later, this comprehensive program is world-leading, providing a new template for training excellence in conservation science and giving talented young ecologists good quality, hands-on field experience. By the end of 2020, 99 AWC interns will have graduated from this program – many of them (62 per cent) going on to work for AWC permanently or under contract, while others are building careers in conservation elsewhere in Australia and around the world.

AWC is a science-based organisation and our on-ground actions – from fire management to feral animal control to mammal reintroductions – are informed by rigorous research. Our ecologists undertake an extensive terrestrial biodiversity monitoring program, (in 2019, it involved over 160,000 trap nights), underpinned by AWC's innovative Ecohealth framework for measuring ecosystem change.

Through involvement in our science program, interns experience the challenges of real-world conservation and participate in projects covering a diversity of unique ecosystems and environments across AWC's national network of properties. These projects have ranged from reintroducing Bridled Naitail Wallabies (*Onychogalea fraenata*) into NSW national parks, to studying feral cat ecology outside the fence at Mt Gibson, to conducting the first biodiversity surveys of Bullo River Station. Interns are mentored by skilled AWC ecologists with master's or PhD qualifications, learning fieldwork techniques including trapping, surveying, GPS-tracking and animal handling.

Internships are usually four to six months in duration, with more than 200 applicants competing for the 12 to 14 sought-after positions. This year, COVID-19 saw the positions reduced to just five placements, but we hope to be able to return these numbers back to a dozen in 2021. AWC actively recruits interns and, to date, 16 per cent of graduates have gained permanent employment and 46 per cent have gained further contract work with AWC.

The 2020 intern for the south-west region, Amelia Catterick-Stoll, completed her internship in July. Amelia holds a strong connection to the south-west having volunteered in the region for many years. When discussing her internship, Amelia lists the excitement of unexpectedly trapping a juvenile Bilby (*Macrotis lagotis*) during Red-tailed Phascogale (*Phascogale calura*) surveys, and carrying out Brush-tailed Bettong (Woylie, *Bettongia penicillata*) surveys with the whole AWC south-west team as her most memorable experiences.

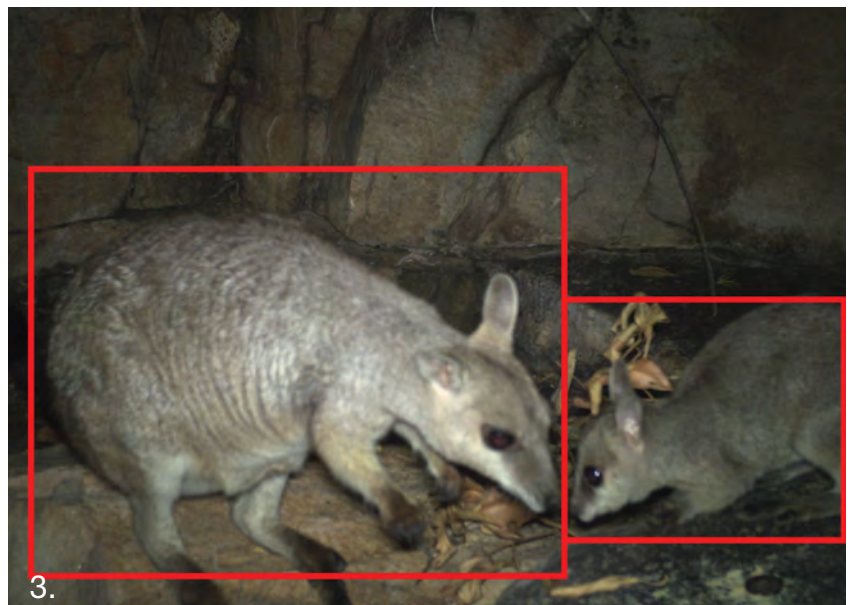
Amelia adds, "it was excellent to see first-hand how well threatened species are doing at Mt Gibson and to have the opportunity to learn from a hard-working and experienced team of ecologists."

Amelia is now finishing her master's degree, specialising in conservation biology, and has already gained her first paid contract with another conservation organisation, assisting in the coordination of a sea turtle monitoring program.

Rigorous scientific monitoring and research underpins AWC's mission to provide effective conservation for all Australian animals and the habitats in which they live. Training the next generation of conservation leaders is an essential component of AWC's strategy for securing Australia's biodiversity and future-proofing science-based conservation.



2.



3.

Images

1. AWC ecologist James Dunlop sets a camera trap. *Joey Clarke/AWC*

2. AWC's AI program can identify the presence of a single animal in the frame. Here, a Spotted-tailed Quoll is caught on camera. *AWC*

2. The AI program can identify multiple subjects in one frame – here, two Short-eared Rock Wallabies. *AWC*

Harnessing Artificial Intelligence to deliver more effective conservation

*By Damien Kerr, Chief Information Technology Officer
and Lizzy Crotty, Development Executive, FoAWC*

Australian Wildlife Conservancy is committed to reversing the decline of Australia's threatened wildlife by taking practical steps to deliver effective on-ground management (i.e. fire management, feral animal control, weed eradication) informed by world-class science. Excitingly, AWC is now harnessing the power of a suite of innovative new technologies to inform and deliver conservation.

Camera traps are an essential tool for collecting data on species diversity and abundance, and enabling us to track and measure our progress on the ground. Traps are activated by motion sensors and record a huge number of images; a three-month survey can capture more than 500,000 photos. Around 60 per cent of these images are set off by non-animal motion such as leaves blowing in the wind, making camera traps both a boon and a bane for AWC ecologists, as every image has to be checked manually. Important metadata such as temperature, time and moon phase, also have to be recorded on each capture, making the process extremely labour intensive.

AWC has been investing in strategies to increase our efficiency in processing camera trap images and launched the AWC Artificial Intelligence (AI) Program in 2019, in partnership with Microsoft. Microsoft describes our relationship as a "true collaboration" – AWC is the only partner they have worked with which actively codes alongside its team, and one of only three global partners using the advanced AI toolset in this way.

AWC's investment in the development and application of technology for conservation is breaking new ground in our sector. The AI program is already proving to be incredibly effective, freeing up hundreds of hours for our ecologists and land managers to take more direct action in the field, and increasing the speed at which the team can identify the presence of threatened species and feral predators.

The AWC AI Program has successfully developed the Animal-Filtering model. This model is capable of identifying images triggered by non-animal motion with success rates well over 90 per cent and reduces the number of images that need to be processed manually

by 60 to 70 per cent – an astounding gain in efficiency. As of August 2020, more than four million images (five terabytes of image data) have been put through this process.

AWC continues to chart new territory in conservation technology with construction of our first Species Classifier model. This machine learning technology has been 'trained' to identify common species in a specific area. As it was impractical to upload every single known species into the model, we chose to prioritise the 20 most commonly seen species on camera traps.

AWC has an extensive library of images due to decades of on-ground conservation work with some of Australia's rarest and most threatened wildlife. In the north-east region, the Species Classifier model can identify 20 different species – including feral species – and can even pick up and identify multiple subjects in one frame. This process refines the resulting dataset from the Animal-Filtering model, by a further 80 to 90 per cent. AWC plans to eventually implement the software at sanctuaries across the country, adding further species to the Species Classifier model.

AWC's ultimate aim is to improve the model recognition capability until it can consistently and correctly identify species with a very high degree of accuracy. Our AI program is in a state of testing and trialling, and we have found it is particularly important to use high-quality training image sets to improve learning success. AWC ecologists are uploading hundreds of thousands of images for the AI output and metadata to analyse. When needed, the program can be corrected and tweaked to improve its capacity. The next step is to develop a model that can identify individuals based on their stripes or patterns.

Recognising the increasing importance of technology for improving outcomes for Australia's wildlife, AWC is committed to growing our investment in conservation technology. Already the 'returns' are proving very worthwhile and are helping us deliver more effective conservation for Australia's wildlife and habitats.

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Your Rights:

- You may terminate your monthly donation to Australian Wildlife Conservancy at any time by giving written notice directly to us (PO Box 8070 Subiaco East WA 6008), or through your nominated Financial Institution. Notice given to us should be received by us at least 5 business days prior to the due date.
- You may stop payment of a monthly donation by giving written notice directly to us (PO Box 8070 Subiaco East WA 6008), or through your nominated Financial Institution. Notice given to us should be received by us at least 5 business days prior to the due date.
- You may request a change to the donation amount and/or frequency of the monthly donations by contacting us on (08) 9380 9633 and advising your requirements no less than 5 business days prior to the due date.
- Where you consider that a drawing has been initiated incorrectly (outside the monthly donation to Australian Wildlife Conservancy arrangements) you may take the matter up directly with us on (08) 9380 9633, or lodge a Direct Debit Claim through your nominated Financial Institution.

Privacy

AWC collects personal information to process donations, issue tax deductible receipts and to contact you. AWC's full privacy policy is available at www.australianwildlife.org/privacy.

Your commitment to us, Your responsibilities:

- It is your responsibility to ensure that sufficient funds are available in the nominated account to meet a drawing on its due date. (You may be charged a fee by your Financial Institution if the account details are incorrect or there are insufficient funds in the nominated account when we attempt to deduct donations.)
- It is your responsibility to ensure that the authorisation given to draw on the nominated account, is identical to the account signing instruction held by the Financial Institution where your account is based.
- It is your responsibility to advise us if the account nominated for transactions with the Australian Wildlife Conservancy Fund is transferred or closed.
- It is your responsibility to arrange a suitable alternative payment method with us if the Australian Wildlife Conservancy Fund drawing arrangements are cancelled either by yourselves or by your nominated Financial Institution.
- Please enquire with your Financial Institution if you are uncertain whether direct debit functions are available on your account. (You may be charged a fee by your Financial Institution if the direct debit facility is not available on your account.)