PROTECTING NATURE FOR ALL OF US

Environmental benefits of Australia's Indigenous Protected Areas and Indigenous rangers

COUNTRY NEEDS PEOPLE
Protecting nature, transforming lives

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Acknowledgements

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Beyond those organisations, we acknowledge ranger groups and Traditional Owners around Australia who are working to protect country for all of us. Partner organisations – including state and federal governments, industry, universities and non-government organisations like environment non profit organisations – are also fundamental to environmental achievements in the Outback and helped with the compilation of this report. We also acknowledge The Pew Charitable Trusts and Dr Ian Lunt for their advice and support.

Country Needs People is a growing alliance of more than 30 Aboriginal and Torres Strait Islander organisations from around Australia, and The Pew Charitable Trusts. The campaign is calling for the growth of funding and long term security for Indigenous ranger and Indigenous Protected Area programs because of their unique success in delivering outstanding results for the environment, people, communities and the economy.

This report was coordinated by Patrick O'Leary and Sophia Walter for the Country Needs People campaign.

Cover photo
The work of Warru Rangers like Jacob McKenzie is bringing the warru, or black-footed rock wallaby, back from the brink of extinction on the Anangu Pitjantjatjara Yankunytjatjara Lands in South Australia. Credit APY Land Management.

countryneedspeople.org.au

Foreword

Indigenous Protected Areas and Indigenous rangers are an outstanding success story for Australia. That story is about genuine leadership, resilience, strength and commitment, by Indigenous men and women right across our continent.

Up until recently, we have been led to believe that culture and connection to country is part of 'the problem' to be solved in Indigenous policy. In fact the truth is that culture and connection to country is an integral part of the solution, not only for Indigenous Australians, but for every Australian.

Put simply, it is in Australia's interests to have Indigenous Australians better connected to culture and country, so that all Australians can be more connected to the land and sea we share. When we understand and appreciate this, modern Australia is anchored by not 240 years of history, but by 50,000 years of history. I want to share the strength of this connection to our deep, rich and vibrant history, so that modern Australia can contemplate a future that is more united, and more deeply anchored.

This report shows the outcomes Indigenous rangers and Indigenous Protected Areas are achieving for our environment. Practical outcomes that are good for all Australians. That success is built on the strength of our connection to culture and country.

Recently I told the Prime Minister the following principles must inform policy in Australia if we are to walk this road together:

1. Acknowledge, embrace and celebrate the humanity of Indigenous Australians;
2. Bring us policy approaches that nurture hope and optimism rather than entrench despair;
3. Do things with us, not to us.

The fundamental reason Indigenous Protected Areas and Indigenous rangers are succeeding is because they reflect these principles. Our people are achieving major results in environmental protection even though we may approach the situation from a different starting point than a scientist or non-Indigenous land manager. We are combining the richness of our traditional knowledge and strength of our connection to country with the techniques of modern science to work together.

This presents an incredible opportunity to be seized for our future. We need to sustain and extend the environmental success we see within these pages to the scale our country needs. We need to hear now about plans for Indigenous Protected Areas and most importantly future growth beyond current funding timelines. Indigenous ranger jobs are proving transformative for my countrymen and women Australia-wide. Now is the time to commit to expanding their numbers to match the scale our continent demands.

I strongly urge all our political representatives from the Prime Minister down, to work with us by committing now to support a growing and secure future for Indigenous rangers and Indigenous Protected Areas right across Australia.

Professor Chris Sarra
University of Canberra
Stronger Smarter Institute

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Indigenous Ranger Groups

Northern Territory
1 Anangu Rangers on Angas Downs
2 Anangu Luritjiku Rangers
3 Anmatyerr Rangers
4 Muru-warinyi Ankkul Rangers
5 Tjuwanpa Rangers
6 Tjuwanpa Women Rangers
7 Kaltukatjara Rangers
8 Warlpiri Rangers
9 North Tanami Rangers
10 Bulgul Land and Sea Rangers
11 Malak Malak Land Management
12 Wagiman Guwardagun Rangers
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18 Anindilyakwa Rangers
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34 Njanjma Rangers
35 Mangarrayi Rangers

Western Australia
1 Miriuwung Gajerrong Rangers for Reserve 31165
2 Balanggarra Rangers
3 Bardi Jawi Rangers
4 Gooniyandi Rangers
5 Karajarri Rangers
6 Ngurrara Rangers
7 Nyikina Mangala
8 Nyul Nyul Rangers
9 Paruku Rangers
10 Uunguu Rangers
11 Wunggurr Rangers
12 Jigalong Rangers
13 Punmu Rangers
14 Parngurr Men Rangers
15 Parngurr Women Rangers
16 Warburton Women Rangers
17 Warburton Men Rangers
18 Blackstone Rangers
19 Warakurna Rangers
20 Kija Rangers
21 Nyangumarta Rangers
22 Goldfields Land Management Rangers

South Australia
1 Anangu Land Management Rangers
2 Warru Kaninytjaku APY Rangers– Musgrave Ranges
3 Warru Kaninytjaku APY Rangers - Tomkinson Ranges
4 Gawler Ranges Rangers
5 Nantawarrina Rangers
6 Ngarrindjeri Rangers
7 Raukkan Rangers
8 Riverland Rangers
9 Yalata IPA Rangers

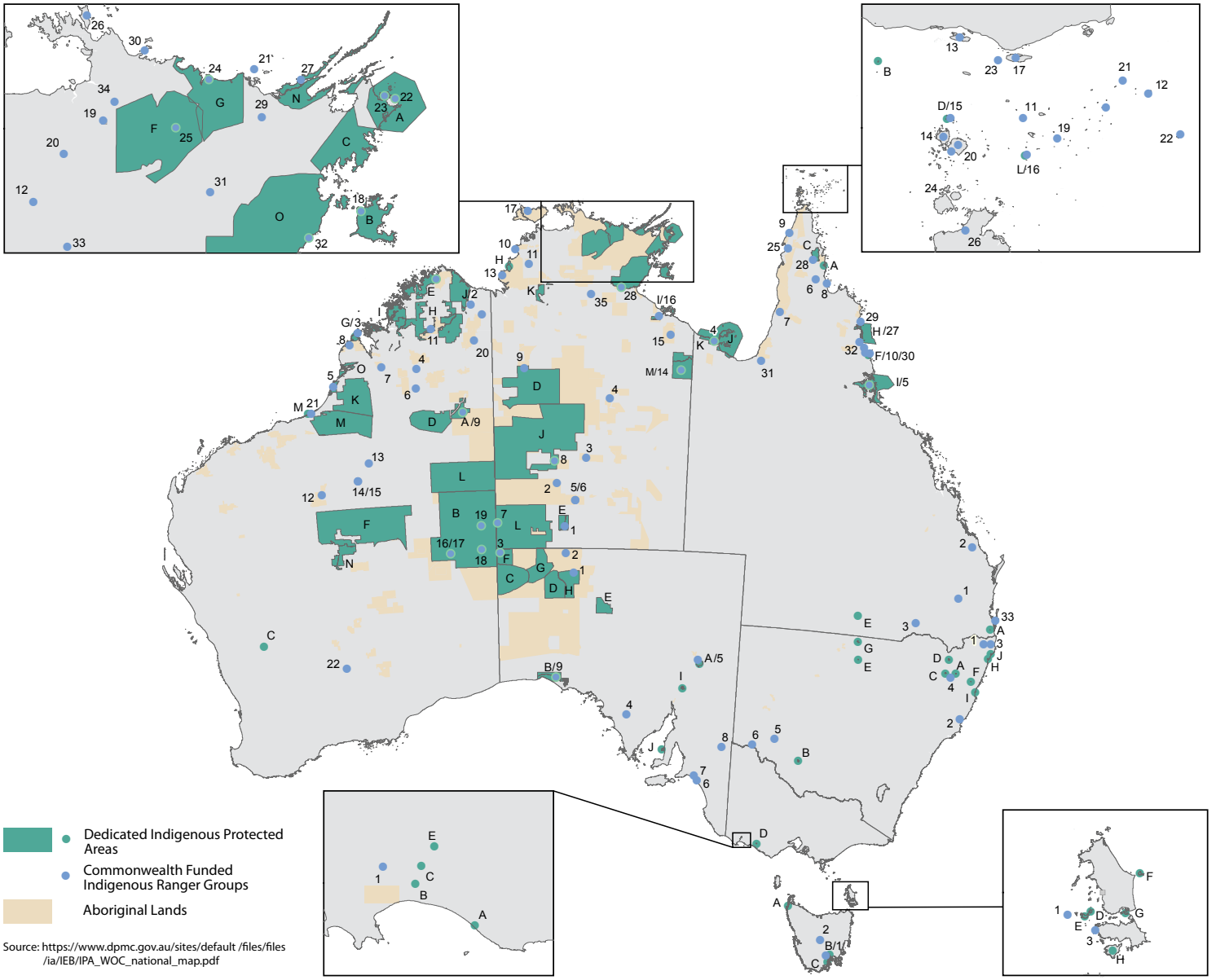
Victoria
1 Budj Bim Rangers

Tasmania - WOC Ranger Groups
1 Tasmanian Aboriginal Centre Rangers - Milaythina Pakana
2 Tasmanian Aboriginal Trainee Rangers (statewide)
3 Truwana Rangers

New South Wales
1 Githabul Aboriginal Rangers
2 TIDE Rangers
3 Ngulingah Nimbin Rocks Rangers 4 Wattleridge & Tarriwa Kurrukun IPA Rangers
5 Willandra Lakes World Heritage Area Rangers
6 Barkindji Maraura Rangers

Queensland
1 Bunya Mountain Murri Rangers
2 Gidarjil Rangers
3 Queensland Murray Darling Rangers
4 Gangalidda Garawa Rangers
5 Girringun Rangers
6 Kalan Rangers
7 Kowanyama Land Office Rangers
8 Lama Lama Rangers
9 Mapoon Land and Sea Rangers
10 Mandingalbay Yidinji Rangers
11 Lamalgal Rangers
12 Erubam Rangers
13 Malu Kiai Rangers
14 Mura Badhulgau Rangers
15 Mabuygiw Rangers
16 Warraberalgal Rangers
17 Mura Buway Rangers
18 Masigalgal Rangers
19 Porumalgal Rangers
20 Mua Lagalgau Rangers – Kubin
21 Mua Lagalgau Rangers – St Pauls 22 Ugaram Rangers
23 Meriam Gesep A Gur Keparem Le Rangers
24 Simakal Rangers
25 Nanum Wungthim Land and Sea Rangers
26 Apudthama Rangers
27 Eastern Kuku Yalanji Rangers
28 Chuulangun Rangers
29 Yuku-Baja-Muliku Rangers
30 Gunggandji Rangers
31 Normanton Rangers
32 Yirrganydji Rangers
33 Quandamooka Rangers

Indigenous Protected Areas and Commonwealth funded Indigenous ranger groups - January 2017



Source: https://www.dpmc.gov.au/sites/default /files/files /ia/IEB/IPA_WOC_national_map.pdf

Bardi Jawi Rangers are working with other ranger groups, government and non-government organisations to protect threatened 'Monsoonal Vine Thicket', a coastal rainforest type in the Kimberley, by stopping wildfires, controlling invasive weeds and replanting.

Kimberley Land Council

Executive Summary

2017 marks the 20th and 10th anniversaries respectively of a pair of world leading federal government initiatives, the Indigenous Protected Area program and the Working on Country Indigenous Ranger program. Both programs deliver environmental and cultural heritage protection at the same time as delivering significant social and economic benefits.

Indigenous rangers and Indigenous Protected Areas now represent the frontline of much of the necessary work to protect nature across Australia. As a result, the nation is now reaping a range of environmental benefits, such as the elimination of feral pests and recovery of native species. This successful work presents a compelling case for growing and securing support for Indigenous land and sea management nationwide.

Despite the documented success of both programs, the future of vital government funding remains uncertain. Indigenous Protected Area and Indigenous ranger programs require expansion and long term security to fully address the scale of Australia's environmental needs and maintain the environmental gains that have been made so far.

This report documents a series of case studies illustrating how Indigenous Protected Areas and Indigenous rangers improve the environment for the benefit of all Australians. The case studies include specific examples of successful interventions that improve ecosystem health at both a local scale and a broader regional scale.

Managing a big country: The scale of keeping Australia's environment healthy

Over 20% of Australia is held in Indigenous ownership – more than 170 million hectares and growing. Many of these landscapes are especially rich in native species, including threatened species, which require active management to survive.

Environmental challenges apply across these landscapes. Tens of millions of feral pigs, hundreds of thousands of feral buffalo and camels, millions of feral cats and goats, invasive weeds capable of occupying entire climatic zones, and vast areas where fire is uncontrolled, illustrate the scale of the management task. If these threats are left unmanaged, they will affect not only Australia's unique natural heritage but create great economic costs for agriculture and infrastructure across vast areas of Australia.

Practical and successful approaches to tackling large scale environmental threats are being applied through the work of Indigenous Protected Areas and Indigenous rangers now. These efforts must be successfully expanded to secure existing environmental gains and extend effective management to unmanaged or undermanaged regions.

Key findings of this report:

Real benefits are being secured

Indigenous Protected Areas and Indigenous rangers are making a measurable difference to the protection of biodiversity across vast areas of Australia, turning around damaging trends in habitat degradation and species decline. IPAs and rangers are making a major contribution to preventing wildlife extinctions, controlling wildfire and limiting the impact of feral animals and invasive weeds.

Core role in natural heritage conservation

Work on Indigenous Protected Areas and by Indigenous rangers now represents a core component of Australia's frontline efforts to protect threatened species and ensure ecosystem health. The future health of large parts of the Australian environment is now inseparable from the growth and security of IPAs and Indigenous rangers.

Scaling up will deliver greater environmental benefits

Indigenous Protected Areas and Indigenous rangers provide a cost effective model to meet the environmental challenges Australia faces but they need to be supported at the scale required. Some pressures, such as fire, are managed across large areas with corresponding benefits, but successful local or regional initiatives need to be scaled up and secured for the long term to achieve lasting change.

We need to secure the gains we have made

Environmental gains reverse if support lapses. Success in improving the survival of threatened species, reducing the impacts of feral animals and invasive plants and applying better fire management can be rapidly lost. Past investment has built a proven capacity for IPAs and Indigenous rangers to protect Australia's biodiversity. Ongoing investment is needed to ensure these gains are not lost.

Expanded investment will benefit all Australians

Indigenous Protected Areas and Indigenous rangers now represent a key front in Australia's efforts to manage and protect our environment against multiple pressures and are delivering measurable results in many different conditions. Securing and expanding these two vital initiatives for the long term will benefit every Australian by leaving a healthier environment for the future

▲ "The National Reserve System is Australia's network of protected areas, conserving examples of our natural landscapes and native plants and animals for future generations. Based on a scientific framework, it is the nation's natural safety net against our biggest environmental challenges." (Department of Environment and Energy, 2017)

State of the Environment Report: Indigenous leadership in frontline management

The 2016 Australian State of the Environment (SoE) Report, released in March 2017, documents the challenges involved in arresting biodiversity decline in Australia. The report identifies the significant contributions that Indigenous land and sea managers have made to address this national challenge.

"Indigenous people, their land, and their cultural and natural resource management activities make core contributions to managing Australia's environment. Indigenous lands contain significant levels of biodiversity, and long-term investment in Indigenous land management programs has delivered environmental, cultural and economic benefits" (SoE 2016).

The SoE Report identifies that the expansion of Indigenous Protected Areas over the previous decade has contributed greatly to Australia's world-class network of protected areas.

Nevertheless, the SoE report identifies a number of challenges to achieving the maximum effectiveness of Indigenous management, especially: "short-term funding cycles [that] reduce job security and long-term management planning."

More specifically, the SoE Report laments the lack of ongoing funding for IPAs and Indigenous rangers:

"Despite these significant contributions to Indigenous and non-Indigenous society, the future of Indigenous Protected Areas and the Working on Country program remains uncertain."

Stable, expanded support for Indigenous rangers and IPAs would improve the efficiency and effectiveness of Indigenous land and sea management across large areas, and further enhance our ability to arrest Australia ongoing biodiversity crisis.

Indigenous Protected Areas: the success of Indigenous-led partnerships

Indigenous Protected Areas represent a contract for management of environmental and cultural values between Traditional Owners and the federal government according to agreed criteria that satisfy requirements of the International Union for the Conservation of Nature. They are voluntarily entered into by Traditional Owner groups, and made operational after a management plan has been developed and agreed upon by the government and Indigenous partners, and when Traditional Owners deem that informed consent has been achieved.

Australia's network of 75 Indigenous Protected Areas covers over 67 million hectares across a variety of ecosystem types varying from tropical rainforest and savanna in Northern Australia, to sensitive arid and semi-arid desert environments, coastal and riverine ecosystems. It now represents almost half of our national system of protected areas, the Australian National Reserve System.

This report demonstrates that Indigenous Protected Areas provide a successful framework between Traditional Owners and the federal government to address environmental management priorities. Management includes work like feral animal control, threatened species protection, invasive weed eradication and prescribed burning.

Without active management throughout the year, many of Australia's ecosystems will decline particularly through impacts of uncontrolled wildfire, degrading pressures caused by feral animal predation, competition for food and habitat destruction or ecosystem change caused by exotic weed invasions and other threats. IPAs provide a catalyst for brokering effective partnerships for management with state land and sea management agencies, non-profit groups, the philanthropic sector and industry (SVA, 2016).

The Indigenous Protected Area program was first instituted by the federal government in 1997 and has since grown rapidly. Indigenous land owners around Australia see IPAs as a practical way of asserting their responsibility to protect the natural and cultural values of their country and foster local jobs.

Continuity and success

Australia's first Indigenous Protected Area, Nantawarrina in South Australia, provides just one of the many successful examples highlighted in this report. Nantawarrina Rangers' efforts in addressing and remediating the growing problem of local environmental degradation by feral goats shows that, 20 years since the creation of the Indigenous Protected Area program, investment in Indigenous land and sea management continues to pay off for our environment. Removal of 5600 goats over the last four years has significantly reduced grazing pressure in the IPA, allowing respite for threatened species such as the slender bell-fruit tree. Monitoring has shown a recovery in grazing sensitive vegetation such as native saltbush and sandalwood species increasing habitat quality. In different ways around Australia all Indigenous Protected Areas are contributing to local environmental improvement like this.

Indigenous rangers: Working on Country

Closely integrated with the Indigenous Protected Area program is the federally funded Working on Country program, which supports Indigenous rangers. Building on more recent initiatives by Traditional Owners to manage land and sea country, Working on Country was initiated in 2007 in recognition that more secure, flexible and streamlined funding arrangements were needed to support the success and continuity of Indigenous ranger work (van Bueren 2015).

The program has grown to support 110 ranger groups across Australia, and fund 883 full time equivalent positions which translate into employment for over 2500 individuals in full time, part time and casual or seasonal work each year. This report highlights how support for Indigenous ranger jobs is building a skilled workforce that is delivering practical improvements to our environment by combining science with traditional and local knowledge.

The social and economic benefits of Indigenous ranger jobs and Indigenous Protected Areas to individuals and communities are increasingly well documented, notably in recent research conducted by Social Ventures Australia for the Department of Prime Minister and Cabinet. This research found Indigenous Protected Areas with Working on Country rangers delivered up to a three to one return on the public dollar (SVA, 2016).

Indigenous rangers are now at the forefront of turning around environmental degradation right across Australia. Indigenous rangers and Indigenous Protected Areas are also enabling scientists and other stakeholders to access and support management of these important areas with the consent and active leadership of Traditional Owners.

Australia's environment: Unique threats require active management

Australia, as an island continent existing in long periods of relative isolation from our neighbours, has unique flora and fauna that has evolved with the influence of thousands of years of Indigenous land and sea management practices. The biodiversity of our continent includes many unique species found nowhere else, and our environment is particularly vulnerable to recent changes such as the introduction of feral animals and invasive weeds. Disruption of the fire regimes historically carried out by Aboriginal and Torres Strait Islander peoples across large expanses of Australia have led to hotter fires over larger areas. These wildfires degrade important wildlife habitat, impacting on Australia's dismal record of wildlife extinctions – one of the worst rates of extinction of any developed country in the time since European settlement with some 130 species gone forever.

The Australian Government recognises that over 1700 native species and ecological communities are known to be threatened and at risk of extinction; the individual fate of each of these species and communities make up the larger story of biodiversity decline. Indigenous Protected Areas and Indigenous rangers now represent an essential element of our response to this crisis providing locally skilled teams of workers able to both remediate and prevent specific environmental threats and do so with consent, support and active leadership, of their local communities and senior Traditional Owners of those places.

Threatened Species: Turning around decline

Many of Australia's threatened species' range occur across the same landscapes that Indigenous Protected Areas and Indigenous rangers operate. Within these regions are some of our most biodiverse and relatively intact landscapes. That fact, along with the strong examples of environmental success detailed in this report, demonstrate the need to extend Indigenous Protected Area and Indigenous ranger programs further. In the case of the iconic threatened species, the greater bilby, it is estimated that over 75% of the species' existing range occurs on Indigenous owned or managed lands. Work, such as strategic patch burning and feral cat control, undertaken by the Kiwirrkurra Rangers in the Kiwirrkurra Indigenous Protected Area is significantly increasing and improving survival prospects for the bilby.

Securing a healthy environment for all Australians

The opportunity in front of us is to extend the successes presented in this report both into the future and across more of Australia in partnership with Indigenous owners and managers of land and seas.

Indigenous land and sea management, through the Indigenous Protected Area and Indigenous Ranger programs, is turning around biodiversity decline and protecting species. The case studies in this report show that thoughtful expansion over time and area of IPAs and rangers will make a major contribution to protecting Australia's environment and averting further high rates of species extinction. Ensuring resilient and well managed ecosystems will need to be part of our ongoing response to environmental pressures including larger issues such as climate change. As a result, the future of many of our most valued and biodiverse places is now increasingly inseparable with the future growth and security of Indigenous Protected Areas and Indigenous rangers Australia-wide.

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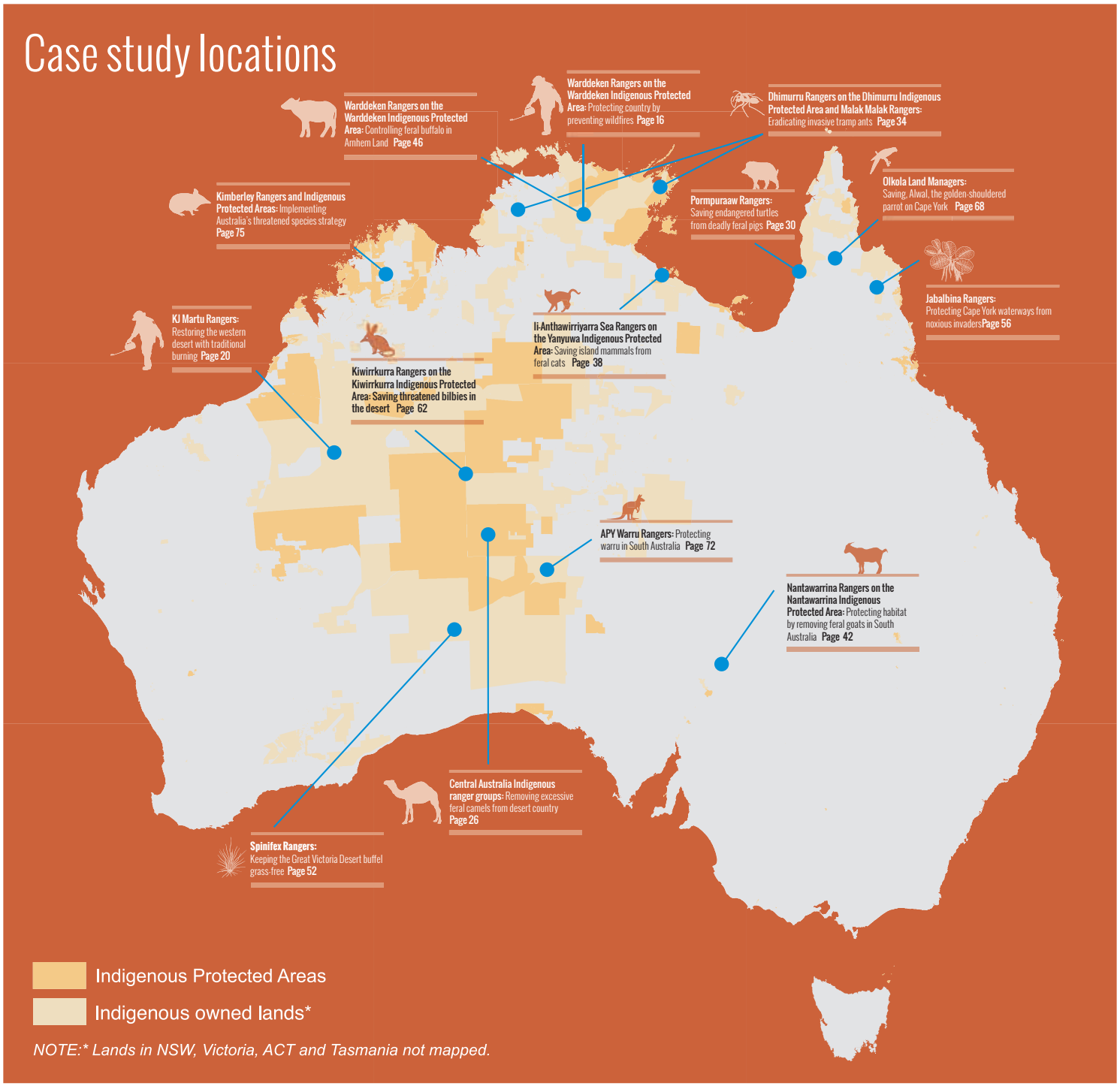
Nationwide examples of success

Around Australia, the work of Indigenous rangers and on Indigenous Protected Areas is delivering outstanding environmental protection. The case studies in this report represent local and regional scale efforts to limit wildfires through strategic burning, control feral animals, stop the spread of invasive weeds and protect threatened species. The following outlines the case studies included in this report.

- The groundbreaking **fire management program to limit wildfires on the Warddeken Indigenous Protected Area** in west Arnhem Land has safeguarded fire-sensitive species and ecosystems, reduced atmospheric greenhouse emissions, protect sacred sites, and reduce threats to people and infrastructure.
- **KJ Martu Rangers' work managing fire** in the western desert is reducing wildfires, protecting native species, and protecting and maintaining culture as they combine old and new technologies to strategically burn.
- Regional coordination by Indigenous rangers and through the Indigenous Protected Area framework has reduced both the numbers and the impacts of **feral camels in Central Australia**.
- **Pormpuraaw Rangers** on the Cape York Peninsula have used research and an integrated strategy to apply a greatly **reduce predation by feral pigs on the endangered olive ridley turtle**.
- Tramp ants are considered some of the world's worst invasive species but **Dhimurru Rangers on the Dhimurru Indigenous Protected Area and Malak Malak Rangers** on the Daly River are successfully eradicating and **controlling the spread of yellow crazy ants and African big-headed ants**.
- In the Yanyuwa Indigenous Protected Area in the Gulf of Carpentaria, scientists and **li-Anthawirriyarra Rangers** are reversing declines in small threatened mammal species by strategic **feral cat control**.
- Australia's first Indigenous Protected Area – the **Nantawarrina IPA – continues to protect and restore habitat by tackling rising pressures through feral goat management**.
- The Warddeken IPA is one of Australia's biodiversity hotspots, and work by **Warddeken Rangers to control feral water buffalo populations** and to monitor the precious wetlands and cultural sites they threaten has had outstanding results.
- **Spinifex Rangers** have developed a sophisticated and strategic approach to **keep the invasive weed, buffel grass, out of the Great Victoria Desert**, protecting one of Australia's last buffel grass free arid areas from wildfire and habitat destruction.
- Constant monitoring, strategic planning and hard manual labour by **Jabalbina Rangers has stopped the spread of the salvinia** weed from infesting pristine wetlands in Cape York Peninsula.
- The greater bilby's range has shrunk and now has most of last strongholds on land owned or managed by Indigenous people. On the Kiwirrkurra Indigenous Protected Area in a remote corner of the Western Desert, **Kiwirrkurra Rangers are protecting bilbies** through mosaic burning, feral cat control and population surveying.
- In the lush sub-tropical savanna of central Cape York Peninsula, dedicated work by **Olkola Land Managers has created a ray of hope for the beautiful but threatened 'Alwal'** or golden shouldered parrot. The parrot's future depends equally on whether Olkola Land Management can survive and thrive.
- In the APY lands of South Australia, a multifaceted **plan to save the warru is being implemented by the Warru Rangers**, so they can protect one of the Outback's cutest but most endangered marsupials.
- Four of the 10 mammals prioritised for protection by the government live in Indigenous Protected Areas in the Kimberley. The **Kimberley Ranger Network plays a pivotal role in protecting threatened species** through research and monitoring, fire management work, feral animal control, fencing and more.

Case study locations



Traditional knowledge and modern science combine to deliver environmental and cultural benefits. Here Warlpiri Elder Joe Jangala Bird shares knowledge with North Tanami ranger Jeffrey Matthews Junior as they conduct a prescribed burn at Papunya.

Credit Central Land Council.

Burning for conservation

Fire is an inseparable part of how the nature of Australia has been shaped. Over thousands of years, most of Australia's ecosystems adapted to some level of carefully managed mosaic burning by Indigenous Australians as they moved around their many different estates from the tropical savannas to the living deserts and beyond.

Mosaic burning shaped both our native vegetation and the wildlife that depends on it. With subtle variations according to local ecosystems and cultural law, the broad application of smaller, cooler fires throughout the year typically prevented the broadscale raging wildfires we often see today. These wildfires threaten not only human life and property but degrade our environment, destroying vegetation and leaving no refuge for wildlife.

With the introduction of fire-promoting invasive weeds, changes in climate, and the removal and restriction of Indigenous mosaic burning from the landscape over the last 200 years, a new approach to using fire to promote biodiversity is needed. That approach is now being applied over vast landscapes through the work of Indigenous Protected Areas and Indigenous rangers.

The case studies that follow are a snapshot of the results of this combined approach from the West Arnhem tropical savanna 'stone country' in the Northern Territory and the Western Deserts of Western Australia. From Cape York to the Kimberley, central New South Wales to southwest Western Australia, nature is being protected by mosaic burning by Indigenous rangers and on Indigenous Protected Areas.

There are many millions of hectares of Indigenous land where strategic fire management is not yet supported or sufficiently resourced. A thoughtful expansion of mosaic burning could bring major and large scale benefits to nature.

Indigenous rangers and Indigenous Protected Areas combine local traditional fire knowledge and practice with scientific information, mapping and techniques to deliver contemporary Indigenous fire management.

Jupp, Tony, James Fitzsimons, Ben Carr, and Peter See. "New Partnerships for Managing Large Desert Landscapes: Experiences from the Martu Living Deserts Project." The Rangeland Journal 37, no. 6 (2016): 571–582.

Warddeken Rangers on the Warddeken Indigenous Protected Area:

Protecting country by preventing wildfires

Warddeken Rangers are protecting country from wildfires by:

- Developing and instituting detailed fire management plans for the entire Warddeken IPA in Arnhem Land;
- Burning extensive areas every year using controlled, low-intensity fires, in accordance with annual fire management plans;
- Greatly reducing the frequency and extent of intense late-season wildfires;
- Protecting fire-sensitive ecosystems and irreplaceable cultural sites from wildfires;
- Reducing greenhouse gas emissions by preventing extensive wildfires.

Intense, late-season wildfires cause significant damage to nature and people in northern Australia. An intensive controlled burning program by the Warddeken Rangers has greatly reduced the frequency and extent of late-season wildfires on the Warddeken Indigenous Protected Area in Arnhem Land. Early-season fire management programs safeguard fire-sensitive species and ecosystems, reduce atmospheric greenhouse emissions, protect sacred sites, and reduce threats to people and infrastructure. Damaging wildfires can be greatly curtailed by lighting planned mosaics of low intensity fires early in the dry season. By doing this, Warddeken's fire management program has effectively reduced greenhouse gas emissions and damage to important cultural sites and fire-sensitive ecosystems. Their hard work and strategic planning provides a model for fire management programs across northern Australia.

Damaging wildfires in northern Australia

Large, intense late-dry-season fires pose serious ecological and social risks in northern Australia. Late-season wildfires burn at high intensity across large areas and cause significant ecological and social damage by:

- Destroying habitat for wildlife, especially by killing hollow-bearing trees;
- Damaging fire-sensitive ecosystems, such as rainforests;
- Increasing greenhouse gas emissions;

Warddeken Rangers, including Darius Maralngurra (right), worked with Jawoyn Rangers, including Brendan Ashley (left), to put out three wildfires on the west Arnhem Land plateau in late 2016.

Credit David Hancock

- Destroying irreplaceable cultural sites, including rock art; and
- Endangering life and property (Woinarski et al. 2014).

Fires cannot be eliminated from northern Australia but late-season wildfires can be greatly reduced through strategic fire management, especially by lighting mosaics of low intensity fires earlier in the year. Early-season fires burn small areas at low intensity and avoid the social and ecological damage that is caused by larger and more intense wildfires later in the dry season. Reducing the extent of late-season fires is a key land management objective for land owners and land management agencies across northern Australia.

Protecting Arnhem Land from wildfires

The Warddeken Indigenous Protected Area occupies 1.4 million hectares in Arnhem Land. Warddeken IPA contains an extraordinary abundance of cultural sites, including unique and irreplaceable rock art complexes, as well as significant ecological communities such as threatened sandstone shrublands and anbinik (Allosyncarpia ternata) rainforests. Intense, unplanned late-season wildfires damage these important features and threaten human lives, buildings and infrastructure.

Guided by the Warddeken IPA Plan of Management (Warddeken 2016a) and annual fire plans, the Warddeken Rangers undertake extensive controlled burning early in the dry season to prevent large, intense, unplanned fires later in the season. In 2016 alone, the Warddeken Rangers undertook the following fire management activities (Warddeken 2016b):

- Extensive community consultations were held before burning was initiated;
- Low intensity fires were lit along 3,043 km of roads and tracks plus additional protection around buildings, outstations and infrastructure;
- Helicopter crews dropped 135,000 incendiaries along 10,302 kms of flight lines to protect the IPA from wildfires that start in rugged and inaccessible country;
- Fire breaks were constructed around more than 500 ha of Anbilik dry rainforests, protecting these significant ecosystems from damage; and
- Ground and helicopter crews suppressed 15 late-season wildfires, preventing an increase in their extent.

These activities led to the creation of an extensive mosaic of low intensity fires across the Warddeken IPA (see Figure 1). This mosaic – in combination with areas burnt in earlier years – effectively restricted intense late-season wildfires to small areas only.

Ongoing fire protection work by the Warddeken Rangers has greatly improved fire patterns in the IPA over the past decade.

Before strategic burning was re-instituted, most of the IPA was burnt by large and intense, late-season fires.

From 1995 to 2004, virtually the entire IPA burnt late in the dry season at least once, and many areas were burnt multiple times by late-season wildfires (see Figure 2).

By contrast, late-season fires were greatly curtailed from 2006 to 2015 during the period of strategic fire management by the Warddeken Rangers. Approximately 35-40% of the IPA was totally protected from late-season fires during this period, and the frequency of late-season fires was greatly reduced across the entire IPA (Figure 3). Fire protection activities within the IPA also reduced the extent of intense late-season wildfires in adjacent regions (Figure 2 & 3).

By reducing the extent of intense late-season wildfires, the Warddeken Rangers have improved the ecological condition of their country, safeguarded important cultural sites and reduced atmospheric greenhouse emissions. Their hard work provides a model for improved fire protection across northern Australia.

Having strong governance through a well managed Indigenous Protected Area and a skilled ranger workforce has provided a sophisticated and strategic fire management capacity in the region.

Long term security for IPAs and their attendant ranger workforce, and enough support to extend similar capacity throughout the tropical savannah ecosystems of Northern Australia which cover almost 20% of the continent, will deliver major environmental gains for Australia.

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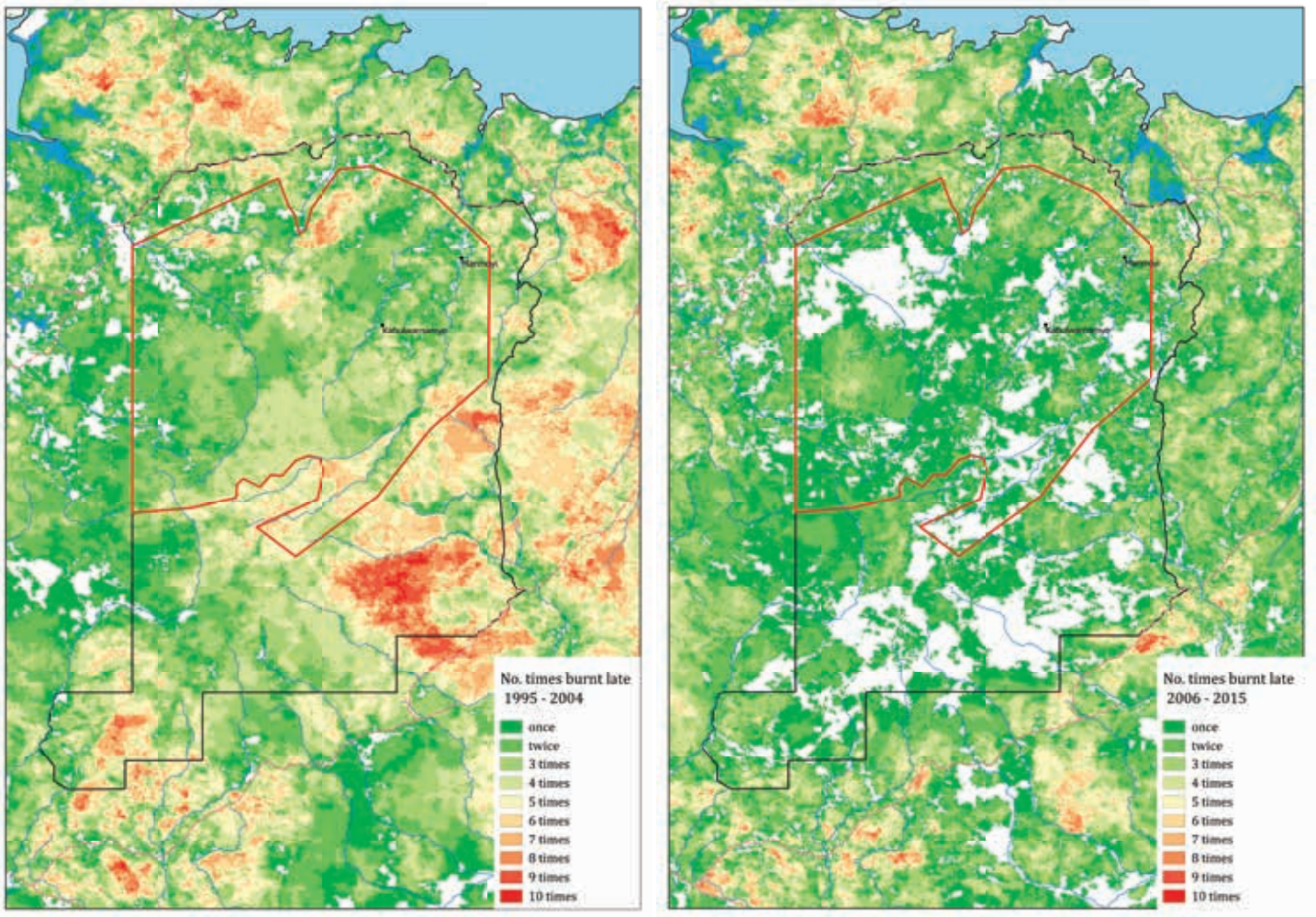
Damaging wildfires before and after the Warddeken fire management project



Red boundary line represents the Warddeken Indigenous Protected Area boundary

Black boundary line represents the Warddeken fire management project boundary

▲ Since systematic, strategic burning and wildfire suppression by Warddeken Rangers began, there has been a dramatic reduction in the size and frequency of destructive late dry season wildfires. The extensive boundary of the fire management project creates a buffer protecting both the Warddeken Indigenous Protected Area and the adjacent Kakadu National Park.

KJ Martu Rangers:
Restoring the western desert with traditional burning

In the western deserts, Indigenous fire management has prevented wildfires and promoted biological diversity for thousands of years. These traditional fire regimes suffered disruption when Martu briefly moved off country in the 1960s. During the 20 years Martu lived off country, wildfires burnt across large areas, damaging the habitat of threatened species such as the bilby and great desert skink. Kanyirninpa Jukurrpa (KJ) Martu rangers have been reinstating traditional fire regimes across vast areas of the western deserts by using a combination of old and new technologies, including aerial ignition. This work is improving habitats for many threatened animals and reducing damage to important cultural sites and natural areas. Martu continue to build their skills and capacity to look after their country, 13.5 million hectares, approximately twice the size of Tasmania.

Fire - the potential to harm or renew desert ecosystems

The western deserts region is one of Australia's largest intact natural landscapes. This vast area is home to many beautiful and threatened animals, including the great desert skink, mulgara and greater bilby.

All three species benefit from a fine mosaic of vegetation ages as affected by fire frequency, with older spinifex generally providing shelter, and regrowth areas providing diverse foraging opportunities. Traditional burning opened up the country, prevented catastrophic wildfires and is thought to have maintained healthy populations of bilby (Burbidge et al. 1988:35, Burrows and Christensen 1990:297).

KJ Martu Rangers are protecting cultural and natural sites by:

- Reducing large, intense wildfires by replicating traditional patch burning across the western deserts;
- Enhancing habitat for threatened species like the greater bilby and great desert skink;
- Reducing the risk to fire-sensitive habitats, including the habitat of endangered species such as the black-flanked rock-wallaby;
- Protecting long-lived woody vegetation such as mulga;
- Increasing the capacity of Indigenous communities to carefully manage fire across large, remote areas; and
- Reducing greenhouse gas emissions by limiting the spread of large, intense wildfires.

Fire has been central to the way Martu have cared for their country for thousands of years. It was and continues to be used for hunting, maintenance of cultural sites, communication, ceremonial reasons and renewal of country through the removal of old growth allowing for fresh and diverse regeneration.

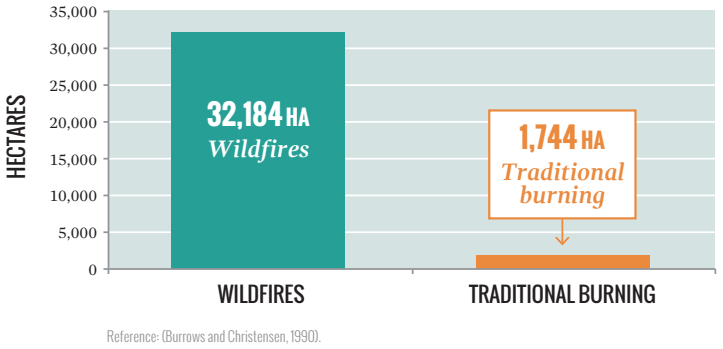
Minyawe Miller, Punmu elder and ranger, burning country using traditional jangi (fire sticks). Fire has been central to the way Martu have managed their country for thousands of years. It was and continues to be used for hunting, maintenance of cultural sites, communication, ceremonial reasons and renewal of country through the removal of old growth allowing for fresh and diverse regeneration.

Credit: Kanjirrinpa Jukurrpa.

During the 1960s to the 1980s, Martu were briefly absent from country as they moved out of their traditional lands to missions and pastoral stations on the fringes. Without human intervention, El Niño-driven monsoons had allowed dense spinifex to spring up in some areas and sprawling lightning caused fire scars to appear in others.

This resulted in what is generally referred to as an 'altered fire regime' characterised by more frequent, large, hot wildfires which are more destructive to people, habitat, communities and biodiversity. These wildfires were driven by lightning storms in late spring and early summer when winds are strong and variable and the country is dry. Wildfires often cover vast areas and leave little remnant vegetation. This impacted on small native animals as they were exposed to predators, especially to feral cats which travel to burnt areas to hunt native animals. Martu have always known fire has the potential to harm or renew desert ecosystems, depending on how it is applied.

Maximum fire size



Reference: (Burrows and Christensen, 1990).

▲ Vast wildfires damage fire-sensitive ecosystems and cultural sites.

KJ Martu Rangers: returning 'right way' fire to country

Martu moved back to the western deserts in the 1980s and began reinstating 'right way' fire. Right way fire refers to the mild patchy fires expertly applied through the cool times of the year. Right-way fire:

- increases diversity in habitat;
- makes communities safer;
- increases abundance and availability of bush foods;
- connects people to country;
- utilises traditional skills and cultural knowledge which is passed onto the younger generation;
- maintains the health of the western desert; and
- reduces greenhouse gas emissions by preventing the spread of large, intense wildfires.

> "Under traditional law and custom, Aboriginal people inherit, exercise and bequeath customary responsibilities to manage their traditional country."
>
> (N BURROWS ET AL 1990)

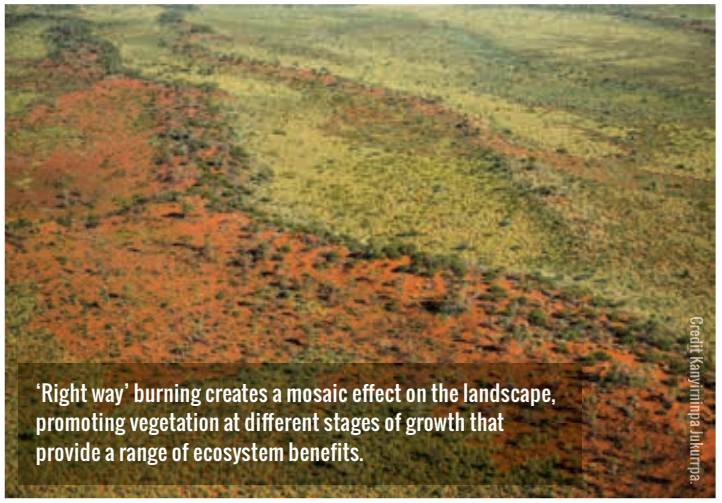
> You ask the Martu people, and they explain, "We left, and the fire regime broke down"
>
> Douglas Bird, http://news.stanford.edu/news/2012/july/australia-hunting-fire-071212.html

'Right-way' fire is an important factor in the health of Martu country, with traditional Martu burning practices an essential part of Martu management of their country. 'Right way' fire is implemented on country by rangers using a combination of traditional burning techniques and contemporary techniques in mapping, planning and burning.

Training and delivery of aerial ignition, in particular, has increased the rangers' capacity to emulate traditional patch burning across large areas. It also enables Martu to access remote and virtually trackless country to reinstate 'right way' fire.

Patch burning also creates strategic breaks to protect significant cultural and biological areas from wildfire; these include art sites, significant stands of vegetation and populations of endangered species such as black-flanked rock-wallabies.

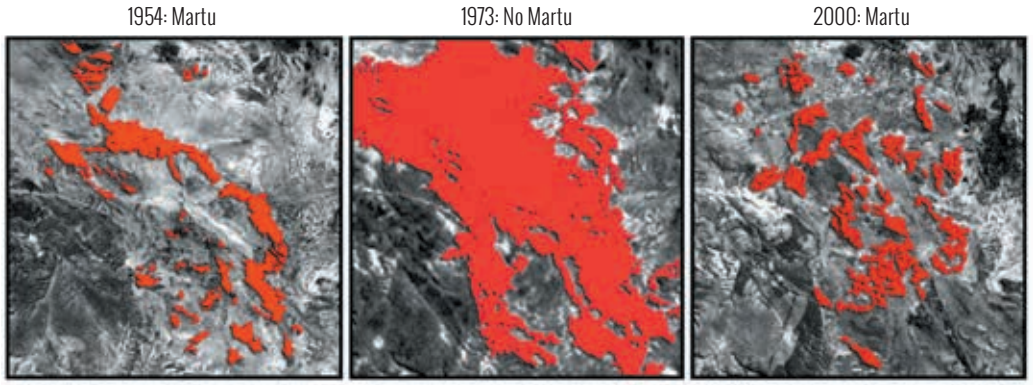
This work "improves the health and biodiversity of the Western Desert by extending fire management significantly across the Martu native title determination areas" (G. Catt, 2013)



'Right way' burning creates a mosaic effect on the landscape, promoting vegetation at different stages of growth that provide a range of ecosystem benefits.

Credit: Kanyirninpa Jukurrpa.

Fires between Yalpul and Parnngurr rockhole



The images are from aerial photographs (1954) and satellite images (1973 and 2000) of the Yulpul region just south of Parnngurr (total area of each image is 144 km²). This area has always been an important location for living, hunting, and gathering. The areas in red are recent burns. The images show the dramatic effects of wildfire that devastated the country when the Martu mosaic burning in the area collapsed during the years when they left their homelands for missions and settlements such as Jigalong. As shown in the 2000 image, the mosaic has now been reestablished with regular hunting and burning. It is this patchwork that buffers against climate driven wildfires in the region. Since then, this work has been able to extend over larger areas through the work of Indigenous rangers. Rebecca Bliege Bird, Nyalangka Taylor, Douglas W. Bird, Curtis Taylor, Brian F. Codding, Fiona Walsh.

Working together to keep country healthy through fire

With vast areas of Australia subjected to a changed fire regime since European settlement, there is an urgent need to find solutions for the health of the environment, and the people who interact with it through their cultural practices.

The vast and trackless nature of the desert and the limited opportunity for burning at ideal times means that a multi-faceted cross agency approach is required. Skills and expertise need to be developed across cultures to ensure that an increased understanding of 'good' fire is continually developed. Rangers require significant resources to ensure all areas of high biological and cultural importance are protected.

A 15 year fire strategy for Martu country has been produced in collaboration with Parks and Wildlife. This strategy, in conjunction with knowledge from the elders, guides the work of the rangers. The strategy aims to replace the lightning fire regime with a more traditional-based fire regime (smaller mosaic type burning with varied ages of regrowth). Such a regime will protect natural and cultural values, reduce the risk to infrastructure and increase the diversity of habitat.

> "Desert conservation programs won't work unless they include an understanding of Aboriginal fire."
>
> (D. Bird cited in D Strain - http://news.stanford.edu/news/2010/april/martu-burning-australia-042910.html).

Continuing the restoration of fire regimes in the western deserts will be central to increasing ecological resilience across the deserts. Martu have demonstrated the capacity to implement this at scale with the right resources. The growth and security of Indigenous ranger and Indigenous Protected Areas is fundamental to continuing successful fire management like this across Australia.

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Bliege Bird, Nyalangka Taylor, Douglas W. Bird, Cur:s Taylor, Brian F. Codding, Fiona Walsh waruku ngurra, waruku kuwiyi Martu people, hun3ng and fire in the western desert Rebecca

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Foxes, pigs, starlings, carp, rabbits, donkeys, brumbies. The list of feral animals threatening the health of Australia's environment is too long but the work of Indigenous rangers, like toad-busting Crocodile Islands Ranger Fabian Gaykamangu, are dramatically limiting their impacts.

Credit: Crocodile Islands Rangers

Controlling feral animals

Feral animals are major drivers of Australia's devastatingly high rate of native wildlife extinctions and a major contributor to large scale destruction of landscapes.

Controlling feral animals requires strategic planning and well-focused management actions across vast landscapes, and skilled people on the ground to implement those plans. Indigenous Protected Areas and Indigenous rangers are at the forefront of this work throughout the range of Australia's most prominent and damaging feral animals, such as feral camels, pigs, buffalo and cats.

The distribution and impacts of each these species cover tens of millions of hectares of Australia but regional scale containment, research and eradication of feral animals is making a difference to local environments. The following case studies demonstrate the variety of ways feral animal impacts are being successfully controlled across Australia in a range of different ecosystems. Informed by local knowledge and scientific research, Indigenous rangers and Indigenous Protected Areas are tackling feral animals and their impacts directly and helping reduce pressure on our native wildlife and ecosystems.

Our capacity to stem and reverse the impacts of feral animals depends on sustained, strategic efforts over large landscapes, varying environmental conditions, and over time. Strategic expansion of Indigenous Protected Areas and Indigenous rangers, and securing the organisational and workforce skills they provide, will be an essential part of reducing the distribution and impact of feral animals on a wider scale.

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Central Australia Indigenous ranger groups:

Removing excessive feral camels from desert country

Hundreds of thousands of feral camels roam over much of central Australia, damaging the sensitive desert environment. Camel numbers were greatly reduced during a systematic culling program prior to 2013, in which Indigenous rangers and Indigenous Protected Areas were an integral component. Though reduced, there are approximately 300,000 camels continuing to degrade waterholes and damage vegetation and infrastructure across the Outback. Indigenous groups own and manage large areas of the Outback and Indigenous rangers play a critical role in preventing camel numbers from rising sharply in the future. Groups like the Spinifex Rangers are actively monitoring and controlling feral camels, but their actions are constrained by funding and resources. Indigenous ranger groups and Indigenous Protected Areas with expanded, ongoing support can protect the natural and cultural heritage of the Outback from damage by large herds of feral camels.

Central Australia Indigenous ranger groups have protected the Outback by:

- Implementing their strategic goal to ensure that camel numbers do not increase on country;
- Monitoring feral camels while patrolling thousands of kilometres of roads and tracks and mapping the locations of all camels using mobile GPS units;
- Reducing camel numbers by on-ground and aerial culling. In total, 67% of all camels seen in ground surveys in 2015 were killed, as were 49% of camels seen in 2016;
- Removing dead and decaying camels from traditional waterholes; an important activity that highlights the damage camels inflict on significant cultural sites.

Australia's feral camel problem

Introduced feral camels are a major threat to environmental, production and cultural features in Outback Australia. Large groups of feral camels cause significant damage by polluting natural wetlands, outcompeting native species for scarce water resources, damaging water holes and other Indigenous cultural sites, eating Indigenous "bush tucker" plants and grazing-sensitive plants, wrecking fences, water supplies and other infrastructure, and threatening people (NRMMC 2010).

Hundreds of thousands of feral camels were estimated to live in the Australian Outback at the commencement of the National Feral Camel Action Plan (Saalfeld & Edwards, 2010). The four year camel action plan greatly reduced camel numbers in many areas by an estimated 160,000 camels, however an estimated 300,000 feral camels survived at the end of the control period; these camels continue to degrade the natural and cultural heritage of central Australia (Hart & Edwards 2016). Camel populations can double every eight years and scientists expect populations will rapidly increase unless current control efforts are expanded.

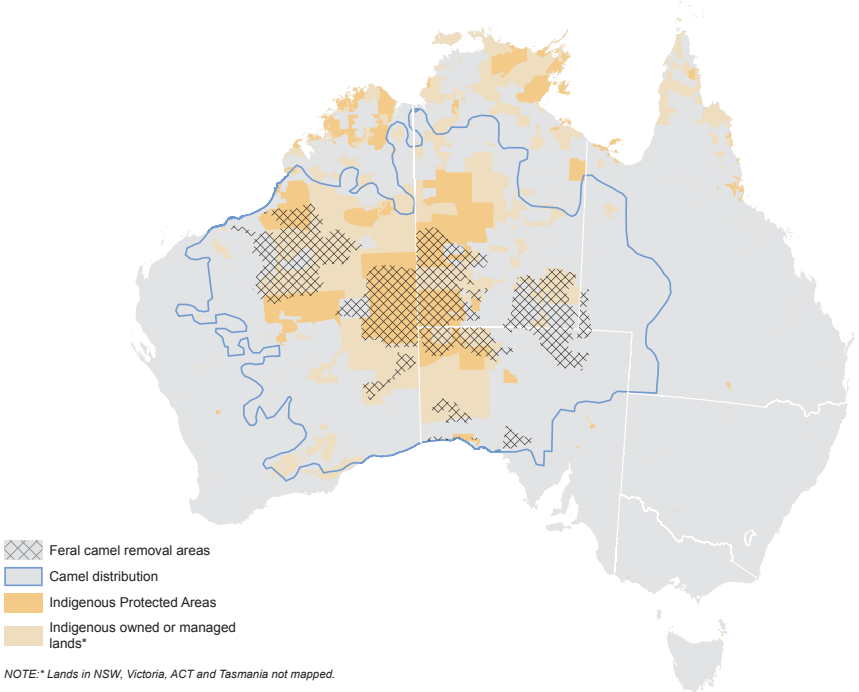
Credit: Central Desert Native Title Services

Indigenous people's key role

Indigenous communities own and manage large areas in central Australia.

Many Indigenous groups – including Indigenous ranger groups on Indigenous Protected Areas – enabled the plan's success. Indigenous organisations facilitated educational workshops and provided permission for camels to be culled or harvested on their land. In many areas, discussions within Indigenous communities changed community attitudes to camels by highlighting the damage that camels had inflicted on traditional water holes and cultural sites.

Camel control approaches do not prevent commercial use of camels, but realistic opportunities for this are extremely limited



◀ Indigenous rangers and Indigenous Protected Areas are fundamental to reducing feral camel numbers and impacts.

Source: see References

due to limited markets, remoteness, and expensive logistics. The changed attitudes and local ownership of the feral camel problem and solutions has resulted in more effective camel control (Kaethner et al., 2016). Indigenous Protected Area plans and Indigenous ranger workplans across the feral camel range now typically prioritise camel control as part of year on year work. Both IPAs and Indigenous rangers are now at the frontline of ensuring camel numbers do not rebound, and opportunities are taken to reduce impacts on the environment and economy.

Removing camels from Spinifex Country

The Spinifex Rangers work across 95,000 km^2 on lands managed by the Pila Nguru Aboriginal Corporation in the Great Victoria Desert. The rangers are one of many Indigenous groups who have removed excessive camels from their country, both during and after completion of the national camel program.

> Active involvement of Indigenous people was recognised as a key reason for the success of the National Feral Camel Action Plan
>
> (HART AND EDWARDS, 2016).

The Pila Nguru's Spinifex Healthy Country Plan lists feral camels as a key threat to Spinifex country. The plan includes a goal to "remove as many camels as possible from Spinifex country by 2020" so that, "in 2020 there is less camel impact at priority sites than in 2016."

To meet this goal, the rangers are undertaking extensive monitoring and control work. In 2014, they reduced camel numbers by aerial culling. More recently, the rangers have reduced camel numbers through on-ground culling.


Credit: Central Land Council

In 2016, the Spinifex Rangers monitored camels while patrolling 2,300 kms of roads and tracks: 88% of all tracks on their lands. They mapped the locations of all camels they saw, including culled animals, using portable GPS units. In 2016, the rangers culled almost half (49%) of all camels seen during patrols. The previous year, they culled 67% of camels seen during patrols.

Culling reduced camel impacts across 408,706 ha of Spinifex country in 2016

Reduced destruction will only be maintained with ongoing camel control

This estimate is based on a camel impact zone of 10 km radius around each culled animal (PNAC 2016). The Spinifex Rangers also removed dead camels from traditional waterholes; an important activity that highlights the damage that camels continue to inflict on significant cultural sites.

Where next?

The National Feral Camel Action Plan greatly reduced problems caused by excessive feral camels in central Australia. Indigenous rangers and Indigenous Protected Areas were integral to the success of that plan across millions of hectares of central Australia. However, unless camels continue to be controlled, their numbers will again rise to extreme and damaging levels.

The Spinifex Rangers, and many other Indigenous ranger groups across central Australian deserts, are at the forefront of the campaign to control camel numbers, and to continue the legacy set by the national action plan.

Work to date by Indigenous rangers and Indigenous Protected Areas has made a significant improvement to reducing the impacts of feral camels on our desert ecosystems and wildlife. Ensuring that proper resourcing is available for this work going forward is the key to prevent a resurgence in the feral camel population and to continue to improve environmental health over the more than three million square kilometres of their range through Queensland, Northern Territory, Western Australia and South Australia. Indigenous rangers and Indigenous Protected Areas are critical to making this happen.

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Pormpuraaw Rangers:

Saving endangered turtles from deadly feral pigs

The Pormpuraaw Land and Sea Rangers on the west coast of Cape York Peninsula have delivered spectacular success in protecting endangered olive ridley turtle hatchlings from feral pigs. Feral pigs are one of the most destructive pest animals in Australia; among other damage, they kill endangered marine turtles by destroying their nests and eating their eggs and newborn. Endangered olive ridley turtles are especially vulnerable to predation by feral pigs at nest sites on Cape York Peninsula. The Pormpuraaw Land and Sea Rangers are monitoring pig predation on turtle nests, culling feral pigs and protecting nests using innovative, predator-proof cages. The rangers' actions more than doubled the proportion of turtle nests that escaped pigs and other predators from 2014 to 2016. The incredible success of the Pormpuraaw Land and Sea Rangers demonstrates the need for ongoing and expanded support for Indigenous ranger groups to protect turtle hatchlings from deadly feral pigs and other predators.

The Pormpuraaw Land and Sea Rangers protected turtle hatchlings by:

- Monitoring predation of turtle nests by feral pigs and other predators;
- Reducing pig predation of turtle nests by culling more than 6000 feral pigs;
- Designing and building predator-proof cages to protect turtle nests;
- Improving nesting success by endangered olive ridley turtles.

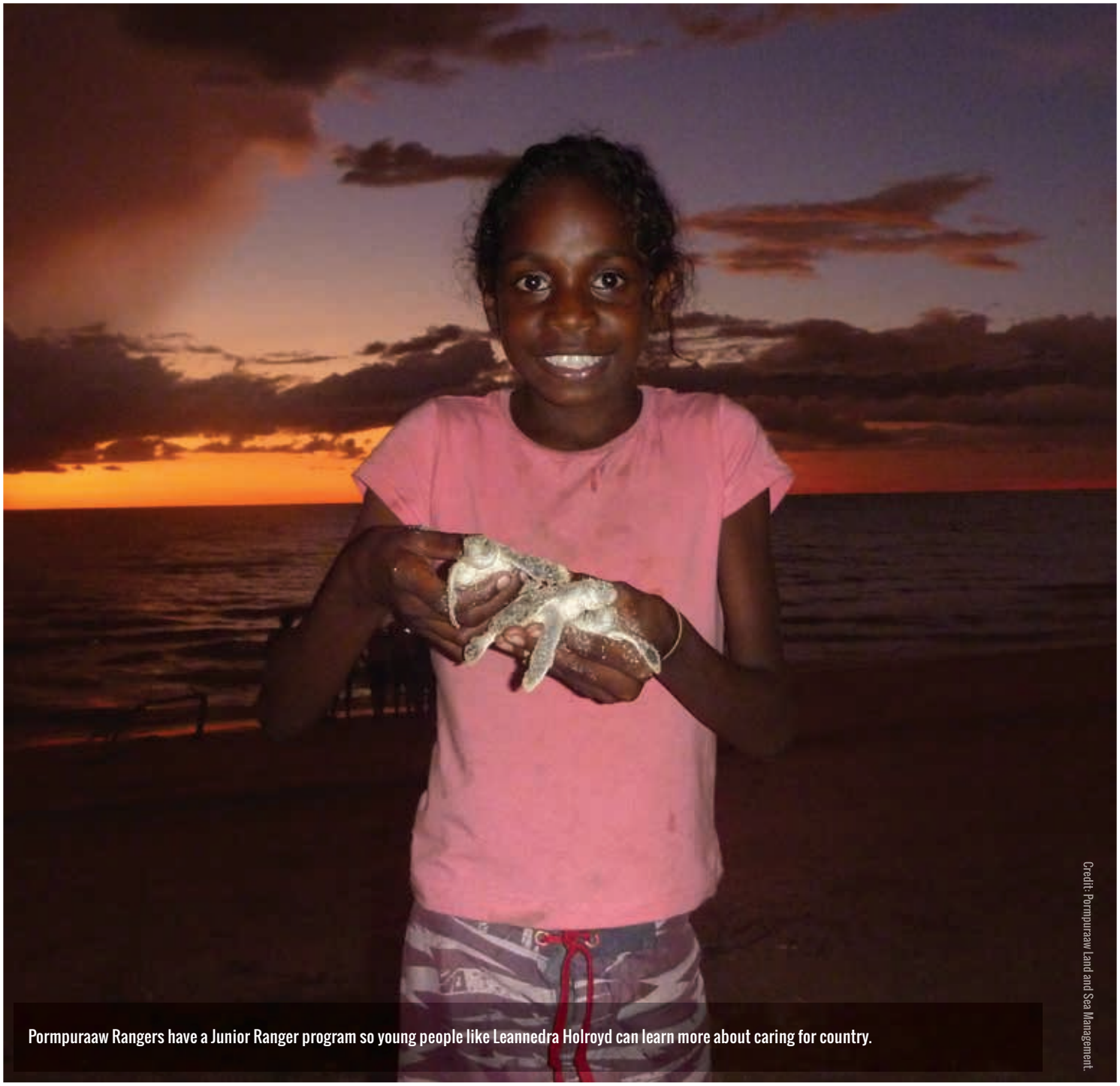
Deadly feral pigs

Feral pigs are one of the most damaging pest animals in Australia. The cost to the economy of pig damage and control exceeds $100 million every year (Australian Government, 2015); this estimate does not include damage to the environment.

Feral pigs damage the natural environment in many ways. They eat native plants and animals, including endangered frogs, fish, birds, turtles and mammals. Pigs degrade natural ecosystems and erode soils as they dig and forage. They pollute wetlands and streams, and spread diseases and invasive weeds (Australian Government 2015).

Turtles bury their eggs along sandy beaches, and feral pigs dig up the nests and eat the eggs and newborn turtles.

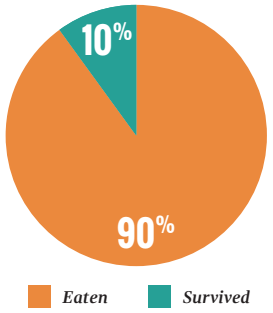
Feral pigs pose a severe threat to marine turtles. In some areas, pigs destroy up to 90% of turtle nests (Australian Government, 2017), contributing to a long-term decline in endangered turtles.



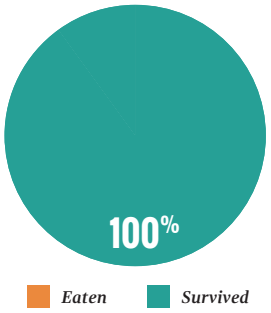
Pormpuraaw Rangers have a Junior Ranger program so young people like Leannedra Holroyd can learn more about caring for country.

Credit: Pormpuraaw Land and Sea Management.

Feral pigs destroyed 90% of turtle nests before pig and predator control began.

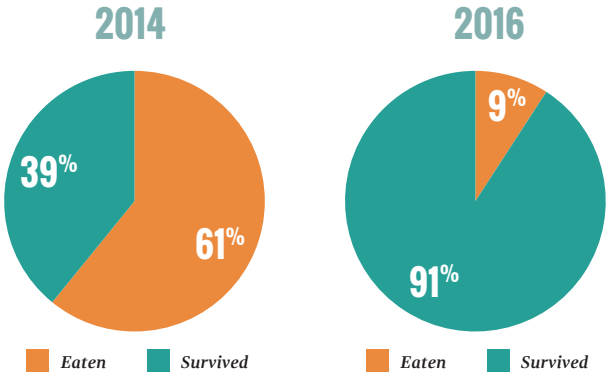


Predator-proof cages completely protected all turtle nests from pigs and other predators



Note: this is the survival in the nests that were caged only.

Survival of monitored turtle nests improved from 39% in 2014 to 91% in 2016 on one beach



Olive ridley turtles

The olive ridley turtle (*Lepidochelys olivacea*) is the smallest of the six species of marine turtle in Australia. It is listed as an endangered species under the national EPBC Act (Australian Government, 2017).

Olive ridley turtles feed in shallow waters off the northern Australian coast (and elsewhere in the Pacific and Indian Oceans). Female turtles lay about 100 round eggs in shallow nests on sandy beaches. Two months later, the young turtles emerge, crawl to the surface and dash to the ocean (Limpus 2008).

Feral pigs are abundant on Cape York Peninsula in northern Queensland where olive ridley turtles nest.

On remote Cape York Peninsula, Indigenous rangers are the people best placed to control pigs and protect endangered turtles.

Pormpuraaw Rangers have developed a strategy for limiting predation on turtle hatchlings by culling, designing nest cages and intensive research and monitoring.

Credit: Pormpuraaw Land and Sea Management

> “The control of feral animals is essential at nesting sites along Queensland’s coast to protect eggs from predation.”
>
> QUEENSLAND GOVERNMENT, 2013

Culling pigs and saving turtles

The Pormpuraaw Land and Sea Rangers live and work on the west coast of Cape York Peninsula. The rangers began monitoring olive ridley turtle nests along 85 kilometres of remote coastline in 2009. Their monitoring results from 2009 to 2013 – before intensive pig culling began – showed that feral pigs destroyed more than 90% of turtle nests every year.

To protect the turtles, the rangers began a major culling program and invented a special cage to protect turtle nests. The rangers culled feral pigs from a helicopter 4-5 times a year from 2014 to 2016, with additional ground shooting.

The portable cages Pormpuraaw Rangers designed and constructed prevent pigs and other predators from digging up turtle nests at the same time as allowing young turtles to escape through an open wire mesh. The cages led to 100 per cent nest success, and no predator damage, when tested at 200 nests in 2015-2016.

Ongoing monitoring from 2014 to 2016 revealed that the rangers’ actions more than doubled the proportion of turtle nests that escaped pigs and other predators. At one beach, 91% of nests that were monitored in 2016 hatched successfully compared to just 39% in 2014 – a spectacular improvement.

In addition to these actions, the rangers also remove discarded fishing nests (ghost nets) from beaches and nearby waters to prevent adult and hatchling turtles from becoming entangled and dying.

What is the future for olive ridley turtles?

Hard work by the Pormpuraaw Land and Sea Rangers has substantially improved nesting success by endangered olive ridley turtles on Cape York Peninsula. Their success is due to an integrated strategy of intensive culling of predatory pigs plus targeted protection of turtle nests. Systematic monitoring provides unambiguous evidence of successful outcomes.

The skills developed by the rangers, and lessons learnt, provide opportunities to further improve the fate of endangered turtles. However, as in the other profiles in this booklet, future successes depend entirely on ongoing support for the Pormpuraaw Land and Sea Rangers and neighbouring Aboriginal land and sea management groups. Unless their great work continues, baby olive ridley turtles have no way to escape from predatory feral pigs. Australia’s success in turning the tide on reducing feral animal impacts on threatened species depends on extending and securing this work over wider areas.

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Dhimurru Rangers on the Dhimurru Indigenous Protected Areas and Malak Malak Rangers:

Eradicating invasive tramp ants

African big-headed ants, yellow crazy ants and other introduced pest "tramp ants" are listed as some of the world's worst pest animals. They ruin crops, damage buildings and degrade natural areas by preying on, outcompeting or destroying the habitat of native animals. Indigenous rangers in the Northern Territory have played an important role in eradicating and controlling invasive ants across northern Australia. Two notable examples are: (1) the Malak Malak Rangers who, with CSIRO scientists and the Wangamaty Landcare Group, have completely eradicated African big-headed ants from a Daly River rainforest; and (2) the Dhimurru Rangers in Dhimurru Indigenous Protected Area in north-east Arnhem Land, who have coordinated and undertaken the largest control program for yellow crazy ants in Australia. Indigenous rangers have an intimate knowledge of their country and are best positioned to keep pristine areas free of invasive ants and other pests. Indigenous Protected Areas provide a structured framework for Traditional Owners to work with scientists and management agencies to access affected land and treat infestations. Success to date shows that properly resourced IPAs and Indigenous rangers can eliminate and reduce tramp ant threats across large areas of Australia.

Malak Malak Rangers eradicated African big-headed ant by:

- Discovering and mapping an African big-headed ant infestation at Daly River;
- Strategically poisoning the invasive ants, with collaborators;
- Monitoring the area to ensure African big-headed ant populations did not survive or re-invade the area;
- Totally eradicating African big-headed ants from the Daly River rainforest.

Controlling tramp ants

Tramp ants – invasive ants that have spread around the globe – are among the world's most serious invasive species, with enormous impacts on human enterprises and natural areas.

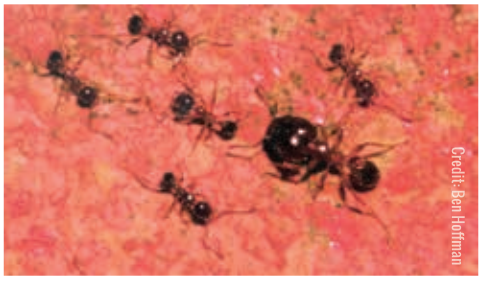
A major challenge in controlling tramp ants is finding colonies when they are new, small and amenable to eradication and control. Old, large established populations can be extremely difficult to eradicate, especially for species that form "super colonies" that cover large areas. Argentine ants, for example, form a super-colony across much of the Melbourne metropolitan area (Australian Government, 2012).

> "The cost of tramp ants to the Australian economy is estimated to exceed $1.5 billion annually."
>
> (AUSTRALIAN GOVERNMENT, 2012).

The Malak Malak Indigenous Rangers and partners won a Northern Territory Landcare award for their important role in safeguarding the Daly River environment from invasive tramp ants.

Credit: Ben Hoffman

In large parts of Australia, Indigenous rangers living on Indigenous Protected Areas and other Aboriginal lands form the major point of detection and defence against invasive tramp ants. Not surprisingly, Indigenous rangers have made major contributions to controlling and eradicating tramp ants in a number of areas in northern Australia. Two major successes involve the complete eradication of African big-headed ant populations on the Daly River and eradication and control of yellow crazy ants by Indigenous rangers in East Arnhem Land in the Northern Territory.



Credit: Ben Hoffman

African big-headed ant

Credit: Bob Taylor

Yellow crazy ant

Malak Malak rangers: Eradicating African big-headed ants at Daly River

African big-headed ants (Pheidole megacephala) are one of the world's worst pest animals (GISD, 2017). African big-headed ants are listed for national control in the Threat Abatement

Plan to Reduce the Impacts of Tramp Ants on Biodiversity in Australia and its Territories (Commonwealth of Australia 2006). Most Australian infestations are along the east coast with scattered populations in the Northern Territory, including Darwin.

In 2005, an isolated population of African big-headed ants was discovered in rainforest on the banks of the Daly River in the Northern Territory. Unless eradicated, the population would have expanded further to degrade the environment along the Daly River and surrounds. Working in collaboration with the CSIRO and Wangamaty Landcare Group, the Malak Malak Rangers worked on a program to: (1) identify and map the extent of the infestation, (2) kill the African big-headed ants using insecticides, and (3) monitor the site to ensure that African big-headed ants did not survive or re-establish.

The action was successful and African big headed ants were completely eradicated from the area. This success was documented in a series of scientific papers (e.g. Hoffmann 2010) as eradication of tramp ants had previously been seen as intractable. Among other factors, project success was attributed to the fact that the colony was discovered early on, while it was relatively small, and before it had grown too large to be controlled.

A scientific study at Daly River by CSIRO documented that native ants (which were locally exterminated by the African big headed ants) quickly recovered after the pest ants were eradicated (Hoffmann 2010).

The rangers' work not only removed the invasive pests but also led to the rapid restoration of rainforest diversity.

The Malak Malak Indigenous Rangers, Wangamaty Landcare Group and partners won a Northern Territory Landcare award for their important role in safeguarding the Daly River environment from invasive tramp ants.

Dhimurru Indigenous Rangers have controlled yellow crazy ants in the Dhimurru Indigenous Protected Area by:

- Coordinating all management of invasive yellow crazy ants in the Dhimurru Indigenous Protected Area, through the Dhimurru Aboriginal Corporation;
- Mapping and containing or eradicating crazy ant infestations, with collaborators;
- Monitoring treated areas to ensure yellow crazy ants do not survive or re-invade;
- Locally eradicating at least 20 infestations of yellow crazy ants and containing many more;
- Preventing the expansion of yellow crazy ants into pristine habitats in north-east Arnhem Land and beyond.

Dhimurru Rangers and Indigenous Protected Area: Controlling yellow crazy ants in north-east Arnhem Land

A far larger program to control tramp ants has been conducted by the Dhimurru Rangers and partners in the Dhimurru Indigenous Protected Area in north-east Arnhem Land. Following the discovery of yellow crazy ants on Gove Peninsula and surrounds, including in bauxite mining areas, the Dhimurru Aboriginal Corporation took control of the eradication program (in the absence of any lead state or federal agency). The Dhimurru program is underpinned by 'two-ways' management that incorporates both mainstream scientific and Indigenous skills (Hoffmann et al. 2012).

As occurred at the Daly River, the Dhimurru Indigenous Rangers collaborated with CSIRO scientists to find, poison and

Dhimurru rangers have conducted the largest successful control program of yellow crazy ants in Australia.

Brendie Ben Hoffman

assess the effectiveness of control of yellow crazy ant colonies. The rangers eradicated at least 20 colonies of yellow crazy ants; the largest eradication program in Australia. However, ongoing surveys detected more colonies than expected, especially in areas mined for bauxite (Hoffmann 2009).

The *Dhimurru Yellow Crazy Ant Management Plan* provides a strategic framework for all control efforts at Dhimurru, and has provided a model for yellow crazy ant control in other regions of the country (Hoffmann et al. 2012). The current management goal is to eradicate all populations on Gove Peninsula and contain a larger, isolated infestation to prevent its further spread (Lach and Barker 2013). The Dhimurru Indigenous Protected Area provides ongoing support for this work and implementation of the Crazy Ant Management Plan by ensuring governance of the protected area is stable, responsive and able to continue to broker strong relationships with government agencies and scientists working with Dhimurru.

Continued, ongoing control is required to ensure that yellow crazy ants do not spread further across Arnhem Land and beyond. With continued and expanded resourcing current success can be expanded to scale-up current efforts to a level that will result in permanent eradication of tramp ants from Arnhem Land and other remote areas. The benefits of this work for all Australians are highly significant.

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Ii-Anthawirriyarra Sea Rangers on the Yanyuwa Indigenous Protected Area:

Saving island mammals from feral cats

Feral cats have a devastating effect on Outback ecosystems but work by Indigenous rangers on islands is proving to be a key opportunity to protect Outback wildlife from extinction. The Ii-Anthawirriyarra Sea Rangers working on the Yanyuwa Indigenous Protected Area have made great strides in protecting native animals by culling feral cats on West Island in the Gulf of Carpentaria. After cat numbers were reduced, the rangers recorded substantial increases in small native mammals – some of which had not been seen locally for many years. The rangers are keen to expand the program to completely eradicate feral cats from West Island. Once cats are eliminated, threatened species can be re-introduced to West Island, boosting the biodiversity of the island and safeguarding threatened species on the mainland, where roaming cats still prey on many native animals.

Scourge of the Outback: Feral cats

Feral cats are one of the greatest threats to native animals in Australia and the rest of the world (Woinarski et al. 2014, Doherty et al. 2016). Feral cats threaten 74 mammals and at least 40 birds, 21 reptiles and four species of amphibian in Australia (Commonwealth of Australia 2015).

It can be difficult to control feral cats on the mainland due to the large area to be managed, the low density of people and cryptic behaviour of feral cats. Fortunately, feral cats can be more easily controlled and even eradicated on offshore islands (and in fenced 'mainland islands') to generate long-term sustainable increases in native animals.

Ii-Anthawirriyarra Sea Rangers are protecting native animals by:

- Providing access and information to scientists working to control cats and protect wildlife on West Island;
- Surveying feral cats and native mammals in collaboration with scientists;
- Humanely culling feral cats using aerial and ground baiting;
- Surveying the recovery of native mammal populations after cats were removed;
- Reducing numbers of feral cats and boosting native mammals on West Island.

Feral-free islands

The goal to "eradicate, or control, cats on offshore islands of high, or potentially high, biodiversity value" is listed as a "very-high priority" in the national *Threat Abatement Plan for Predation by Feral Cats* (Commonwealth of Australia 2015).

Credit: Rachel Paltridge

Ii-Anthawirriyarra Sea Ranger Anthony Johnston with a dead cat found after the 2015 baiting. Indigenous rangers across Australia are trained to kill feral animals as humanely as possible.

▲ A combination of aerial and ground baiting was used to control cat numbers. An advantage of aerial baiting to control feral cat numbers, like the work li-Anthawirriyarra Sea Ranger Lynette Simon is about to undertake, is that a large area can becovered.

The 'remoteness' of many offshore islands – many islands are far away from capital cities – can make this goal difficult to realise. However, for Traditional Owners who live on or near these islands, their country is neither 'remote' nor inhospitable; it is familiar, nearby and home. Indigenous rangers living and working in Indigenous Protected Areas and beyond are well located to efficiently carry out tasks on many offshore islands, including controlling feral cats and monitoring the recovery of native animals.

Removing cats from West Island in the Northern Territory

Cats were first introduced to West Island – in the Sir Edward Pellew group of islands in the Gulf of Carpentaria – in 1993, and quickly caused a catastrophic loss of native mammals.

No native mammals were recorded in intensive surveys in 2003, 2005, 2008 and 2009, although it was thought that some species may have persisted in extremely low numbers. The northern brush-tailed phascogale (*Phascogale pirata*) – a vulnerable species under the EPBC Act (Woinarski et al. 2014) – was among the species that disappeared from West Island after cats were introduced.

In 2011, the li-Anthawirriyarra Sea Rangers from the Yanyuwa Indigenous Protected Area, with support from scientists from Desert Wildlife Services and Territory NRM, began a scientific program to control cats and monitor mammal recovery on West Island (Paltridge et al. 2016). The program aimed to reduce, and hopefully eliminate, feral cats and to boost the number of surviving native animals. The rangers used repeated aerial baiting from 2011 to 2014 to control cats. They monitored outcomes annually using track transects, small mammal traps and camera traps on both West Island and a nearby island (Vanderlin Island) where cats were not controlled.

Rapid outcomes from li-Anthawirriyarra Sea Ranger work

The li-Anthawirriyarra Sea Rangers' control program led to a very rapid decline in feral cats and an increase in native mammals. The number of feral cats is estimated to have been reduced by 80% (Paltridge et al. 2016).

> "Beaches are now teeming with Delicate Mice and every creek has grassland melomys."
>
> DR RACHEL PALTRIDGE, DESERT WILDLIFE SERVICES.

At the start of the program in 2011, no native mammals were trapped on West Island (consistent with findings over the previous decade). In 2012, after cat control began, small mammals were recorded in 5% of mammal traps. Trap success increased to 11% in 2013 and 17% of mammal traps in 2014.

Camera traps showed a similar trend. No native mammals were recorded by camera traps from 2011 to 2013, but sightings then increased and native mammals were recorded at 28% of camera traps in 2015. By contrast, native mammals did not increase in abundance on Vanderlin Island, where cats were not controlled (Paltridge et al. 2016).

Since cat control began, three species of native mammals have once again been recorded on West Island: the delicate mouse,

grassland melomys and water rat. The vulnerable Northern Brush-tailed Phascogale has not yet been found, and cats may have caused its local extinction before the rangers began their work.

Building on success

Future work by the li-Anthawirriyarra Sea Rangers on West Island could both maximise the benefits attained under the control program, by preventing an increase in cat numbers and subsequent decline in native mammals, and build on past successes by facilitating the complete eradication of feral cats from the island.

Complete eradication of feral cats would enable a sustainable, long-term recovery of native mammals (at low cost over the longer-term) and would also allow the vulnerable northern brush-tailed phascogale to be re-introduced to the island. The re-introduction of phascogales to the islands, after cats are eradicated, is listed as a priority action in the Action Plan for Australian Mammals (Woinarski et al. 2014).

The skills gained and lessons learned by the li-Anthawirriyarra Sea Rangers provide an excellent stepping stone to expand cat control and eradication across the Sir Edward Pellew Island group. This could lead to greater benefits for other fauna that may be re-introduced from mainland Australia in the future. The successful work in the Yanyuwa Indigenous Protected Area by li-Anthawirriyarra Rangers provides a model for making other islands cat free around the Northern Territory and Australia. Increasing and securing this work over the longer term offers a practical pathway to preventing and then reversing the decline in Australia's threatened and vulnerable native mammals on offshore islands.

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Since cat control began, three species of native mammals have once again been recorded on West Island: the delicate mouse, grassland melomys (being recorded by li-Anthawirriyarra Sea Ranger Clem Goodman) and Water Rat.

Credit: Rachel Paltridge

Nantawarrina Rangers on the Nantawarrina Indigenous Protected Area:

Protecting habitat by removing feral goats in South Australia

Feral goats are a major pest animal in many conservation areas, severely degrading natural environments and habitats for threatened species. The Nantawarrina Rangers in South Australia have removed thousands of goats from the Nantawarrina Indigenous Protected Area and monitored the recovery of native vegetation after goats were removed. "Competition and land degradation by unmanaged goats" is listed as a key threatening process under the EPBC Act. By protecting grazing-sensitive plants and restoring degraded areas, Nantawarrina Rangers have helped improve condition of the natural environment while gaining revenue from mustered goats. With ongoing and expanded support from the Indigenous Rangers Working on Country scheme, the Nantawarrina Rangers can continue to protect the sensitive landscape of the Nantawarrina IPA and create viable economic options for their community and children.

Nantawarrina Rangers on the Nantawarrina Indigenous Protected Area have protected and restored habitat by:

- Removing thousands of feral goats from the Nantawarrina IPA in South Australia;
- Monitoring vegetation recovery after goats were removed;
- Protecting grazing-sensitive plants from damage by feral goats;
- Revegetating degraded, over-grazed areas with native plants.

The feral goat problem

Feral goats are a major pest in conservation areas in inland Australia, especially in rocky ranges where densities may be high but populations are difficult to control. Goats erode fragile soils, eat palatable plants (including threatened species) and degrade habitats for native animals, including the beautiful and vulnerable yellow-footed rock-wallaby.

While goat numbers vary greatly over time, it was estimated that were about 3.3 million feral goats in Australia in 2010. Numbers have continued to increase over the past two decades (Australian Government, 2013). The problem is so serious that "Competition and land degradation by unmanaged goats" is listed as a key threatening process under the national Environment Protection and Biodiversity Conservation Act (1999).

Feral goats erode fragile soils, eat native plants and degrade habitats for native animals.

As well as their negative impacts on the environment, feral goats can provide sources of income for some pastoralists, and some Indigenous groups. Large mobs of goats can be mustered and transported to processing plants. Feral goat management involves an ongoing balancing act between removing goats from areas of high conservation value and while allowing the use of some populations for economic purposes (Australian Government, 2013).

Nantawarrina Rangers removing goats from Nantawarrina IPA

The Nantawarrina Indigenous Protected Area (IPA) in South Australia was the first IPA declared in Australia in 1998 after initiation of the IPA program in 1997. The 58,000 ha IPA is home to the Adnyamathanha people, and is located near the Vulkathunha-Gammon Ranges National Park and Arkaroola Wilderness Sanctuary. As Traditional Owners, the Nantawarrina Rangers seek to care for their traditional country and to develop sources of income to ensure economic sustainability for future generations. They are achieving this goal by developing ecotourism facilities – to attract many tourists who visit the nearby parks – and by mustering and selling feral goats (Australian Government, 2015).

In total, 900 goats were removed in 2013/14, 2,100 in 2014/15 and 2,600 in 2015/16, greatly reducing grazing pressure in the region.


Australia's first Indigenous Protected Area has shown the success of the model through long lasting environmental gains: Nantawarrina Senior Ranger Ian Johnson Snr, Elder Kelvin Johnson, Rangers Dulcie Wilton, Ian Johnson Jnr, Daniel Johnson and IPA Manager Alan Smith.

Nantawarrina Indigenous Protected Area

Surveying and restoring native vegetation

The rangers are also using vegetation monitoring sites, set up at the beginning of the IPA, to monitor the effectiveness of their efforts. Results from vegetation surveys in 2016 show increases in highly palatable plant species including saltbush species (Chenopodiaceae family), Berrigan (Eremophila longifolia) and Northern Sandalwood (Santalum lanceolatum). Additionally, the rangers have protected grazing-sensitive plants from damage, including the slender bell-fruit tree (Codonocarpus pyramidalis) which is listed as an endangered species in South Australia (Australian Government, 2015).

Simultaneously the rangers are revegetating areas of worst impact by planting seedlings and by 'seed bombing': an activity which involves encasing native seeds collected from the IPA in balls of clay and dispersing the 'seed bombs' across the country, giving the seeds a good distribution and a protective coat while they wait for rain. Among the species planted are species which are both culturally important and important food sources for native animals such as quandong (Santalum acuminatum) and saltbush.

Nantawarrina Rangers are culling goats, strategically controlling their movement and revegetating to reduce their devastating impact on the landscape.

Credit: Nantawarrina Indigenous Protected Area

Feral goats - being herded off country by Nantawarrina Ranger Bruce Wilton.

Credit: Nantawarrina Indigenous Protected Area

Long-term goals

As goat numbers are brought under control and vegetation is rejuvenated, the rangers have an ambitious long-term goal to return species to the IPA which have become locally extinct, such as the brush-tailed possum (Trichosurus vulpecula). Rangers recently travelled south to Wilpena Pound to participate in a possum reintroduction project which they hope will help to guide their own reintroduction efforts in the future.

With ongoing and expanded support from the Indigenous Rangers scheme, the Nantawarrina Rangers can continue to protect the sensitive and breathtaking landscape of the Nantawarrina IPA and create viable economic options for their community and children. As the oldest and first Indigenous Protected Area in Australia their aspiration is to secure good management in the long term for the health of the environment and people.

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Warddeken Rangers on the Warddeken Indigenous Protected Area:

Controlling feral buffalo in Arnhem Land

The Warddeken Rangers in the Warddeken Indigenous Protected Area in Arnhem Land have devoted significant effort to strategic control of feral buffaloes, and the protection and monitoring of important wetlands and cultural sites buffalo threaten. Feral buffalo have had dramatic impacts on the environment, especially on sensitive wetlands and floodplains in northern Australia. Buffalo also destroy irreplaceable rock art and damage important Indigenous cultural sites. Guided by a five year plan of management, Warddeken Rangers have removed thousands of buffalo from their IPA every year. Nevertheless, buffalo numbers continue to rise in Arnhem Land, causing ever-increasing damage. Buffalo can be reduced to manageable numbers with consistent and strategic effort. An increased and sustained effort like Warddeken's to manage buffalo populations through their Indigenous Protected Area and Indigenous rangers, alongside collaboration with other IPAs and ranger groups across Arnhem Land, can protect the unique natural and cultural heritage of Arnhem Land for future generations.

Warddeken Rangers have protected wetlands, floodplains and cultural sites by:

- Culling thousands of destructive feral buffalo from the Warddeken IPA;
- Erecting fences to protect selected wetlands, burial sites and rock art from buffaloes;
- Monitoring water quality and vegetation recovery after buffalo removal;
- Developing collaborations with university researchers to refine monitoring techniques.

The feral buffalo problem

The introduction of feral Asian water buffaloes (Bubalus bubalis) to Australia in the 1800s has led to disastrous ecological outcomes. Buffalo severely damage wetlands and floodplains and degrade habitats of many native animals including crocodiles, barramundi, freshwater turtles and waterbirds.

In coastal wetlands, paths created by buffaloes allow seawater to enter into freshwater floodplains, killing freshwater trees and wetland plants and destroying habitat for freshwater animals. Buffaloes also spread the livestock diseases brucellosis and tuberculosis, and aggressive animals endanger human lives (Commonwealth of Australia, 2011).

Buffalo numbers in northern Australia peaked at 350,000 in the 1980s, but then declined after an intensive eradication campaign. However, numbers have steadily increased since that period, and there were estimated to be 150,000 buffalo in the Northern Territory in 2008 (Commonwealth of Australia, 2011). The lack of Territory-wide strategic approach to buffalo control since then indicates numbers are now at least that or higher across millions of hectares.

Buffaloes in Warddeken Indigenous Protected Area

Warddeken Indigenous Protected Area occupies 1,394,951 hectares in the rugged stony country of Arnhem Land. Buffaloes cause major problems in the Warddeken IPA, especially in areas of rocky terrain where monitoring and control can be extremely challenging.

Feral buffalo transform clear-water wetlands to mud-filled soaks and destroy traditional wetland food plants. Fragile, spring-fed wetlands in stream headlands are most severely affected. A 2011 survey found that feral buffalo had caused moderate to high levels of damage at 93% of more than 300 surveyed wetlands (Warddeken Land Management Ltd 2012).

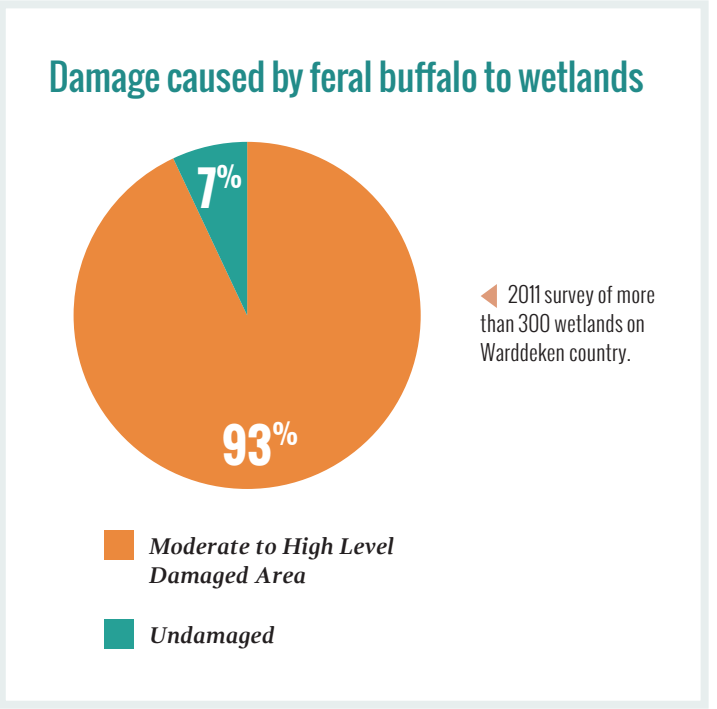
Buffaloes also pollute drinking water, pose a physical threat to people, and destroy important cultural sites, especially rock art sites. The large animals shelter beneath rock overhangs and rub against the rock walls, destroying important and irreplaceable cultural heritage.

Culling buffaloes to protect country

Since declaration of the Warddeken IPA in 2009, the Warddeken Rangers have devoted considerable energies to reducing numbers of feral buffaloes. Current management aims to control buffalo numbers and, through targeted efforts, to prevent further degradation of upland wetlands and culturally significant areas, including wetlands, rock art and burial sites (Warddeken Land Management Ltd, 2016).

Since 2011, rangers have culled 900 to 2,200 buffaloes each year, using aerial and ground shooting (data from Warddeken annual reports). Meat from some culled animals is distributed to local people to increase food security and maintain support for the control program. Rangers have also erected strong fences at rock art sites to prevent buffaloes from damaging irreplaceable artwork.

Warddeken IPA has developed productive collaborations with university researchers to refine monitoring techniques and to enhance the rangers' capacity to monitor buffalo impacts.



Warddeken Rangers now test water quality at selected wetlands and analyse high resolution aerial photographs to monitor wetland condition across areas that are difficult to access. Their monitoring results show recovering vegetation and soils in areas where buffaloes have been consistently controlled.

More work needed

The dedicated hard work by Warddeken Rangers has limited the rise in feral buffaloes in the Warddeken IPA and prevented damage to sensitive spring-fed wetlands and irreplaceable cultural sites. However, despite concerted efforts by the Warddeken Rangers, buffalo numbers continue to increase in Arnhem Land, further damaging important wetlands and cultural sites.

In neighbouring Djelk Indigenous Protected Area, where rangers are also culling buffalo, recent estimates suggest there are up to 20,000 buffaloes and that 4500-5000 need to be culled annually to prevent further increases in animal numbers and damage.

(OATEN 2015)

Warddeken Ranger Berribob Watson in front of famous Warddeken rockart that is protected from damage by feral buffalo by fences.

Credit: David Hancock

Work to date demonstrates that Indigenous Protected Areas and Indigenous rangers are key players in reducing and controlling feral buffalo numbers and impacts. A systematic approach to feral buffalo control over their range has high prospects of success in dramatically reducing negative impacts on the environment and maintaining good environmental health. Increasing and sustaining support to IPAs and rangers is a high value investment and key pathway to achieving this.

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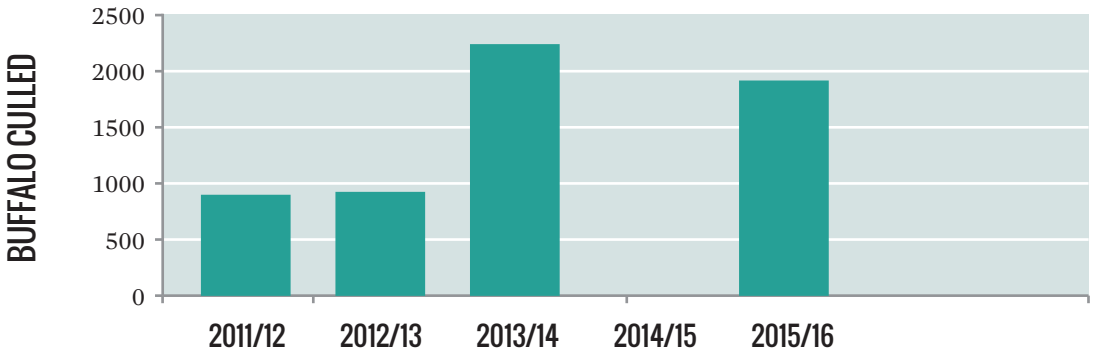
Number of buffalo culled each year in Warddeken IPA



NB. data not reported for 2014/15

Monitoring shows that the damage caused by feral buffalo has decreased in areas where control programs are active.

Invasive weeds, like the prickly pear being eradicated by the Tjuwanpa Rangers in Central Australia, are among the most serious threats to Australia's natural environment and primary production industries.

Credit: Central Land Council

Fighting the spread of invasive weeds

Large scale existing and potential invasions by introduced weed species have become a major threat to Australia's biodiversity. The impacts are clear: weeds crowd out or kill native vegetation and with it key wildlife habitat.

Fighting the spread of weeds needs boots on the ground. The capacity for weeds to lay dormant for years but expand rapidly in favourable conditions means the treatment of outlying infestations, and pre-empting and containing the spread of weeds, is often as important as eradication from a given area.

The following case studies demonstrate that Australia needs skilled personnel on the ground across large areas to conduct surveillance and strategically tackle weed outbreaks. Indigenous Ranger groups and Indigenous Protected Areas provide the skilled workforce needed. These programs encourage regional strategies to ensure weeds are prioritised for management and control in the landscape.

Across many different kinds of ecosystems – from the tropics to temperate forests to arid desert environments – invasive weeds continue to be a major degrading impact across our landscape. Preventing their spread and eradicating them from key areas can be achieved with decisive action. Adequate resourcing for Indigenous Rangers and Indigenous Protected Areas are key to fighting the spread of invasive weeds.

Spinifex Rangers:
Keeping the Great Victoria Desert buffel grass-free

Buffel grass, an invasive weed spreading across Central Australia, is one of the worst threats to biodiversity in the Outback, but the work of the Spinifex Rangers is demonstrating how intensive management can stop its spread. Spinifex rangers plan to completely remove isolated, but spreading, patches of buffel grass across 95,000 km^2 in the Great Victoria Desert – one of the last remaining areas where buffel grass can still be eradicated. They have mapped all infestations along thousands of kilometres of tracks and have begun strategically spraying the weed. The Spinifex Rangers are the first and last line of defence for keeping buffel grass out of the pristine Great Victoria Desert. Their determination is limited only by resources. Like Indigenous rangers across Australia, the Spinifex Rangers need more support to keep natural areas free of invasive plants and animals.

Spinifex Rangers are protecting the Great Victoria Desert by:

- Setting a target to eradicate all buffel grass across their region in the Great Victoria Desert within 10 years;
- Mapping buffel grass infestations along more than 2,000 kms of tracks and around community areas;
- Beginning the process of strategically removing buffel grass infestations.

Invasive buffel grass

The invasive buffel grass (Cenchrus ciliaris) is widely recognised as, “arguably the single greatest invasive species threat to biodiversity across the entire Australian arid zone” (Biosecurity SA, 2012). Buffel grass is a “transformer species” that alters natural environments. It out-competes native plants, increases fire intensity, degrades habitat for native wildlife and can outcompete bush tucker food plants for Indigenous people (CRC Weed Management, 2008).

To control widespread invasive species, strategic management is required, to ensure that the best “bang for buck” is delivered using available resources. The invasive grass is also used by the pastoral industry as a fodder species (Friedel et al. 2006). Buffel grass is widespread and cannot feasibly be eliminated from all parts of the arid zone. However, there is an urgent need and opportunity to ensure that buffel grass is eradicated from the few remaining large regions where it is still scarce, particularly in areas of low or no pastoral value to prevent further spread.

Buffel-free Great Victoria Desert

Despite its widespread distribution, “There are large areas of South Australia that are free of buffel grass or have sparse populations. With committed and sustained action, these areas can be protected from the establishment or further spread of the plant” (Biosecurity SA).

Hot work in the desert. Spinifex Rangers like Delwyn Franks have shown incredible commitment to keeping buffel grass out of the Great Victoria Desert despite limited resources.

Credit: Spinifex Land Management

In particular, the Great Victoria Desert bioregion in South Australia and adjacent Western Australia is, "still largely free of buffel grass" (Biosecurity SA).

> The Great Victoria Desert region is now Australia's best opportunity to protect a large intact arid ecosystem free of invasive buffel grass.

The "South Australia Buffel Grass Strategic Plan" notes the extensive Alinytjara Wilurara – Maralinga Tjarutja Lands as a key region where buffel grass can strategically be eradicated. Current infestations are small, widely scattered and localised, and total eradication is feasible (Biosecurity SA).

An ambitious target by Spinifex Rangers

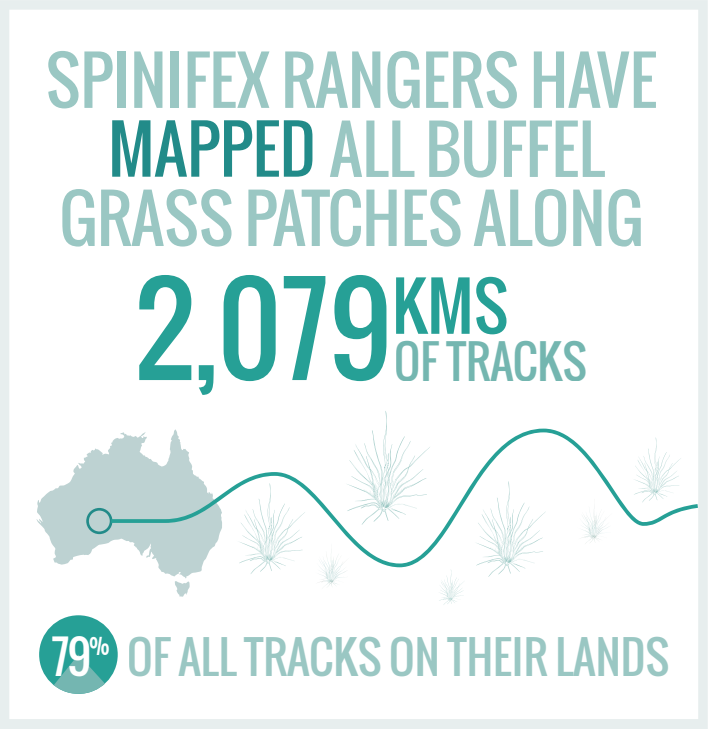
A large part of the Great Victoria Desert is managed by the Pila Nguru Aboriginal Corporation. Guided by the "Spinifex Healthy Country Plan", the corporation's Indigenous rangers, the Spinifex Rangers, work to maintain culture and keep their country healthy for future generations.

The Spinifex Rangers work across 95,000 square kilometres – an area the size of 40% of Victoria – in western South Australia and adjacent Western Australia. As part of their Healthy Country Plan, the Spinifex Rangers have adopted the goal to totally eradicate buffel grass from their lands within 10 years. To achieve this goal strategically across such a large area, the Spinifex Rangers have mapped, and plan to strategically control, all known infestations of buffel grass.

Strategic mapping and control

Buffel grass invades the desert along roads and tracks. Using the Fulcrum GPS mobile phone app, the Spinifex Rangers have now mapped all buffel grass patches along 2,079 kms of tracks: 79% of all tracks on their lands. A drone was used to produce a detailed map of a large infestation at the Tjuntjuntjara community. The resultant mapping reduced the area of infestation around the community from a prior estimate of 1,000 ha to just 87 ha (Pila Nguru Aboriginal Corporation, 2016). With concerted action, buffel grass can be eradicated from an area this size.

> The broader goal of attaining a "Buffel-free GVD" (Great Victoria Desert) relies entirely on the commitment of Spinifex rangers.



Following purchase of new spray equipment, the Spinifex Rangers plan to greatly expand control of buffel grass through spot and boom spraying. Isolated outlying patches have been prioritised for control.

Concerted work by the Spinifex Rangers is enabling the achievement of a key goal for continental-scale management of the invasive buffel grass: total eradication of this invasive species from one of the few remaining large natural regions where eradication remains a practical option. The challenge will be to support enough ranger work, over a long enough time frame to both eradicate buffel grass from the Great Victoria Desert and maintain protection over this area of more than 6 million square kilometres into the future. Spinifex Country Traditional Owners are keen to explore the development of an Indigenous Protected Area in the region and support additional ranger jobs to make their goal a reality.

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Jabalbina Rangers:

Protecting Cape York waterways from noxious invaders

Fast work by the Jabalbina Indigenous Rangers and their partners has largely eradicated infestations of the water weed *Salvinia molesta* from the Normanby River upper catchment. This noxious weed was poised to spread downstream into 3,500 pristine wetlands on Cape York Peninsula in far north Queensland. Healthy rivers and wetlands support diverse terrestrial ecosystems. Invasive noxious weeds have degraded many rivers and wetlands, destroying wildlife habitats and reducing recreational and production opportunities. Ongoing vigilance is required to ensure uninvaded rivers and wetlands remain pristine. Jabalbina Rangers treated areas and are now monitoring and managing waterways to ensure that salvinia does not re-establish and spread downstream in the future. The work by the Jabalbina Rangers has prevented extensive damage and saved millions of dollars in remediation costs. Growing and securing Indigenous ranger and Indigenous Protected Area funding nationally is essential to support this kind of work.

Jabalbina Rangers have protected vital waterways by:

- Discovering infestations of the noxious water weed salvinia, which threatens to invade 3,500 wetlands in Rinyirru National Park in north Queensland;
- Erecting a boom and wire fence to block the weed from spreading downstream;
- Spraying and manually removing salvinia from infested areas, greatly reducing infestations;
- Saving millions of dollars in remediation costs, should salvinia have escaped and spread downstream.

Clean, healthy rivers

Healthy rivers, lakes and wetlands support diverse, functional ecosystems across large regions and landscapes. They also support productive local economies and provide recreation and tourism opportunities for many people to enjoy. Wetlands in northern Australia, at Kakadu and on Cape York Peninsula, are famous attractions for national and international tourists.

Noxious and invasive water weeds degrade many watercourses and wetlands. Many noxious water weeds spread and increase rapidly, and large infestations can be difficult to eradicate. The most effective control strategy is to attack new populations before they spread further.

Salvinia molesta is one of the world's worst waterweeds. Introduced from Brazil, Salvinia is a declared Weed of National Significance in Australia (DAF, 2016).

Jabalbina Rangers - including Jabalbina Indigenous Protected Area Manager Rowan Shee and Ranger Team Leader Bradley Creek - worked long and hard hours to stop salvinia spreading into the biodiversity-rich wetlands of Rinyirru National Park.

Credit: Jabalbina Yalanji Aboriginal Corporation

Jabalbina Rangers have protected the waterways on Jabalbina country for the benefit of all Australians.

Credit: Jabalbina Yalanji Aboriginal Corporation

Salvinia forms floating mats that can completely cover large lakes and rivers. The dense mats reduce oxygen in the water, kill fish and other water life, damage pumps and machinery, and prevent recreational water use.

In the 1970s, salvinia completely covered 400 ha of Mt Isa's water supply, Lake Moondarra, with an estimated "50,000 tonnes of fresh weight of weed" (DPI, 2006). By that stage, "the salvinia was growing faster than the herbicide could kill it" (DPI, 2006).

Severe infestations can now be treated using integrated herbicide applications, biological control and manual removal. Salvinia is now scattered and widespread in eastern Australia south of Cairns. For now salvinia remains absent from pristine rivers and wetlands in the wet tropics on Cape York Peninsula.

Jabalbina Rangers at work

In 2015, Jabalbina Indigenous Rangers discovered salvinia growing in two abandoned mine dams at Mt Poverty, on Kuku Nyungkal Country near the headwaters of the East Normanby River in north Queensland (Jabalbina Yalanji Aboriginal Corporation, 2016). The Normanby River flows through a network of 3,500 wetlands in Rinyirru (Lakefield) National Park before it reaches the northern Australian coast at Princess Charlotte Bay. If salvinia were to spread downstream, the ecological outcomes would be catastrophic.

To prevent salvinia invading the Cape York wetlands, the Jabalbina Rangers and partner organisations fast-tracked a program to contain, reduce and eradicate salvinia from the East Normanby headwaters.

The rangers erected a boom and wire fence below the dams to prevent salvinia washing downstream, and then treated infested dams using chemical control and manual removal. Their work effectively reduced the population to a small number of surviving plants. Ongoing monitoring and control are now required to ensure that survivors cannot multiply and spread downstream (Jabalbina Yalanji Aboriginal Corporation, 2016).

Hard work and a rapid response by the Jabalbina Indigenous Rangers, working in collaboration with partner organisations, has saved the biologically diverse wetlands of Rinyirru National Park on Cape York Peninsula from invasion and degradation by the noxious waterweed salvinia.

The work by Jabalbina Rangers to eradicate salvinia shows how Indigenous rangers can prevent extensive damage before it occurs and save millions of dollars. It shows why we need rangers to be constantly active and resourced on country to monitor and respond to emerging threats. Growing and securing Indigenous ranger and Indigenous Protected Area funding nationally is essential to support this kind of work and prevent enormous damage to environment, property and the economy from the destruction brought by invasive weeds.

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From marine life to desert reptiles, Indigenous rangers are protecting threatened species across Australia through research, feral animal control, fire regimes, wildlife rescue and invasive weed control.

Credit: Dhimurru Aboriginal Corporation

Protecting threatened species

Australia has one of the world's worst records of species extinction. In the short time since European colonisation, Australia has lost 130 native species to extinction.

This crisis demonstrates there is much pressing work to do. In order to avert a continuing wave of extinction, Australia must implement strategic threat abatement and recovery strategies. Work to ameliorate landscape or local scale threatening processes which could push more numerous species down the extinction path is essential.

Work of this nature is demonstrated by Indigenous rangers and Indigenous Protected Areas around the country in the case studies in this report. Practical and scientifically-informed approaches being undertaken by rangers and on IPAs include fire management to promote healthy bilby habitat, feral cat baiting to reduce predation pressure, and accurate mapping of threatened species distributions to inform strategic conservation.

Australia's Threatened Species Strategy nominates Indigenous Protected Areas and Indigenous Rangers as a 'critical' element of tackling species decline. The network of 75 Indigenous Protected Areas, covering more than 67 million hectares and representing almost half of our entire national reserve system, are nominated in the Strategy as a key element of Australia's response. The location of Indigenous owned and managed lands is frequently in strategically important areas for species recovery, and the growing success of informed on ground action in those places is helping remaining threatened species populations and habitat to recover and survive.

The Indigenous estate, Indigenous rangers and Indigenous Protected Areas must be resourced according to the scale of the task at hand. The capacity to support threatened species protection by local Indigenous land and sea management organisations across some 170 million hectares of the Indigenous estate in Australia will be a major determinant of our success in stemming and reversing species decline and extinction across our continent. The key is applying this work across greater areas and sustaining it over time.

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Kiwirrkurra Rangers on the Kiwirrkurra Indigenous Protected Area:

Saving threatened bilbies in the desert

The bilby, elusive icon of the Outback, is facing severe threat from large wildfires and feral animals, but Indigenous rangers on the Kiwirrikurra Indigenous Protected Area in central Australia are working alongside scientists to protect remaining populations. Large wildfires leave bilbies nowhere to hide from marauding feral cats, which prey on bilbies and other native animals. Kiwirrkurra Rangers are protecting bilbies by re-instating traditional patch-burning on the Kiwirrkurra IPA. The mosaics of small, patchy fires lit by the rangers provide food and places for bilbies to hide from feral cats. The rangers, working with scientists, are monitoring bilby numbers and humanely removing predatory feral cats. Investing in long term support and adequate funding for Indigenous rangers at Kiwirrkurra IPA, and across the Outback, can reinstate strategic traditional burning and predator management across larger areas and better protect threatened animals and plants from extinction.

Kiwirrkurra Rangers protect bilby populations by:

- Providing access and information to scientists in Kiwirrkurra Indigenous Protected Area;
- Reinstating traditional patch burning across 1500 km^2, with benefits for threatened bilby populations;
- Working with scientists to survey threatened bilbies and other animals;
- Humanely culling feral cats.

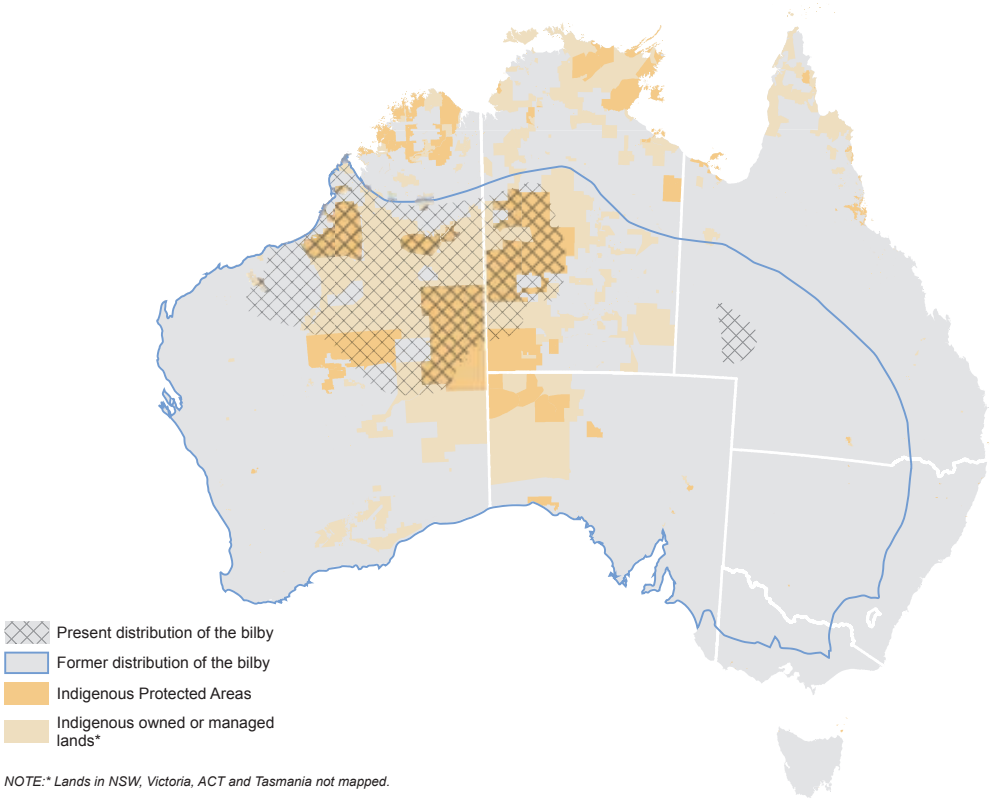
Our vulnerable bilbies

The greater bilby (*Macrotis lagotis*) is one of Australia's most recognised and iconic native animals. With silky, silver-blue fur, a pointed pink nose, long ears and a bushy black and white tail, bilbies are immediately recognised by many Indigenous and non-Indigenous Australians. Bilbies also play important ecological roles as "ecological engineers"; their diggings and soil scratchings create a wide range of ecological benefits (James & Eldridge 2007) and their burrows provide shelter for a range of other species (Hofstede & Dziminski 2017).

The bilby is a flagship species, representing the threat of extinction to mammal populations across Australia. Once found across 70% of Australia, the greater bilby is now restricted to a small number of colonies in the wild and to a series of fenced enclosures where animals are raised and bred (Bradley et al. 2015). It is listed as a Vulnerable species under the EPBC Act. It has been estimated that more than 75% of the current range of bilbies in the wild is on land owned and managed by Aboriginal people (V. Westcott 2016, unpublished data).

Bilbies are nocturnal and rarely seen but Kiwirrkurra rangers like Sally Butler are skilled at spotting tell-tale signs of bilby movement, for example tracks and scats.

Credit: Central Desert Native Title Services



NOTE: Lands in NSW, Victoria, ACT and Tasmania not mapped.*

More than 75% of the greater bilby's remaining range is on country owned or managed by Aboriginal people. More support for Indigenous rangers and Indigenous Protected Areas is fundamental to the iconic species' recovery.

Source: see References

Threats to bilby survival

Like many native mammals, bilbies are threatened by a number of interacting processes, including destructive wildfires (especially in northern Australia), predation by feral cats and foxes (fox predation is more important in southern populations) and livestock grazing and clearing (Bradley et al. 2015).

Bilbies are recognised as being under "very high – extreme" threat from predation by feral cats and foxes (Commonwealth of Australia 2015). Uncontrolled fire can act to amplify predation pressure by feral animals. Large fires may attract cats to burnt areas, reduce cover for bilbies and other native mammals, and can result in increased predation pressure (Bradley et al. 2015). By contrast, small mosaic burns provide shelter for native mammals, reducing the impacts of cat predation.

Bilbies have survived in many regions where traditional Indigenous burning practices have continued and have declined when traditional burning practices have ceased. As a result, the recent interim conservation plan for the Greater bilby (Bradley et al. 2015) recognised that:

> "Mobilising the support and knowledge of Traditional Owners in remote communities was considered to offer one of the greatest opportunities for sustained on-ground conservation action for the Greater Bilby across its range."

Kiwirrkurra Rangers protecting bilbies

Indigenous Rangers, in collaboration with scientists, are undertaking innovative work to protect bilbies by developing integrated programs of traditional burning and feral animal control within and outside Indigenous Protected Areas across Western Australia, the Northern Territory and South Australia.

This work is exemplified by work by the Kiwirrkurra Rangers in the Kiwirrkurra Indigenous Protected Area in Western Australia, over 700 kilometres west of Alice Springs. Kiwirrkurra people have identified protecting Bilbies and other threatened species as a high priority in their IPA Management Plan. Their rangers have undertaken a number of activities, in collaboration with scientist Dr Rachel Paltridge, including surveying bilbies, maintaining traditional burning regimes, and humanely controlling feral cats.

The Kiwirrkurra work has led to positive outcomes and invaluable learnings. The Indigenous Protected Area has extended burning work by Kiwirrkurra Rangers across a greater area of the desert ecosystem, providing resources to conduct trips to more remote areas where burning can be conducted, and introducing other tools like satellite imagery, fire scar mapping, and, in 2017, aerial incendiary burning to help the rangers to plan and implement fire management on a greater and more strategic scale. Over a 10-year period, 983 fires with a mean area of 78 hectares were ignited. Most fires were less

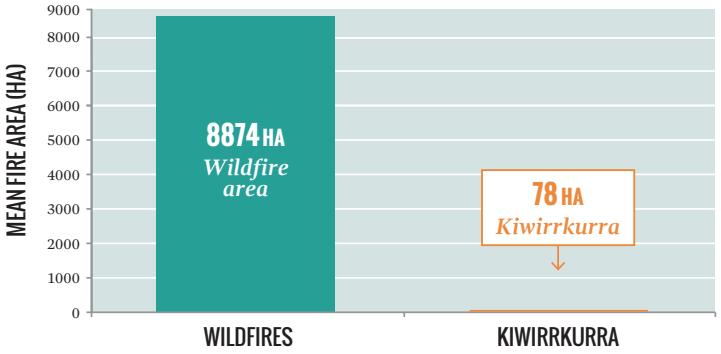
▼ Feral cat control, maintaining slow burning fire regimes and population monitoring (shown here by sorting bilby scats) have underpinned bilby conservation methods on the Kiwirrkurra Indigenous Protected Area.

Credit: Rachel Paltridge

than 10 hectares in size. By comparison, there were only 20 fires with a mean area of nearly nine-thousand hectares in an adjacent area not subject to traditional burning (Schubert & Paltridge, 2015). In unmanaged areas, fires were much larger and hotter and so more destructive. In areas where areas had been strategically burnt in patches, fires were smaller, cooler and left more refuge habitat for wildlife. This indicates the value of traditional patch burning, enhanced by contemporary science through additional resourcing in reducing wildfire damage to vegetation and the wildlife that depends on it.

Tracking surveys have demonstrated that bilbies have persisted better in areas with an established fire mosaic than unmanaged areas. Evidence to date indicates bilbies seem to have survived well on the IPA within the Kiwirrkurra hunting zone and at Murruwa where people still lived traditionally until 1984, and have since returned to several times per year to camp out and go hunting (which involves burning).

Comparison of fires occurring in areas between December 2009 and February 2015 surrounding Kiwirrkurra that do and don't have fire management regimes



Data simplified from Table 2 in Rachel's "Kiwirrkurra Fire Mapping Report"

▲ Large wildfires burn hotter and faster, destroying vast tracts of wildlife habitat.

Kiwirrkurra Rangers are now working alongside researchers to measure bilby numbers at a specific site using the scat DNA analysis method. They are hoping to obtain additional funding to extend this monitoring to compare managed and unmanaged populations to understand more about the benefits for bilby populations at sites with regular predator and fire management.

These activities provide a poster example of integrated management of Indigenous knowledge and fire and feral animal management to save threatened species.

Opportunities

While highly effective, the work by the Kiwirrkurra Rangers is limited in scope; fewer than 1500 km^2 on the 43 000 km^2 Kiwirrkurra IPA have been regularly burnt to date. There is great potential to expand research, and fire and feral management work across high quality bilby habitat in the Kiwirrkurra IPA and in Indigenous lands across the bilby's range in the Northern Territory, South Australia, Queensland and Western Australia. The Kiwirrkurra IPA is over 4 million hectares but currently receives no Working on Country Ranger funding.

Many Indigenous Rangers from other IPAs have expressed great willingness to engage in activities to save Greater bilbies. A Bilby Summit in 2016, hosted at Kiwirrkurra, attracted 170 participants, including 125 Indigenous Rangers from over 20 ranger groups and 9 IPAs.

Additionally, this model of integrated habitat management has considerable potential to benefit other threatened species, such as the great desert skink and black-footed rock wallaby. Well-documented programs, as conducted by the Kiwirrkurra Rangers at Kiwirrkurra IPA, provide the basis for on-ground refinement of operational and strategic approaches for conserving many endangered mammals in natural, unfenced habitats.

The benefits that desert peoples and their rangers are having on bilby survival through a suite of habitat protection, predator removal and monitoring measures is impressive and of national significance.

> Traditional Owners are uniquely placed to protect one of Australia's most iconic species: they own and live in areas of remnant bilby populations and they have the knowledge, skills and motivation to undertake the work.

Supporting Traditional Owners to remain living on and protecting their country, through increased, secure funding for Indigenous Protected Areas and Indigenous ranger jobs across the Bilbies existing and potential range, is key to bilby survival in unfenced areas. These programs create a strong foundation for wildlife conservation across Australia's deserts.

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Olkola Land Managers:

Saving Alwal, the golden-shouldered parrot, on Cape York

The golden-shouldered parrot is a beautiful, colourful and endangered parrot that is restricted to two small regions in Cape York Peninsula. The parrot, called Alwal by Traditional Owners, is a totemic species for the Olkola people, who own and manage much of the bird's remaining habitat in central Cape York. The endangered parrot is threatened by habitat decline due to reduced fire frequency, habitat damage by feral animals, and predation by feral cats and other animals. With Bush Heritage Australia, Olkola Land Managers are monitoring Alwal populations, reducing threats and improving habitat conditions by re-instating natural and traditional fire regimes. The future of the golden-shouldered parrot depends on the level of support given to the good work of Olkola land management.

The beautiful Alwal

The golden-shouldered parrot (*Psephotus chrysopterygius*) – or Alwal, as it is known to the Olkola people, the Traditional Owners of its habitat stronghold – is a bright, multi-coloured parrot with a turquoise breast, black crown, red belly and large, bright yellow patches on its wings. Golden-shouldered parrots build nests and raise young in tall, old termite mounds.

Once seen in large flocks, it is estimated that only 2000 golden-shouldered parrots now survive in the wild. Its closest relative, the paradise parrot, has already gone extinct. Alwal is listed under the federal government's Environment Protection and Biodiversity Conservation Act as Endangered in Australia and is one of 20 endangered birds prioritised for action in Australia's Threatened Species Strategy (Australian Government, 2016). The landscape-scale habitat improvement project led by Olkola and Bush Heritage Australia to secure the future of Alwal has recently been included in the government's new endangered species investment prospectus.

The species is threatened by many factors (Garnett and Crowley 2002), including:

The Olkola Land Managers are protecting Alwal by:

- Implementing key actions in the Golden-shouldered Parrot Recovery Plan;
- Surveying nest sites across the core habitat area within the Moorehead River range;
- Recording fledgling birds and identifying predators;
- Providing supplementary food in the wet season;
- Improving habitat by re-instating natural and traditional fire regimes;
- Monitoring the condition of termite mounds and parrot habitat.

▲ Here, Olkola Elders Jack Lowdon and Johnny Ross, and Olkola Land Managers Hamish Kulka and Glen Kulka, work with Bush Heritage Australia scientist Allana Brown to determine land management priorities on Olkola country.

- Inappropriate fire regimes, prior to handover of management to Olkola, which have changed open grassy savannas to dense stands of broad-leaved ti-tree (Melaleuca viridiflora) in many areas, thereby reducing the amount of grass seed for the parrots to eat;
- Food shortages in the wet season, which are intensified by the loss of open grasslands and savanna woodlands and by grazing by cattle and feral pigs;
- The destruction of termite mounds by cattle and pigs;
- Predation by feral cats.

Golden-shouldered parrots once lived across most of Cape York Peninsula but are now restricted to just 1700 km^2 in the Morehead River catchment and Staaten River National Park (Garnett and Crowley 2002). Most of the Morehead River catchment is now owned and managed by Olkola Traditional Owners.

▲ Olkola cameras captured feral cat predation of Alwal nestlings for the first time – this has led to important research and management challenges and opportunities. In 2017 trialling feral cat abatement strategies is a key focus.

Protecting an Olkola totem

Alwal is a totem animal for the Olkola people, who are committed to ensuring its survival. Olkola people are working in partnership with Bush Heritage Australia (BHA 2016) to maximise the pooled benefits from traditional Indigenous knowledge and mainstream science. Together, Olkola and Bush Heritage are undertaking a wide range of strategic activities – all identified in the species recovery plan – to ensure the survival of the golden-shouldered parrot, including:

- Surveying nest sites across the core habitat area within the Moorehead River range;
- Providing supplementary food to reduce mortality from starvation during the wet season;
- Recording fledgling birds and identifying predators using remote cameras;
- Improving habitat by re-instating natural and traditional fire regimes;
- Recording changes in the abundance and condition of termite mounds; and
- Monitoring vegetation to assess the impacts of habitat management.

> “Olkola and Bush Heritage Australia are working closely together on the ground to save the golden-shouldered parrot. Currently Bush Heritage is the sole funder for Olkola wages for work on this project across Olkola Freehold. Imagine how much more we could do – expanding this project, supporting Olkola to lead new ones – if wages for Land Managers were covered with secure long-term funding! The additional outcomes Olkola could achieve would be phenomenal.”
>
> ALLANA BROWN, BUSH HERITAGE SCIENTIST

Looking forward

Using handheld GPS devices, Olkola Land Managers mapped the locations of nest sites during comprehensive surveys in 2016. Only 53 nests were detected, which is less than half the number recorded seven years earlier (Olkola and Bush Heritage Australia, 2016). This finding underscores the need for more resources to protect this endangered species.

In an important breakthrough, remote monitoring cameras used by the Olkola Land Managers in 2016 provided the first photographic evidence that golden-shouldered parrots in nest hollows are being killed by feral cats.

Currently Olkola are operating with no consistent Indigenous ranger funding and uncertainty about funding stability going forward.

While federal programs such as the Indigenous Protected Areas program could provide vital strategic support to Olkola land management and governance, current funding is fully subscribed and growth in funding would be required to enable groups like Olkola to be supported.

In addition to their important work protecting Alwal, Olkola have developed a Healthy Country Plan that clearly outlines strategies to achieve other major conservation successes and build a sustainable conservation-based economy for the Olkola people. This plan represents the aspirations and responsibility identified by Olkola Traditional Owners to keep country healthy as a whole in order to protect wildlife.

On very limited resources the work that landowners like Olkola have done is proving critical in fighting extinctions of endangered species from Australia. The Olkola Land Managers, in partnership with Bush Heritage, are already achieving early wins in the long-term management challenges that face them in their work to secure the future of their totem, the endangered Alwal. However, the scale of this challenge is enormous and more resources will be required to improve Alwal's grassland and savanna habitat, reduce threats and boost population numbers.

Further support and security for both Indigenous Protected Areas and Rangers could create the tools for Olkola and their partners to ensure its survival for all Australians into the future.

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APY Warru Rangers:
Protecting warru in South Australia

Like many threatened species, warru (the MacDonnell Ranges race of the black-footed rock-wallaby) have declined greatly in number over the past century. Fortunately, dedicated work by the Warru Rangers on the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands has stalled this decline and boosted warru populations in South Australia, in a strongly encouraging example of successful protection of a threatened species. The Warru Rangers, collaborating with partners, have protected warru populations from predators and wildfires, monitored population numbers, and maintained a semi-captive population for return to the wild in the future. The rangers' work illustrates the capacity for Indigenous Rangers to safeguard Australia's threatened species and provides inspiration for threatened species recovery programs elsewhere. With expanded and ongoing support, Indigenous rangers can play pivotal roles in protecting many more of Australia's declining threatened species.

Warru Rangers are protecting warru by:

- Mitigating the impacts of predators and wildfire on South Australia's last warru populations;
- Monitoring warru numbers and recording animal movements;
- Managing a semi-captive population for release to the wild;
- Boosting warru numbers and breeding success in protected populations;

Saving warru

Australia's beautiful rock-wallabies share an unenviable feature with many small mammals; many species that were once widespread are steadily declining. Seven species, six sub-species and two races of rock-wallabies (*Petrogale species)* are now listed as endangered or vulnerable under the national EPBC Act (Australian Government, 2016).

Warru – or the black-footed rock-wallaby (*Petrogale lateralis* MacDonnell Ranges race) – was once, "one of the commonest mammals [in central Australia] with swarming populations in many of the rocky outliers of the main ranges" (Finlayson, 1961). It is now recognised by the Federal Government as one of Australia's Top 10 threatened mammals.

Fortunately, the last populations of warru in South Australia appear to have a promising future due to dedicated, hard work by the Warru Rangers and their collaborators.

Warru Rangers at work

In South Australia, warru are now restricted to isolated populations on Anangu Pitjantjatjara Yankunytjatjara (APY) Aboriginal lands in the northeast and northwest of the state.

▲ Research and monitoring is a fundamental activity for Warru Rangers like Elisha Roesch, who use the information ▶ gathered to understand population dynamics and prioritise conservation actions. Credit APY Land Management.

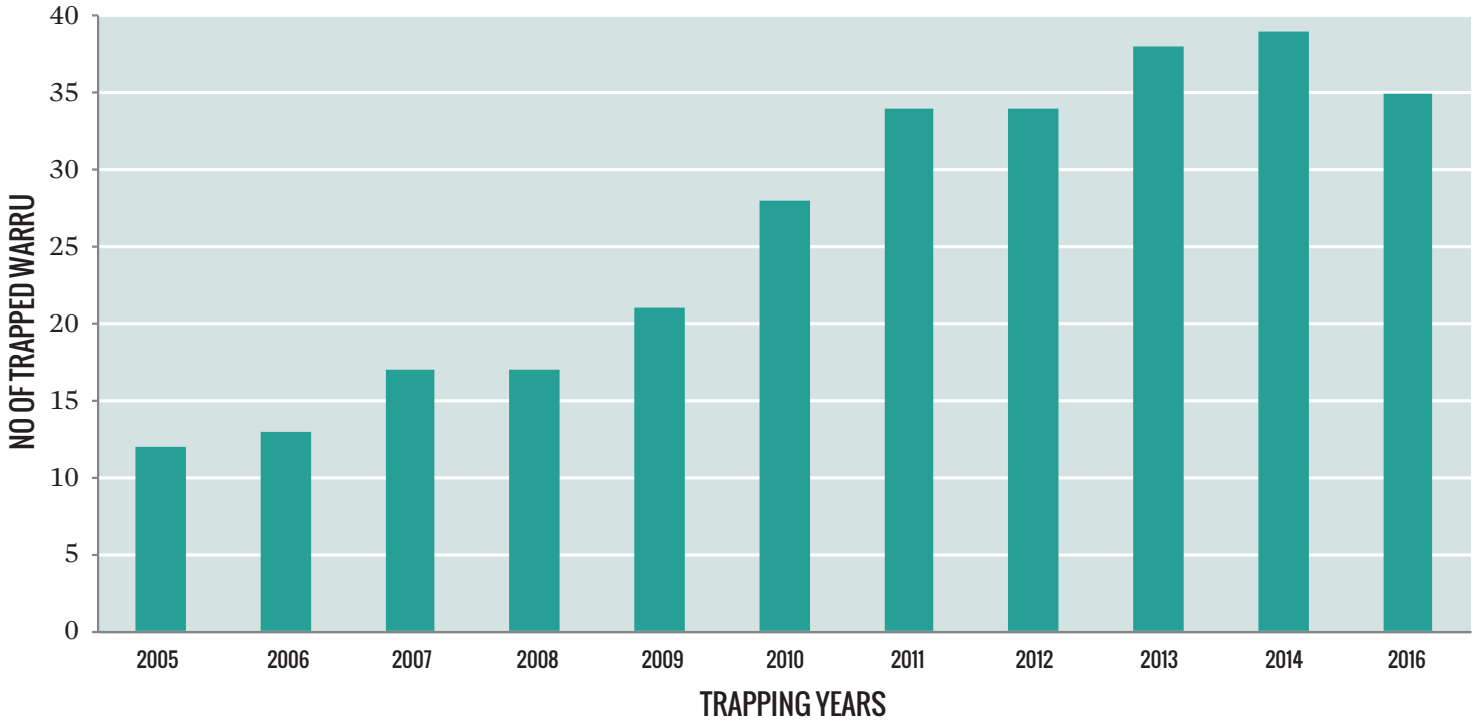
Under guidance from the Warru Recovery Plan, the Warru Rangers (working with APY Land Management and the Warru Recovery Team) deliver all on-ground works to protect the species in South Australia. Thus, Indigenous rangers are pivotal to warru's survival.

The Warru Rangers regularly monitor and protect populations from predators and other threats. They also safeguard a fenced, semi-captive population so animals can be reintroduced to the wild in the future, and they work with scientists to learn more about warru ecology. Their efforts have proved extremely fruitful; since 2005, the number of trapped warru tripled at one population due to predator control, habitat protection and other activities.

This positive outcome reflects an enormous range of activities by the rangers and their collaborators. In 2013-2015 alone, the Warru Rangers monitored known warru populations and searched for new populations using spotlight surveys, cage traps, scat quadrats, track transects and remote cameras. To better understand animal movements, rangers tracked animals using radio tracking equipment (Warru Recovery Team, 2016).

The Warru Rangers killed feral cats and foxes near warru sites by shooting and aerial- and ground-baiting, and they monitored feral animal movements using track surveys and sensing/remote cameras. To protect warru populations from unplanned wildfires, the rangers lit controlled burns and poisoned swards of the flammable, invasive buffel grass. In the Musgrave Ranges, they also provided supplementary food and water every month in an ongoing trial to improve warru survival and breeding success.

In collaboration with researchers and Monarto Zoo, the Warru Rangers released captive-bred animals into a 100ha fenced exclosure (which the rangers built in 2011) and monitored the new animals using cage traps, scat counts and radio-tracking. The rangers patrol the four kilometre fence line every week to ensure new animals are safe from predators. In a promising next step, the rangers plan to release warru from the fenced compound to a rocky outcrop in Wamitjara, where the animals once lived.



▲ Number of trapped warru from 2005 - 2016 in one of the managed warru colonies in the Musgrave Ranges.

The rangers enthusiastically share their knowledge of warru, feral animals and the Warru Rangers with school groups from across the APY lands to ensure their knowledge is passed on to future generations (WRT, 2016).

In recognition of their inspirational work, the warru recovery team received the National NAIDOC Caring for Country award in 2011. Since then, they have been rewarded by increasing numbers of warru at managed sites.

The Warru Rangers are working on the frontline to protect one of Australia's many threatened rock-wallabies. Their work not only protects a rare species, it also informs and inspires others to achieve similar outcomes.

With stable and increased resources, Indigenous rangers across Australia can emulate the successes achieved by the Warru Rangers. And perhaps one day, warru – like many other threatened species – will once again be "one of the commonest mammals" in central Australia.

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Kimberley Rangers and Indigenous Protected Areas:

Implementing Australia's threatened species strategy

Four of the top 10 priority mammal species listed in the national Threatened Species Strategy live in Indigenous Protected Areas in the Kimberley region in Western Australia. The Threatened Species Strategy provides a framework to prioritise efforts to save Australia's unique and distinctive animals and plants. Many threatened species are largely restricted to Indigenous Protected Areas and other Aboriginal lands, where Indigenous rangers play a pivotal role in their protection. The Kimberley Ranger Network, facilitated by the Kimberley Land Council, incorporates 13 Indigenous ranger groups working across 380,000 square kilometres of native title lands which include eight IPAs across 90,000 square kilometres. Ranger groups are delivering on the Threatened Species Strategy through on-ground work, for example by protecting habitats from wildfires and feral animals. Increased and sustained investment in Indigenous rangers and Indigenous Protected Areas is essential to the implementation of wildlife protection according to the Threatened Species Strategy.

Australia's threatened species on Indigenous lands

Australia is a global biodiversity treasure, home to many unique and beautiful plants and animals, most of which live nowhere else on earth. Regrettably, iconic animals like the numbat and greater bilby – and almost 1800 more Australian species – are now threatened with extinction (Australian Government, 2016).

Kimberley Rangers are protecting threatened wildlife by:

- Playing a pivotal role in implementing Australia's Threatened Species Strategy;
- Protecting the habitats of many threatened animals and plants from damaging late-season wildfires by lighting low-intensity, early-season fires across 200,000 km^2;
- Identifying key habitats for threatened species, and determining animal population numbers, through intensive fauna monitoring programs;
- Protecting threatened animals from predation by feral cats;
- Fencing important habitats to prevent feral cattle from damaging key habitats;
- Working with partners in government, industry and the non-profit sector to maximise conservation outcomes.

> “Indigenous land managers [are] critical in the management of Australia’s threatened species.”
>
> AUSTRALIAN GOVERNMENT’S THREATENED SPECIES STRATEGY 2016.

Many of Australia’s threatened species live on lands owned and managed by Indigenous people.

Past and future investments in IPAs and Indigenous ranger groups increase the effectiveness of the hard work by Indigenous rangers to save Australia’s threatened animals and plants.

Kimberley biological hotspot

The Kimberley region is one of Australia’s 15 biological hotspots – regions with large, intact, natural ecosystems and many unique, endemic species that live nowhere else in the world. The West Kimberley is National Heritage listed for its outstanding significance to Australia.

> In Australia, the North West Kimberley is the only region known to have not yet suffered a mammal extinction.

Four of the Top 10 priority mammals in the national Threatened Species Strategy live in the Kimberley – the greater bilby, golden bandicoot, brush-tailed rabbit-rat and black-footed rock-wallaby – as do many other threatened species, including the endemic scaly-tailed possum, endemic minjon rock wallaby and the endangered Gouldian finch.

The Kimberley Ranger Network manage eight Indigenous Protected Areas in the Kimberley, which are protecting threatened species across more than 90,000 km^2 - an area 40 times larger than the Australian Capital Territory.

The following case studies highlight some of the work by Indigenous rangers and on Indigenous Protected Areas in the Kimberley that is delivering on the Federal Government’s commitment to saving Australia’s threatened species, as described in the 2016 Threatened Species Strategy. These activities are emblematic of the broader conservation and management work undertaken by the Kimberley Ranger Network, working across Indigenous Protected Areas in the Kimberley.

Protecting habitats with fire

Fire management underpins threatened species work on land in the Kimberley. Large, intense wildfires destroy and degrade habitats for many species and expose native animals to feral cats and other predators. Wildfires also damage property and infrastructure, and release large quantities of atmospheric greenhouse gases.

The Kimberley Ranger Network manages fire across a 200,000 km^2 region. The rangers create mosaics of low intensity, cool burns early in the dry season to reduce the extent of large intense wildfires later in the dry season. Each year, rangers light early-season cool burns across up to 30% of the northern Kimberley and 15% of the southern Kimberley. Landscape fire management is recognised as one of the most effective practices to protect high-quality habitats for threatened wildlife in the Kimberley and other regions of northern Australia (Woinarksi et al., 2014).

Finding the black-footed rock-wallaby

The beautiful and vulnerable Kimberley black-footed rock-wallaby (*Petrogale lateralis* West Kimberley race) lives only in the Kimberley region. The race now survives only on country managed by the Nyikina Mangala and Karajarri Rangers.

To determine how many wallabies remain, the Nyikina Mangala Rangers have surveyed black-footed rock wallabies since 2012 (WWF, 2013). The rangers used camera traps, active and aerial surveys, scat searches and hair tubes to map populations and identify threats.


Credit: Kimberley Land Council

In 2015 and 2016, the rangers conducted intensive helicopter surveys for the rock-wallabies. Worryingly, they detected very few animals in two of the three ranges where the animals were once abundant. This finding will greatly influence future conservation actions to save black-footed rock-wallabies. The rangers are now using camera traps to more accurately determine how many animals survive at each locality (KLC, 2016).

Saving the greater bilby

The greater bilby (*Macrotis lagotis*) is one of Australia's most iconic threatened animals. Once widespread across Australia, it is now restricted in the wild to small populations in central Australia and Western Australia, including the Kimberley (Woinarski et al., 2016)

Kimberley Rangers have devoted considerable efforts to determining the distribution and abundance of bilbies in the Kimberley. Eight ranger groups – the Gooniyandi, Karajarri, Kija, Ngurrara, Nyikina Mangala, Nyul Nyul, Paruku and Yawuru Rangers – are currently surveying and protecting bilbies. The rangers have:

- Conducted detailed surveys, using quadrats to detect scats and tracks, as well as camera traps, spotlighting and aerial surveys of burrows;
- Erected camera traps at recent burrows to estimate the number of bilbies and other animals at each site;
- Managed fires to protect burrows from large, intense wildfires;
- Erected fences to protect an important bilby habitat at Cherrabun from damage from cattle grazing (KLC, 2016).

These activities, in addition to broad-scale fire and feral animal management, will ensure that bilbies do not follow those from other regions into extinction.


Credit: Kimberley Land Council

The Kimberley region is an internationally defined 'biological hotspot', making Indigenous rangers and Indigenous Protected Areas fundamental to protecting wildlife like this chestnut mouse being held by an Wunggurr Ranger.

Protecting brush-tailed rabbit-rats

One of the top 10 priority mammals in the national Threatened Species Strategy, the brush-tailed rabbit-rat (*Conilurus penicillatus penicillatus*) was once widespread across northern Australia. The species is in sharp decline and is thought to have gone extinct at Kakadu in 2008. The Kimberley is now a stronghold for the species (Woinarksi et al., 2014).

Kimberley Rangers – including the Balanggarra, Dambimangari, Uunguu and Wunggurr Rangers – are protecting brush-tailed rabbit-rats by a range of measures, including:

- Lighting strategic low-intensity fires to prevent large wildfires which destroy the unburnt areas that brush-tailed rabbit-rats use for habitat;
- Removing feral cattle to prevent over-grazing in rabbit-rat habitats;
- Surveying and monitoring populations using remote cameras and other techniques.

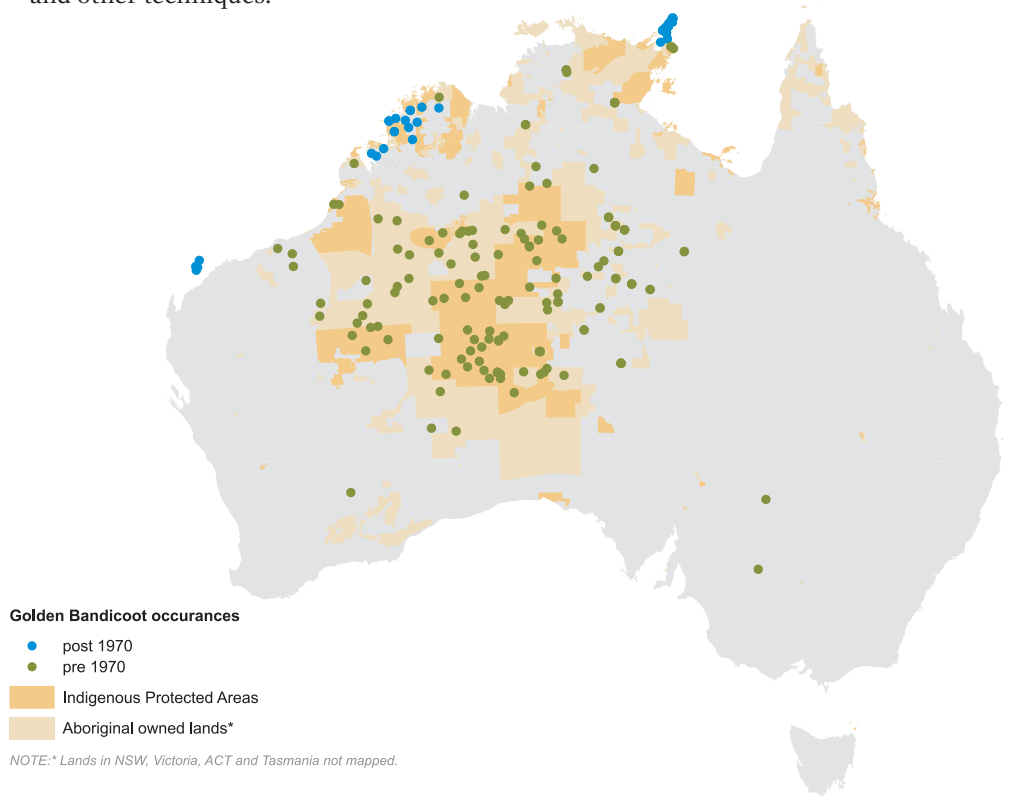
Saving golden bandicoots

Another of the Federal Government's Top 10 threatened mammals, golden bandicoots once lived across vast areas of mainland Australia.

> Golden bandicoots are now completely extinct on the mainland except for surviving populations on Dambimangari and Wunggurr country in the north-west Kimberley.

In addition to the broad-scale fire management that benefits many species, the Kimberley rangers have undertaken a range of activities to save these beautiful mammals.

The rangers are undertaking intensive small mammal surveys to provide data to help determine the impacts of fire management



◀ Remaining golden bandicoot range is largely restricted to Indigenous managed areas in northern Australia

Source: see References

on golden bandicoots. In 2015, the Balanggarra, Dambimangari and Wunggurr Rangers conducted intensive surveys for golden bandicoots and other small mammals in eight regions, using remote cameras, cage traps and spotlighting. Their monitoring results show that golden bandicoots remain abundant in parts of the north Kimberley, thus providing evidence of positive outcomes for threatened species from fire and grazing management by the rangers and partners.

Tackling feral cats

The national Threatened Species Strategy recognises that "scientific evidence is unequivocal that feral cats are one of the greatest threats to Australia's land-based mammals" (Australian Government, 2016). The strategy identifies the Kimberley as a key region to test a new bait for feral cats called Curiosity® 1080 as part of a Federal Government initiative aimed at tackling feral cats. Outcomes from the Curiosity trial will influence feral cat control programs throughout Australia, improving the conservation of native mammals not only in the Kimberley but across Australia as a whole. As part of the project local Indigenous rangers will also be trained in other feral cat management and monitoring techniques.

Fundamental to threatened species protection

Having a network of Indigenous Protected Areas across key areas of the Kimberley is a critical framework for delivering threatened species protection and management not only over the 90,000 square kilometres currently within Kimberley IPAs, but over the more than 380,000 square kilometre region that Indigenous Rangers are actively working across in the Kimberley.

Indigenous rangers are working to protect the last known habitats of nationally prioritised threatened species and a region with National Heritage Listing for its outstanding values to the nation. Their contributions benefit all Australians, and are underpinned by ongoing investments in effective Indigenous ranger programs and Indigenous Protected Areas.

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Conclusion

As they have grown over the last two decades, Indigenous Protected Areas and Indigenous rangers have matured to become an integral part of Australia's response to biodiversity decline and natural heritage protection.

Unmanaged fire, feral animals and invasive weeds are just some of the threats to the health and survival of Australia's natural landscapes and species. They are also persistent threats and require skilled and persistent management if we are to halt and reverse species and ecosystem decline.

The case studies in this report show just some of the practical and effective results Indigenous Protected Areas and Indigenous rangers are achieving in a range of situations around Australia, and how they are succeeding in making their local and often regional environment healthier and more resilient.

The Indigenous ranger and protected area programs are directly benefiting threatened species of national significance listed under our Environment Protection and Biodiversity Conservation Act, such as the greater bilby in the central deserts and olive ridley turtle in the tropics.

Often management of one species or ecosystem produces additional and wider benefits. Control of both feral pigs and feral cats benefits native wildlife beyond the targeted threatened species the work was intended to support.

Fire management across a regional scale in tropical savannas, the central deserts and other areas can rehabilitate entire ecosystems and help to sustain a broad diversity of life. Early intervention in halting and reversing the spread of invasive weeds is a cost effective approach and critical to protecting the large areas they threaten. All the case studies in this report provide direct examples of this work being applied successfully by Indigenous rangers and on Indigenous Protected Areas with far reaching positive effects.

By expanding this work over large areas and sustaining it long term, Indigenous Protected Areas and Indigenous rangers can be a decisive factor in the survival of many Australian species and ecosystems.

The federal government rightly states that our National Reserve System represents 'the nation's natural safety net against our biggest environmental challenges'. At over 44 per cent of our reserve system, Indigenous Protected Areas are making a major contribution to the success of tackling those challenges.

The future for Indigenous Protected Areas and Indigenous rangers

Important decisions must now be made on the future growth and survival of both Indigenous Protected Areas and Indigenous rangers if we are to effectively sustain and increase the environmental gains that are being realised.

Renewing existing ranger jobs and Indigenous Protected Areas will not meet the scale of the task at hand. The benefits of additional workers and, where appropriate, new Indigenous Protected Areas to extend fire, feral animal, weed and threatened species management further to unmanaged or under-managed areas is clear.

Key findings:

Real benefits are being secured

Indigenous Protected Areas and Indigenous rangers are making a measurable difference to the protection of biodiversity across vast areas of Australia, turning around damaging trends in habitat degradation and species decline. IPAs and rangers are making a major contribution to preventing wildlife extinctions, controlling wildfire and limiting the impact of feral animals and invasive weeds.

Core role in natural heritage conservation

Work on Indigenous Protected Areas and by Indigenous rangers now represents a core component of Australia's frontline efforts to protect threatened species and ensure ecosystem health. The future health of large parts of the Australian environment is now inseparable from the growth and security of IPAs and Indigenous rangers.

Scaling up will deliver greater environmental benefits

IPAs and Indigenous rangers provide a cost effective model to meet the environmental challenges Australia faces but they need to be supported at the scale required. Some pressures, such as fire, are managed across large areas with corresponding benefits, but often successful local or regional initiatives need to be scaled up and secured over time to achieve lasting change.

We need to secure the gains we have made

Environmental gains reverse if support lapses. Success in improving the survival of threatened species, reducing the impacts of feral animals and invasive plants and applying better fire management can be rapidly lost. Past investment has built a proven capacity for IPAs and Indigenous rangers to protect Australia's biodiversity. Ongoing investment is needed to ensure these gains are not lost.

Expanded investment will benefit all Australians

Indigenous Protected Areas and Indigenous rangers now represent a key front in Australia's efforts to manage and protect our environment against multiple pressures and are delivering measurable results in many different conditions. Securing and expanding these two vital initiatives for the long term will benefit every Australian by leaving a healthier environment for the future

This report provides a series of examples which hold out great opportunity for Australia's environment. Over recent decades, despite many challenges, Australians have managed to create a successful partnership that supports Indigenous leadership across Australia in sustaining and protecting our natural heritage. Now is the time to fully understand and seize the opportunity presented, to work with Indigenous owners and managers of land and sea across Australia for a healthier environment for us all.

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Credit: Kerry Trapnell

> Our country is like our garden - we need to look after it. There are trees, birds, waterways, fish, mammals and reptiles, and they are all important. We keep country healthy and country keeps us healthy.

DHIMURRU SENIOR RANGER FIONA YUPUNU MARIKA

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