

wildlife matters

Summer 2017/18

australian



wildlife
conservancy



Protecting Australia's
rarest raptor

Saving Australia's threatened wildlife



Welcome to the Summer 2017/18 edition of *Wildlife Matters*.

This is one of our most significant editions, highlighting our success in protecting many of Australia's most threatened species, and outlining important new projects that will help shape the future of conservation in Australia.

Our latest project is a collaboration with the **Dambimangari** Aboriginal Corporation (pages 4-6). This ground-breaking project will see AWC working jointly with Dambimangari traditional owners to help manage more than 800,000 hectares of their country along the remote north-west Kimberley coast. This is some of the most spectacular and ecologically significant land in Australia. Importantly, the project will have an impact far beyond its boundaries. It is the first project of its kind in Australia – a land management partnership designed to also generate income and other socio-economic benefits for Dambimangari people across their native title area.

The area of land now managed by AWC (alone or in partnership) has increased to **4.65 million hectares** – by far the largest private (non-profit) conservation estate in the country. While the recent *State of the Environment* report concludes that Australia's biodiversity continues to decline, AWC is bucking this national trend by protecting and restoring wildlife populations across our estate.

The **emergency Mala translocation** (pages 7-9) is evidence of the critical role that AWC is playing. Faced with the imminent extinction of one of the few remaining Mala populations, the Australian and Northern Territory Governments invited AWC to work with them to save the population. In less than two months, the AWC team built a 150 hectare, feral-free area at Newhaven and successfully translocated one of Australia's most endangered mammals to a secure, new home.

With your support, AWC has now set a new benchmark for threatened mammal rewilding. At **Mt Gibson**, eight nationally threatened mammals have been reintroduced – a feat never before achieved in Australia. For two species – the Banded Hare-wallaby and Djoongari (Shark Bay Mouse) – Mt Gibson will host the only wild populations on mainland Australia.

Our network of feral-free areas is saving species from extinction, as well as rebuilding populations in a manner not possible in an open (unfenced) landscape. However, AWC is also looking beyond the fence and several decades down the track. Our **collaboration with CSIRO** (pages 16-17) is another ground-breaking initiative – exploring the potential for cutting edge, gene drive technology to create, over several decades, **a feral cat-free Australia**.

As part of the AWC team, I trust you feel a strong sense of ownership of our achievements to date. While the challenges ahead are significant, your ongoing support and involvement will help us continue to build an exciting new model for conservation in Australia.

Thank you for your support.


Atticus Fleming
Chief Executive

PS. Enclosed is a 12 Days of Christmas brochure setting out projects that, with your support, will be delivered over summer by our dedicated field staff. There are some great Christmas gift ideas (you can donate online at www.australianwildlife.org).

The AWC mission

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

To achieve this mission our actions are focused on:

- Establishing a network of sanctuaries which protect threatened wildlife and ecosystems: AWC now manages 27 sanctuaries covering 4.65 million hectares (11.49 million acres).
- Implementing practical, on-ground conservation programs to protect the wildlife at our sanctuaries: these programs include feral animal control, fire management and the translocation of endangered species.
- Conducting (either alone or in collaboration with other organisations) scientific research that will help address the key threats to our native wildlife.
- Hosting visitor programs at our sanctuaries for the purposes of education and promoting awareness of the plight of Australia's wildlife.

About AWC

AWC is an independent, non-profit organisation based in Perth, Western Australia. Donations to AWC are tax deductible.

Over the last 10 years, around 87% of AWC's total expenditure was incurred on conservation programs, including land acquisition, while only 13% was allocated to development (fundraising) and administration.

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Cover image:
Red Goshawk, Piccaninny Plains J Young

Pilliga feral-free area set to save 50,000+ animals every year

The final stage of the assessment and approval process is underway for the establishment of a large feral cat and fox-free area in the iconic Pilliga forests of northern New South Wales. The project will deliver exceptional benefits for the wildlife of the Pilliga, where feral predators have caused the local extinction of at least a dozen mammal species. In the 5,822 hectare area which is proposed to become feral predator-free, feral cats and foxes are currently killing more than 50,000 native animals every year.

As part of its *Saving our Species* program, the NSW Government has engaged Australian Wildlife Conservancy (AWC) to deliver land management and science services in a 35,750 hectare area of the Pilliga State Conservation Area and National Park ("Pilliga"). Within this area, it is proposed that AWC build a 32.1 kilometre feral-proof fence to establish a 5,822 hectare feral predator-free area.

Six nationally threatened mammal species - all of which are currently listed as extinct in NSW - will be reintroduced to this fox and cat-free area: Bilby, Western Barred Bandicoot, Bridled Naitail Wallaby, Brush-tailed Bettong, Plains Mouse and Western Quoll. In addition to the historic return of these mammals, the establishment of a permanent fox and cat-free area will deliver significant benefits for a range of extant native species. These include ground-active birds such as the Bush-stone Curlew, Speckled Warbler and Spotted Quail-thrush as well as small mammals such as the Pilliga Mouse and Eastern Pygmy Possum.



A Red-capped Robin in the Pilliga J Young



The first Eastern Pygmy Possum recorded in the Pilliga for six years W Lawler

The removal of cats and foxes is likely to result in a significant increase in the population of these species within the feral predator-free area.

- The precise density of cats and foxes in the Pilliga is unknown. However, both species were frequently detected in baseline surveys conducted by AWC in 2016/17.
- The nearest location to the Pilliga where an estimate of the density of feral cats and foxes has been obtained is Yathong National Park, where the density of feral cats was 0.9/km² and foxes was 2.0/km². Extrapolating conservatively from this study, there may be 25-50 cats and 50-100 foxes in the 5,822 hectare area which is set to become feral-free in the Pilliga.
- Both feral cats and foxes are opportunistic, generalist predators: in the Pilliga, they can be expected to eat native animals (small mammals, reptiles, birds and frogs) and feral animals (rabbits, mice). We know from our research in the Kimberley that each feral cat can be expected to kill in the order of seven prey items per night.
- Assuming native animals make up half the prey of feral cats in the Pilliga, feral cats may be killing ~75-150 native animals per night or in the order of 25,000-50,000 native animals per year in the 5,822 hectare area proposed for fencing.
- Foxes can be assumed to be having a similarly large impact, given their likely density in the Pilliga. Therefore, the permanent exclusion of feral cats and foxes from this area will deliver a very substantial benefit for a large number of extant fauna species.



A feral cat captured on camera trap in the Pilliga

Ground-breaking partnership to help manage Dambimangari country

Australian Wildlife Conservancy (AWC) and Dambimangari Aboriginal Corporation (DAC) have entered into a ground-breaking partnership to deliver land management and science across 800,000 hectares of Dambimangari land adjacent to the Kimberley coast, an area of international significance for conservation. The partnership will help protect a suite of threatened and culturally significant species while generating important socio-economic benefits for Dambimangari traditional owners.

The Dambimangari people are the traditional owners of more than 1.6 million hectares of land along the Kimberley coast in north-western Australia (see map on page 6) together with the adjacent coastal waters and islands. Extending from just south of Yampi to just north of the Prince Regent River, Dambimangari country includes some of the highest priority land for conservation in Australia. In particular, it includes a large proportion of the *only area on the continent to have suffered no animal extinctions since European settlement*.

Dambimangari are thus the custodians of some of the largest and most important populations of many threatened mammal species including the Golden-backed Tree-rat, Nabarlek, Monjon, Golden Bandicoot, Brush-tailed Rabbit-rat and Northern Quoll. Threatened and endemic birds occurring on Dambimangari country include the Gouldian Finch, Kimberley Honeyeater, Black Grasswren, Red Goshawk and Purple-crowned Fairy-wren. Some of these species have disappeared from large areas of their former range across northern Australia; for these species, such as the Golden-backed Tree-rat, this part of the Kimberley is a vital last refuge.

A feature of Dambimangari country is the spectacular coastline ranging from dramatic sandstone cliffs that plunge into the ocean to low sandy beaches that host important sea turtle populations.

Pristine creeks and rivers, freshwater wetlands and rolling savanna woodlands interrupted by rainforest patches provide a diverse mix of habitats. It is a landscape of immense cultural significance to Dambimangari, who have lived here for thousands of years.



Horizontal Falls lies within the Dambimangari partnership area



Dambimangari Rangers Amon Jungine and Jordan Barunga with AWC Kimberley Operations Manager Toby Barton, Vice Chair of the Dambimangari Aboriginal Corporation Warrenja Barunga and Indigenous Protected Areas Manager James Mansfield



The Dambimangari project includes more than 3,000 kilometres of Australia's most spectacular coastline

The DAC-AWC partnership

DAC and AWC have developed an innovative and ground-breaking partnership under which AWC will help deliver management of 800,000 hectares, consistent with the Dambimangari Healthy Country Plan. The partnership builds on an existing relationship working together at Australia's second largest military training area – Yampi (560,000 hectares) – which is also part of the traditional lands of the Dambimangari.

The partnership is the first of its kind between a non-government conservation organisation and an indigenous community. It is distinguished by the fact it will generate income for DAC, as well as other socio-economic benefits, while delivering measurable conservation outcomes.

Land management will be delivered by AWC field staff and Dambimangari Rangers working hand-in-hand. Fire management (prescribed burning), weed control and feral animal control will be carried out in accordance with agreed work plans. Annual reports will track key metrics such as the area of invasive weeds.

A substantial science program will involve inventory work in one of Australia's most remote locations, searching for some of the last remaining populations of species such as the Brush-tailed Rabbit-rat, Kimberley Brush-tailed Phascogale and Nabarlek.

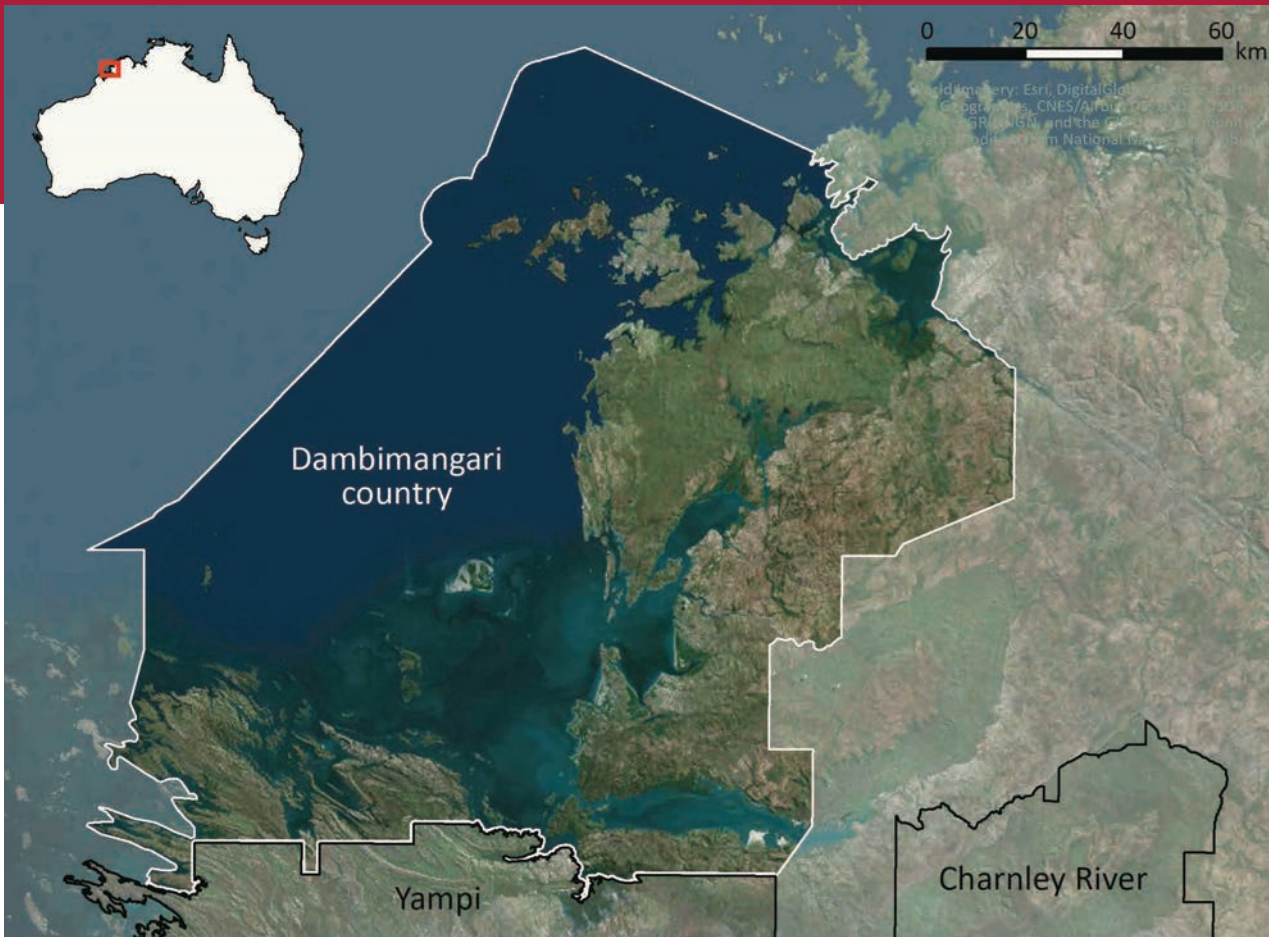
In addition, a monitoring program will be designed to track key indicators such as the population (or other metric) for important species such as the Northern Quoll and Golden-backed Tree-rat.



Dambimangari country



Dambimangari country is a refuge for the Brush-tailed Rabbit-rat *K Brennan*



The Dambimangari project area covers 800,000 hectares

Fire management is a critical element of the partnership. Effective prescribed burning, which limits the scale of late season wildfires, will not only protect wildlife habitat and cultural sites, it will generate carbon credits which can be sold annually by DAC.

In addition to carbon income, the project will deliver a range of other socio-economic outcomes/benefits.

- AWC will pay an annual fee to DAC, recognising that Dambimangari traditional owners are choosing to manage their land in a way that protects conservation values that are important to all Australians.
- Implementation of the agreement will also involve on-the-job training designed to help build the capacity and expertise of Dambimangari Rangers. In turn, AWC staff will learn from Dambimangari Rangers about traditional knowledge.
- AWC will participate in community engagement and education programs and will develop a scholarship program for Dambimangari students.
- AWC and DAC will work together to develop culturally appropriate and environmentally sustainable business opportunities and to leverage Government investment in Dambimangari activities.
- The project will support Dambimangari in protecting cultural heritage (especially sacred sites and rock art) by aligning visits to remote areas for land management/science operations with cultural visits involving senior traditional owners. AWC will also assist in the development of remote area infrastructure designed to help Dambimangari Rangers and family spend more time on country. (Similarly, AWC is building a facility at Yampi, in conjunction with the Department of Defence, which will facilitate Dambimangari involvement in the management of that property.)



Dambimangari country protects an important population of the Golden-backed Tree-rat *A Hartshorne*

Please help support this innovative partnership

The Dambimangari – AWC partnership is vitally important:

- It will help protect a vast landscape (800,000 hectares) in one of Australia's most important natural areas which is a hotspot for threatened species.
- It will define a new business model which generates income for traditional owners, as well as delivering broader socio-economic benefits through training and education.

It will cost AWC approximately \$1/ha per year to implement this partnership. Please consider a tax deductible donation to AWC in support of the AWC-Dambimangari partnership.

Newhaven: Return of the Mala



A Mala is released at Newhaven watched by AWC field staff, including the Newhaven Warlpiri Rangers, and family W Lawler

The last wild Mala died alone in the Tanami Desert more than 25 years ago, probably killed by a feral cat or fox. An animal that once numbered in the tens of millions, and occupied almost half of the continent, had become extinct in the wild within 200 years of European settlement.

Before the last wild population disappeared in 1991, a small number of Mala were removed from the Tanami Desert for captive breeding. There are now less than 400 Mala in semi-wild populations on mainland Australia, plus an offshore population of up to 900 animals (see map on page 9). While it remains one of Australia's most endangered animals, a recent emergency translocation from Watarrka National Park to Australian Wildlife Conservancy's (AWC) Newhaven Wildlife Sanctuary promises to be a turning point in the Mala's fight for survival.

Delivering an emergency response

In mid-2017, routine monitoring of the semi-wild Mala population at Watarrka National Park suggested the population, in decline since a 2013 wildfire removed food and cover, was reaching a critical point. The Watarrka population, exposed to predation from eagles and other native predators, had dropped to less than 20 animals. It was unlikely to survive the 2017/18 summer.

The Watarrka population is important because it contains significant genetic diversity. Its loss would have pushed the Mala a step closer to extinction. The Mala Recovery Team, including officials from the Northern Territory and the Federal Governments, assessed the options and agreed the remaining Watarrka Mala should be captured and transferred to a yet-to-be-built, feral predator-free area at Newhaven Wildlife Sanctuary.

At Newhaven, AWC had already commenced construction of a 9,450 hectare feral predator-free fenced area (Stage 1). However, this massive fenced area is not due to be completed until early 2019. The Watarrka Mala needed a secure home within six weeks.

In response, the AWC team swung into action. Plans were drawn up for a 150 hectare feral-free area surrounded by a 4.8 kilometre fence situated within Stage 1. The Warlpiri-Luritja traditional owners confirmed their support.



Newhaven Manager Josef Schofield and Land Management Officer Duncan Jungala Gallagher inspect the feral-proof fence before the Mala arrive. *W Lawler*

AWC's field team worked around the clock and, within four weeks, the feral-proof fence was in place. The Newhaven Warlpiri Rangers had been methodically working the area in which the fence was built, using their unique tracking skills to remove feral cats.

Kiwirrkurra Rangers travelled to Newhaven to assist. By early November, evidence from 75 camera traps confirmed the fenced area was feral cat and fox-free.

The Mala returns to Newhaven

On the nights of 8 and 9 November, a team of a dozen AWC ecologists gathered at Watarrka to capture the remaining Mala. Working with NT Government officials, 70 traps were set each night. The scientists worked through the night, checking and rebaiting traps. At the end of the first night, five Mala had been captured including three females with pouch young.

The afternoon flight to Newhaven on 9 November took less than an hour. On arrival, the Mala were given a health check before being prepared for their release. Finally, as darkness fell, the five pioneering Mala were transported to their new 150 hectare home. It was an emotional moment for AWC staff, especially the Newhaven Warlpiri Rangers and family members, as the first Mala emerged from his bag, surveyed his new surroundings, and hopped purposefully into the darkness.

These first five Mala were joined by three more Mala on the following night, with the remaining Watarrka Mala to be transferred before Christmas. Over the next 12 months, additional Mala will be translocated from Scotia and other populations. In 2019, they will be released into the 9,450 hectare Stage 1 area, becoming the first wild population on mainland Australia for nearly 30 years.



There are around 400 Mala left on mainland Australia. *W Lawler*



The AWC team is now building 44 kilometres of feral proof fence to establish a 9,450 hectare cat and fox-free area *W Lawler*

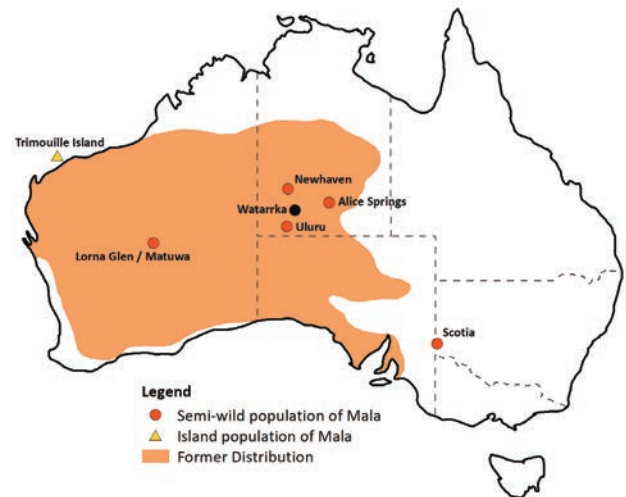
When the feral-free area is increased to more than 70,000 hectares, the Mala population is expected to grow to more than 18,000 animals.

Stepping back in time

The story of the Mala's decline is a familiar story for many of the small to medium-sized mammals which once lived in large numbers across Australia. Two of the Mala's closest relatives – the Eastern Hare-wallaby and the Central Hare-wallaby – are among 30 native mammals that are now extinct. Another six species, including the Mala, are found only in feral cat and fox-free areas. In total, more than 60 Australian mammal species are on the brink of extinction.

At Newhaven, AWC has embarked on a project that will turn back time and provide new hope for the Mala and a range of other species. We are undertaking the planet's largest feral cat eradication, paving the way for the restoration of at least 11 nationally threatened mammals including the Golden Bandicoot, Burrowing Bettong and Numbat.

For the first time, a vast landscape in central Australia will once again be home to a diversity and abundance of native mammals similar to that which existed prior to European settlement and the arrival of foxes and cats. The return of these eight Mala is merely the first step in one of the country's most important conservation initiatives.



Please help us save the Mala by considering a tax deductible donation to help build the 44 kilometre Stage 1 feral-proof fence at Newhaven:

- \$100 will buy one fence strainer
- \$250 will buy 20 metres of netting
- \$1,000 will buy fence pickets for 500 metres of fence

Mt Gibson: Historic return to mainland Australia for one of our rarest kangaroo species

One of our most endangered kangaroo species, the Banded Hare-wallaby, has made a historic return to mainland Australia, more than 100 years after the last wild colony disappeared as a result of foxes and cats.

Seventy-one Banded Hare-wallabies - 35 males and 36 females – have been successfully translocated to Australian Wildlife Conservancy's (AWC) Mt Gibson Wildlife Sanctuary, where they have been released into a 7,800 hectare feral predator-free area. The first tranche of animals (61 hare-wallabies) was airlifted from Bernier and Dorre Islands in Shark Bay as part of a joint operation involving field staff from AWC and the WA Department of Biodiversity, Conservation and Attractions. A further 10 animals were translocated from AWC's Faure Island.

The Banded Hare-wallaby is the sole survivor of a now extinct group of mostly megafauna kangaroos; it is genetically and morphologically distinct from all living kangaroo species. It is also significant because it was one of the earliest macropods to be seen by Europeans, with its presence recorded by English explorer William Dampier in 1699.

Sadly, the Banded Hare-wallaby has suffered a catastrophic decline since European settlement. Once found from near the Victoria/South Australian border to south-western Australia, the last wild animal on the mainland was recorded in 1906. The species is so vulnerable to cats and foxes that it now survives only in feral predator-free areas.

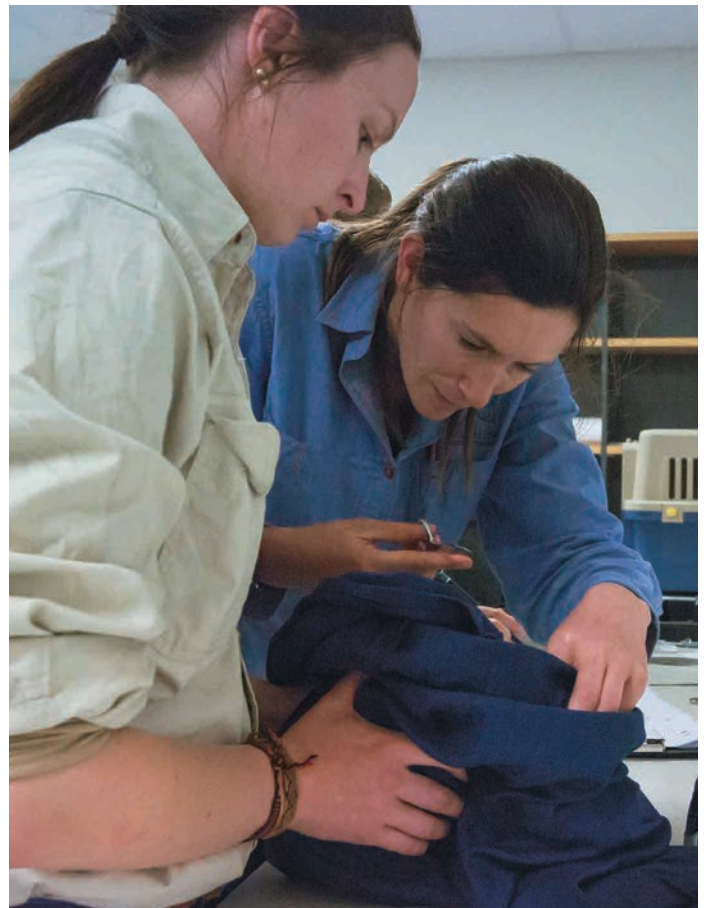
Secure within the largest feral cat and fox-free area on mainland Western Australia, the Mt Gibson population of the Banded Hare-wallaby is expected to grow to ~3,000 animals over the next decade, making it the first self-sustaining wild population on mainland Australia for more than a century.

The initial translocation to Mt Gibson was a complex, logistical exercise. AWC's dedicated staff were based on a boat in Shark Bay, making nightly forays onto Bernier and Dorre islands to net the hare-wallabies. Animals that were caught, and which met prerequisites in relation to age and health, were transported at first light by helicopter to the mainland, before being flown in a fixed wing plane to Mt Gibson and released, after dark, into their new, cat-free home. You can watch a video of the translocation on our website, www.australianwildlife.org.

The hare-wallabies have settled in to their new home; some were observed feeding on acacia scrubs within minutes of their release, while initial monitoring revealed an exceptionally high survival rate (98%).



Banded Hare-wallaby at Mt Gibson *B Leue*



The Banded Hare-wallabies were taken to the Neville Tichbon Field Research Station for health checks by AWC Field Ecologist Nicola Palmer (right), assisted by intern Claire Allison, on their arrival at Mt Gibson *B Leue*



Mt Gibson is now home to the only population of Djoongari (Shark Bay Mice) on mainland Australia *D Portelli*

Mt Gibson sets new benchmark for threatened mammal reintroductions

The reintroduction of the Western Barred Bandicoot and Djoongari (Shark Bay Mouse), alongside the Banded Hare-wallaby, means that AWC has now reintroduced eight nationally threatened mammals to Mt Gibson Wildlife Sanctuary. It is the first time in Australia that eight threatened mammals have ever been reintroduced to a single site.

Djoongari makes mainland comeback

Only three specimens of the Djoongari have ever been collected on mainland Australia. The last specimen was collected in 1895 near Alice Springs. However, subfossil evidence demonstrates the Djoongari was previously distributed across much of western and central Australia, even extending into New South Wales and Queensland. We know that a population of Djoongari once lived at Mt Gibson because old bone fragments have been collected in a cave on the property, probably dropped there by owls.



A Western Barred Bandicoot being released at Mt Gibson *B Leue*

The impact of feral cats and foxes meant that the Djoongari had disappeared from mainland Australia by the late 1800s. For more than 100 years, they survived only on the feral predator-free Bernier Island in Shark Bay. In recent years, five translocations have been attempted but only two new populations have been established on AWC's Faure Island, and on North West Island.

The translocation of 49 Djoongari to Mt Gibson in October is, therefore, a significant step for the species, and for mammal conservation in Australia. If the translocation is successful (risks include predation by goannas, snakes and owls), the Mt Gibson population will be the only population on mainland Australia – a critical step in providing a secure future for a species that has been on the brink of extinction for over a century.

Western Barred Bandicoots dig in at Mt Gibson

Twenty-four Western Barred Bandicoots have also been translocated to Mt Gibson from Dorre Island and Faure Island in Shark Bay. Like the Djoongari, the Western Barred Bandicoot was once found across much of the continent, including as far east as the Liverpool Plains in NSW. By the 1930s or 1940s, however, feral predators had caused its extinction on the mainland. Its prior occurrence at Mt Gibson is confirmed by a lower molar and other bones located in a cave.

The Mt Gibson population, only the second population on mainland Australia, is expected to grow to around 800 animals. AWC also plans to reintroduce the Western Barred Bandicoot to NSW (Pilliga, Mallee Cliffs and Scotia).

AWC acknowledges the major supporters of the Mt Gibson project: Michael Tichbon, Perth Zoo, Lotterywest, the Northern Agricultural Catchments Council NRM and Department of Biodiversity, Conservation and Attractions.

Measuring ecological health at Mallee Cliffs and the Pilliga

Australian Wildlife Conservancy (AWC) has been engaged by the New South Wales Government to deliver land management and science services at two parks – Mallee Cliffs National Park ('Mallee Cliffs') and the Pilliga State Conservation Area and National Park ('Pilliga').

This historic partnership is funded by the NSW Government, and is part of its *Saving our Species* program, which aims to maximise the number of threatened species that can be secured in the wild in NSW over the next 100 years. This is the first time a non-government conservation organisation has been engaged to manage substantial areas of the public conservation estate.

A centrepiece of the partnership is the implementation of a monitoring program designed to measure and report on the ecological health of each park over time, i.e., to generate a Performance Scorecard for each park, based on data collected in a scientifically rigorous manner. AWC's Ecological Health Monitoring Framework (EHMF) measures:

- the level of selected biodiversity indicators (e.g., the abundance of threatened species);
- the level of threatening processes (e.g., feral animal densities); and

- the functioning of ecological process (e.g., diggings by native animals).

In this way, the EHMF will provide a snapshot of the level of natural capital in each park and, over time, will track increases or decreases in the health of the park. Research projects can be embedded within the EHMF, or implemented in conjunction with it, to explain the reason for any changes occurring.

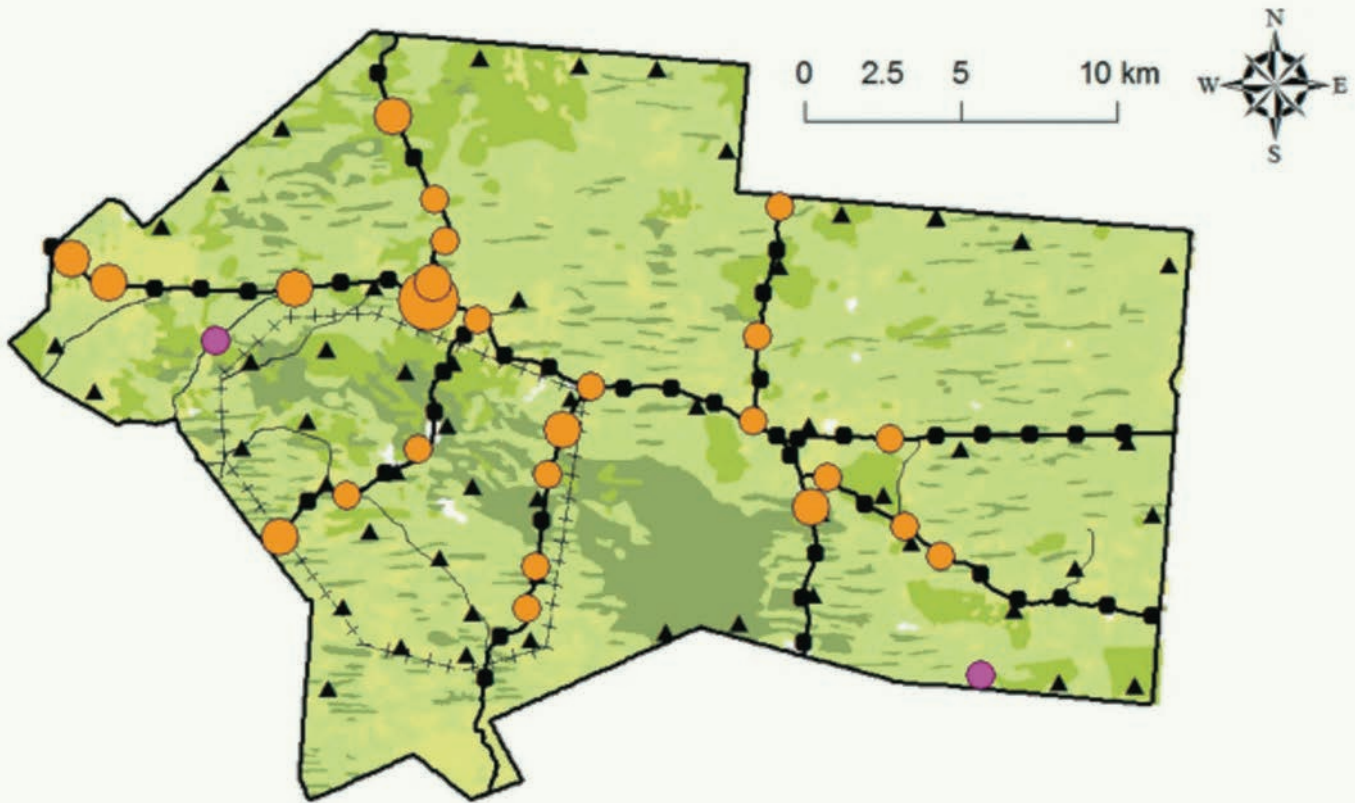
Over 2016/17, AWC conducted detailed biological surveys to collect baseline data on the ecological health of the Pilliga and Mallee Cliffs.

These surveys were conducted in accordance with a draft EHMF for each park; a final EHMF will be prepared in partnership with the NSW Office of Environment and Heritage after taking into account the outcomes of a review process.



A Common Dunnart captured during AWC's baseline surveys in the Pilliga. W Lawler

Mallee Cliffs National Park – Spring 2016 Feral Cat Activity



Key

Vegetation Description




	Belah Woodland
	Mallee Woodland
	Mallee Woodland (Triodia understorey)
	Open Herbland

Cat Activity (Road)



Cat Activity (Site)



	Road Cameras
	Site Cameras
	Proposed Fenceline

Mallee Cliffs: Measuring feral cat and fox activity and abundance

Our Performance Scorecard for Mallee Cliffs includes a measure of feral cats and foxes in the park. Initially, our metric for both cats and foxes is an index of abundance and occupancy based on camera trap arrays. However, the metric will become a density/population estimate after the results of research at Scotia (see page 14) enable us to refine our survey design and accurately generate a density/population estimate.

Surveys for cats and foxes were conducted in spring 2016 and autumn 2017. Cameras were deployed at 1.5 kilometre intervals along roads and at each of our standard fauna monitoring sites; in 2016 this involved 116 cameras while in 2017 the number increased to 120 cameras. Cameras were programmed to take three images per trigger; each camera was attached to a star picket at 50 centimetres above ground level, with a chicken neck used as bait.

Cats and foxes were frequently detected in both surveys (see table right). Both cats and foxes were more frequently detected using the camera traps on the roads than by cameras placed off-road at the fauna monitoring sites.

While cat occupancy at road cameras was slightly higher in spring, fox occupancy was higher in autumn.

The results suggest that, despite the significant baiting program that has previously been implemented at Mallee Cliffs by the NSW National Parks and Wildlife Service, a high number of foxes and cats continue to use the park. Ongoing monitoring of feral predators will assist AWC as it creates a large, feral predator-free area in the park. Importantly, it will also inform development and execution of a strategy to suppress feral predator densities outside the core fenced area.

	Spring 2016		Autumn 2017	
	Site cameras (50)	Road cameras (66)	Site cameras (58)	Road cameras (62)
Feral cat	4%	38%	5%	26%
Fox	14%	56%	26%	85%

Indicator	Number of individuals	Number of sites recorded	Survey Methods
Small-medium mammals			
Yellow-footed Antechinus	59	31 (60 sites)	Box and pitfall trapping
Common Dunnart	16	14 (60 sites)	Box and pitfall trapping
Pilliga Mouse	3	3 (60 sites)	Box and pitfall trapping
Large herbivores			
Black-striped Wallaby	152 (images)	26 (100 sites)	Camera traps
Eastern Grey Kangaroo	335 (images)	59 (100 sites)	Camera traps
Arboreal mammals			
Eastern Pygmy Possum	2	1 (60 sites)	Trapping
Koala	6	5 (50 sites)	Nocturnal survey

Pilliga: Measuring native mammal abundance

Our baseline survey in the Pilliga during the first 12 months has involved more than 13,000 trap nights comprising pitfall traps, cage traps, funnel traps and Elliot traps, as well as camera traps. The surveys are based on a grid design across the Pilliga project area which meets key design criteria including habitat representation and spatial independence of sites. This represents the first comprehensive biological survey in the Pilliga since the area was declared in 2005. While the biodiversity indicators in the draft Pilliga EHM include a suite of bird, reptile and amphibian species, in this article we report only on selected mammal species.

Fourteen native mammal species (excluding bat species) were recorded in our baseline surveys. To put this in context, we expect 17 mammal species (excluding bats) to occur in the Pilliga. AWC will

reintroduce a further six species which are currently extinct in the region.

The results give us an indication of the relative abundance of extant species: for example, the Yellow-footed Antechinus is the most abundant small mammal; the Eastern Grey Kangaroo is the most abundant large herbivore. However, as no survey was conducted at the time the area was protected, the numbers do not tell us whether the health of the area has changed since it transitioned from state forest to national park. In future, the numbers will provide a baseline against which changes in health can be detected and quantified.

Related research projects (such as a comparison of before/after and inside/outside the feral-free area) will help explain the changes and inform future management.

Feral predator research at Scotia Wildlife Sanctuary

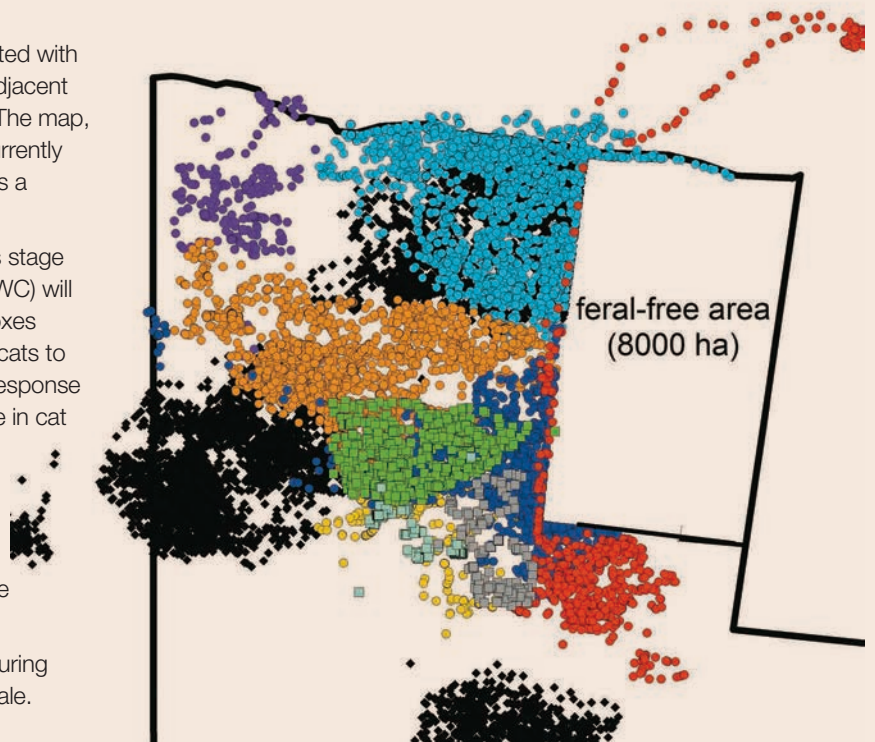
At Scotia Wildlife Sanctuary one of Australia's most important feral predator ecology research projects is entering its next stage.

A total of 29 foxes and 13 feral cats have been fitted with GPS collars across an area of 14,000 hectares adjacent to the feral predator-free (fenced) area at Scotia. The map, right, shows recent data from the 12 feral cats currently collared (each dot is a point in time; each colour is a different cat).

Intensive fox control is now underway. During this stage of the project, Australian Wildlife Conservancy (AWC) will measure the effectiveness of fox control (are all foxes killed? do foxes reinvade?); the response of feral cats to fox control (do cat densities increase?); and the response of small mammals and reptiles (does any increase in cat densities offset any reduction in foxes?).

The next stage will involve delivering integrated fox and feral cat control, answering critical questions such as whether cat densities can be reduced to a level that drives a sustainable increase in native animal numbers.

This is the only research project in Australia measuring the integrated control of cats and foxes at this scale.



North Head: Bringing threatened wildlife back to our cities



The Brown Antechinus was the third species to be reintroduced to North Head *J Clarke*

Sydney, like the rest of Australia, has lost a suite of native mammals since European settlement. However, the retention of high-quality pockets of habitat in peri-urban areas provide unique opportunities to restore some of these lost creatures.

For several years Australian Wildlife Conservancy (AWC) has been working in partnership with the Sydney Harbour Federation Trust at North Head, the iconic northern entrance to Sydney Harbour, to restore some of the small mammal species once found on the headland.

The Bush Rat – outcompeting the invasive black rat

The re-establishment of the native Bush Rat was an important first step. Cities, including urban bushland at places like North Head, are dominated by the invasive (feral) black rat. As it was not feasible to remove all black rats from the headland, we set out to provide an environment in which the native rodent could outcompete the invasive one.

Building on research that showed an established species would have a competitive advantage, we set about manipulating small sections of habitat. Bush Rats were reintroduced into these areas in three stages between 2014 and 2016, giving them an opportunity to establish territories they could then defend against black rats.

The reintroduction of Bush Rats has been incredibly successful with more than 500 animals born on the headland since the program started. This novel approach - using a native species to control an introduced one - has resulted in several sections of the headland being dominated by Bush Rats, with dramatically reduced numbers of black rats. From their initial foothold, Bush Rats have spread across most of the headland.

Pygmy Possums and Brown Antechinus

In the first known translocation of the Eastern Pygmy Possum, 18 individuals were reintroduced to North Head during 2017. These tiny marsupials are threatened in NSW, having disappeared from North Head a long time ago. Pygmy Possums weigh only 15g, slightly more than a triple-A battery. The recent discovery of a couple of juvenile pygmy possums born on North Head is a great sign that the species is settling in to its new home.

The Brown Antechinus was the third species to be reintroduced; 34 individuals have been translocated to the headland so far in 2017. This small carnivorous dasyurid (a relative of the Tasmanian Devil) weighs just over 20g and has an interesting life strategy. Each female is capable of producing up to eight young per year for one to two years, but males live for only one year - all males die following a short and intensive mating season.

The three reintroduced species have wide ranging diets, but all feed on nectar and pollen with a strong preference for banksia flowers. As pollinators they can play an important role in the health of the Eastern Suburbs Banksia Scrub, the largest remaining remnant of which is found at North Head.

AWC and CSIRO join forces in Synthetic Biology search for feral cat solution

Australian Wildlife Conservancy (AWC) and CSIRO have signed an agreement which will explore the potential for new gene technologies to play a role in a continent-wide solution to the feral cat crisis. The CSIRO-AWC agreement provides a framework for collaboration in the emerging field of Synthetic Biology, potentially a game-changer in our long-term quest to reduce the impact of feral cats and other invasive animals.

Australia is currently powerless to stop the impact of feral cats, which kill millions of native mammals, birds, reptiles and frogs every day. Apart from establishing massive feral cat-free fenced areas, there is no existing strategy or technology that can provide effective feral cat control at a landscape scale. Available options – such as baiting, designer cat traps and shooting – cannot suppress feral cat numbers permanently, and to the extent required, to deliver a sustainable increase in native wildlife to natural levels.

Similarly, while we know that the presence of dingoes and/or protecting ground cover, through feral herbivore control and fire management, can sometimes limit the impact of feral cats, neither mechanism has demonstrated it can adequately restore native wildlife populations. Biological control is also not an option – there is no suitable *myxomatosis* or rabbit *calicivirus* equivalent for cats.

Australia needs to consider new approaches if we are to effectively remove feral cats from the Australian bush. The best option may lie in the field of Synthetic Biology and, in particular, gene drive technology. CSIRO and AWC will partner to responsibly evaluate the potential for gene drive technology to help manage feral cats.

This ground-breaking technology is already being assessed by some of the world's leading universities and scientific organisations for its potential in areas ranging from curing diseases to improving crop yields. Any Synthetic Biology solution to feral cats could take decades to develop; it's important we start to investigate the potential of this new technology now, within a regulatory framework that ensures the Australian public has confidence in the assessment and management of any risks.



Gene drives could also be used to improve the resistance of frogs, such as the endangered Common Mist Frog, to the chytrid fungus *E. Milder*

What is gene drive technology?

Gene drive technology involves a process whereby a gene is spread through a population faster than by normal (Mendelian) processes – e.g., aimed at causing 100% of offspring to inherit a particular gene from one parent, compared with 50% in normal inheritance. This means that, over time, a gene spread by a gene drive can become dominant in a population. Gene drives occur naturally and can also be engineered.

How could a gene drive reduce the impact of invasive species?

Driving populations of invasive species to extinction: This strategy may be applicable to feral cats, as it is being considered for other invasive species. An engineered gene drive could be used to spread a gene designed to cause infertility in female cats that only becomes active once most cats carry the gene. Once spread through the population, the gene drive could cause the population to decline towards extinction (because all female cats would become infertile).

Modifying harmful traits of invasive species: Gene drives could be used to spread genes that reduce or remove harmful traits exhibited by an invasive species – for example, to stop cane toads producing their lethal toxins, allowing native predators to survive eating toads.

Improving resistance to harmful traits of invasive species: Gene drives could be used to spread genes that improve the resistance of native animals. For example, gene drives could be used to promote resistance to chytrid fungus in endangered frogs.

Addressing the risks

Like all new technologies, the use of gene drives will require rigorous assessment within a regulatory framework that ensures public confidence that any risks are properly assessed and managed – a process that is now underway around the world where this technology is being considered. In the context of feral animals, a key risk relates to the potential for a gene drive to impact on a population in its native country or, in the case of cats, to impact on animals kept as pets.

There are various technical strategies to prevent the ability of gene drives to invade native populations – these include gene drives that are engineered to work only on the invasive population, by targeting unique gene sequences (so-called 'precision guides'); drives that carry a functional genetic payload only in the presence of a suite of pre-cursor drives (so-called 'daisy drives'); and drives that only work if engineered individuals are a dominant component of the population (so-called 'inundation drives'). In addition, a drive could be developed to 'immunise' an unexposed population to the operative gene drive. It is important to note that pets would not be affected by the female sterility drive envisaged to control feral cats. However, the offspring of pet cats allowed to mate with feral cats would potentially carry the drive.

The next steps

Synthetic Biology, including gene drive technology, is a new and rapidly evolving field. AWC and CSIRO will be working with a range of organisations across several different invasive species to evaluate the potential application of gene drives and to ensure rigorous risk assessment. **No-one has yet developed a functional gene drive to control an invasive vertebrate.** The development of an effective gene drive could take two to five years for mice and a decade for feral cats. Once developed, a gene drive needs to be deployed – it could take several decades for a gene drive to control feral cats across Australia given their relatively long generation time.

The development and deployment of a gene drive for feral cats is therefore a long-term project requiring: a better understanding of the cat genome; design of the gene drive; development of strategies to ensure successful uptake and transmission of the drive; detailed modelling of the ecology of feral cats to develop successful release strategies; and comprehensive assessment and mitigation of

any potential environmental impacts (such as a possible increase in rabbit populations).

Finding a Synthetic Biology solution for feral cats is a substantial project with no guarantee of success. However, the technology offers potentially massive benefits across a range of invasive species and gene drives, in particular, are possibly our best hope in the quest to rid Australia of feral cats and restore wildlife populations.

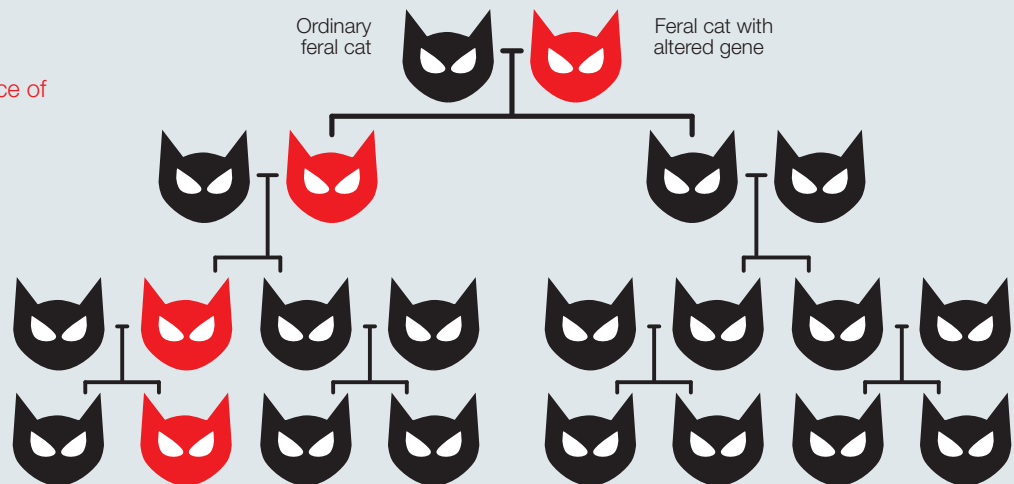
A feral cat-free Australia

Please make a tax deductible donation to help AWC, working in collaboration with CSIRO and others, develop a safe and effective gene drive solution for feral cats.

This is our best hope in the long-term quest to create a feral-cat free Australia.

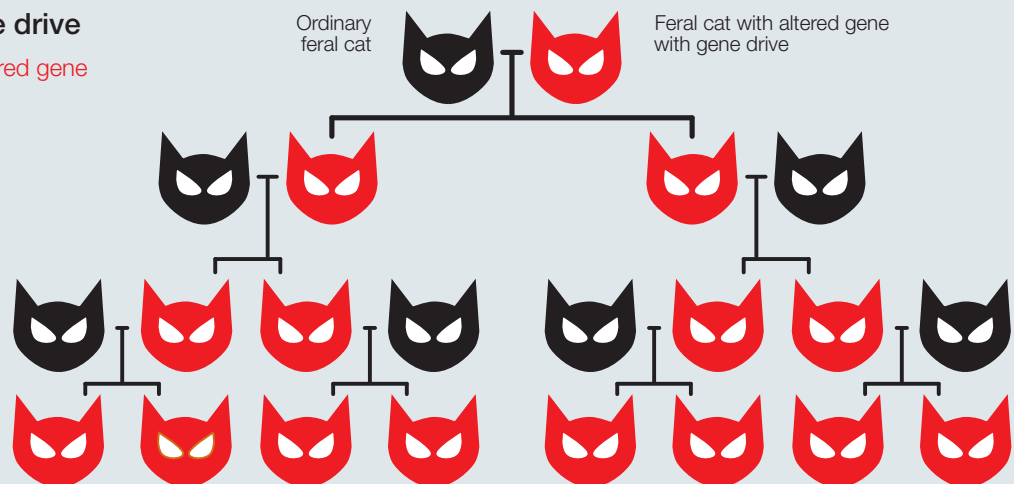
Normal inheritance

Offspring have a 50% chance of inheriting the altered gene

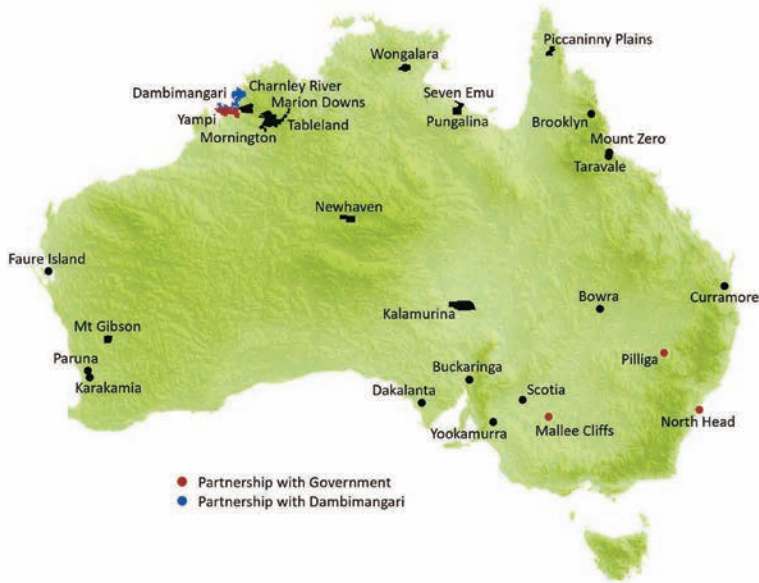


Inheritance with gene drive

Offspring always inherit altered gene



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A feral-cat free Australia

- Developing a gene drive solution for feral cats (with CSIRO)

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