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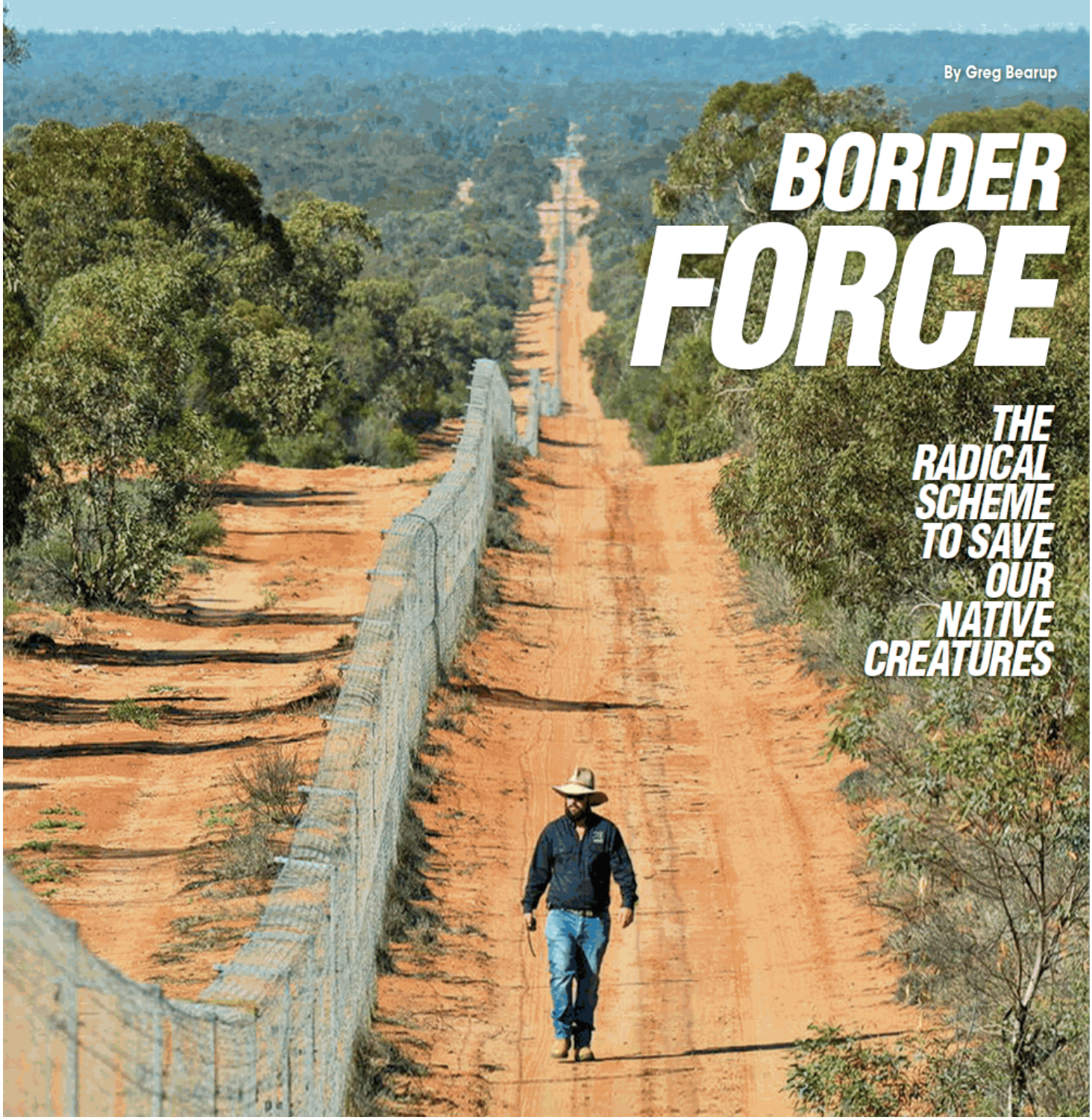


By Greg Bearup

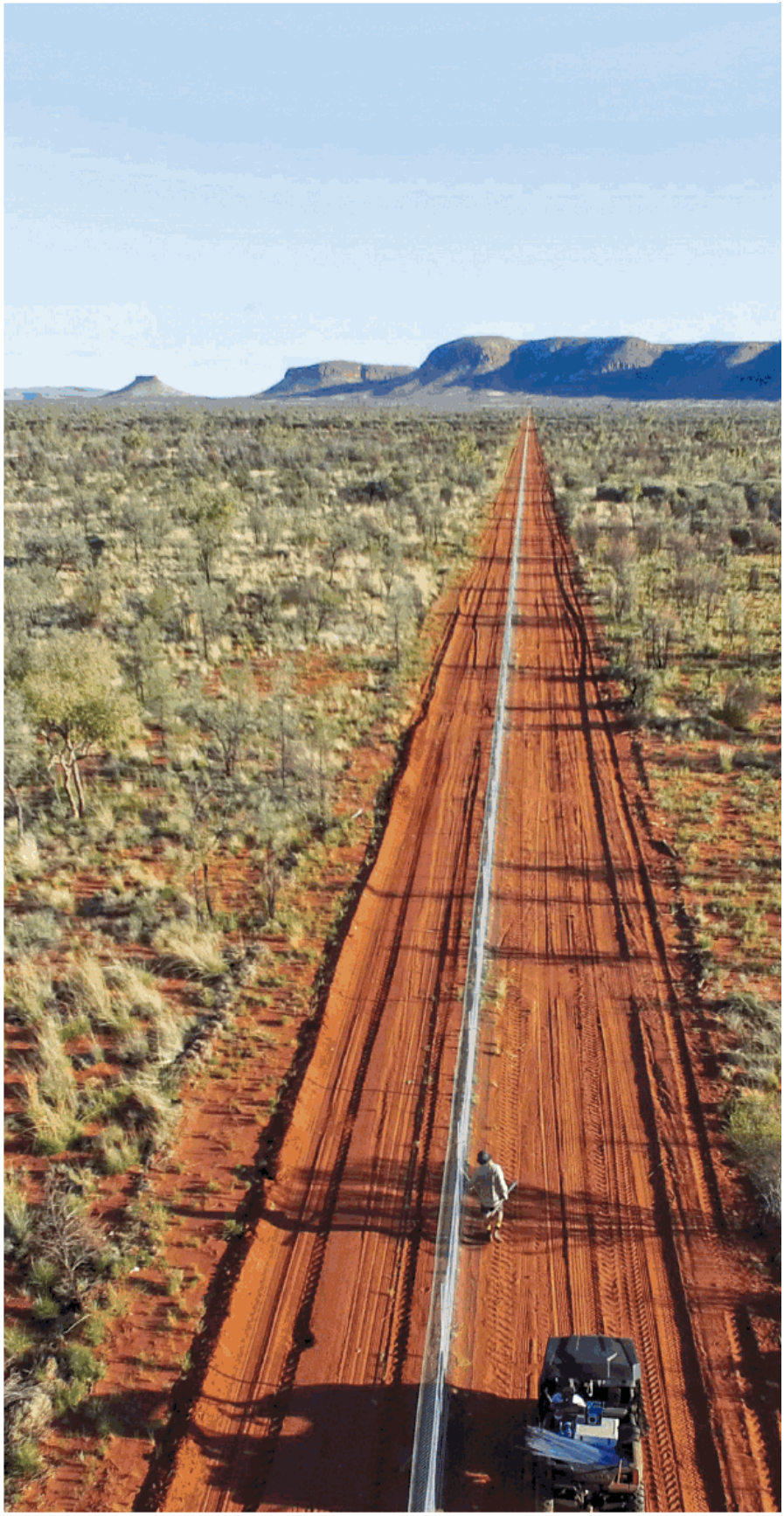
BORDER FORCE

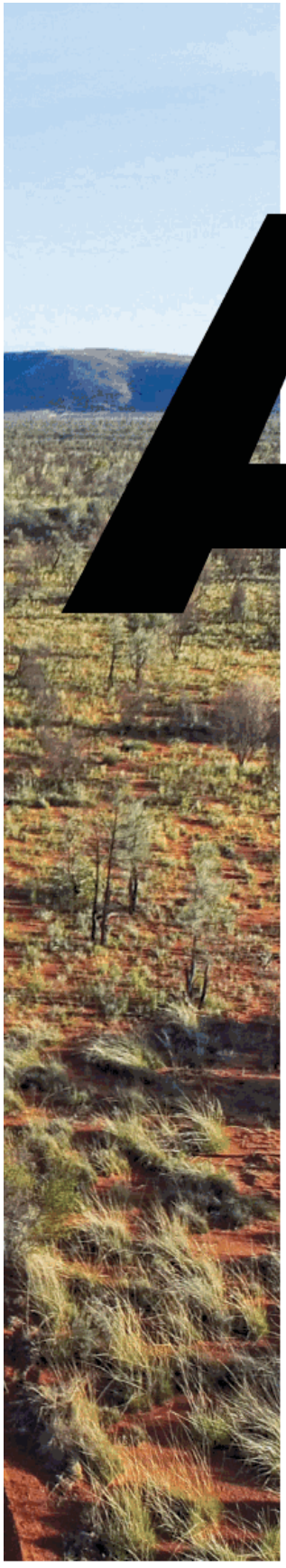
THE RADICAL SCHEME TO SAVE OUR NATIVE CREATURES

LINE IN THE SAND

By Greg Bearup

Feral-proof fencing is being erected around vast tracts of Australian bush. Will it save our endangered mammals?





A nagging chill sets in as the sun disappears into the vast desert plain. It hasn't rained for a long time, but then time ticks to a different clock out here; four seasons are for other, softer places. Here it's boom and then mostly bust. It's like an opal miner who strikes it rich and for a few gluttonous months feasts on lobster in a waterside apartment and then survives in a tin humpy for years on dry biscuits and canned meat. The trees and the undergrowth are grizzled and stunted – the larger mallee gums, the size of lemon trees, have been here since Federation.

We come to a gate that looks like the entrance to a prison farm. The gate is 3m high, heavy steel and mesh. A series of electrified wires runs along the fence on either side. This impenetrable barrier, enclosing 8000ha of desert scrubland in the far south-west of NSW, is designed to keep the murderers out, not in. Once inside, we step from the vehicle, torches at the ready, to search for Australia's disappearing natural history. We've entered Scotia, a nature sanctuary on the SA border, two hours' drive south of Broken Hill.

"Over there, underneath that tree," whispers ecologist Felicity L'Hotellier. "A pair of bettongs." I sneak in close enough to get a photo before they scurry off. This is a privilege very few living Australians have ever had, seeing burrowing bettongs – the short-nosed rat-kangaroo – in their natural environment. L'Hotellier explains that the bettong was once our most common marsupial – there were hundreds of millions of them, more than all the kangaroos. Early explorers wrote of having to dismount from their horses lest they stumble in the pock-marked landscape the critters had dug. They are beautiful; like a small-headed possum that hops along daintily. They're now clinging on, with a total population of fewer than 15,000.

We wander on in the torchlight to a hollow where some bridled nailtail wallabies are hopping about, grazing. These handsome wallabies were once found over a vast area of eastern Australia, ranging inside the Great Dividing Range from the bottom of Victoria to Charters Towers in Queensland. Then their numbers collapsed and they were thought extinct, L'Hotellier says, until a small colony was discovered in the Central Highlands of Queensland in the 1970s. Their population is now estimated to be just 2300 and three-quarters of them are here at Scotia.

Next on our dodo-in-waiting tour is the greater bilby. We pick one up in the spotlight near the gate to the homestead and I creep in for a closer look. It appears that on the day the bilby was created the engineers were away and the draughtsman, a budding cartoonist, took it upon himself to finish the job. With its enormous ears and pointy nose it lopes along on big back legs and small paws. The bilby was once common everywhere west of the Great Divide. The last recorded sighting of one in the wild in NSW was in 1912, at Wagga Wagga, 700km to the east. The nearest surviving wild population is 2000km to the north, near Boulia in Queensland.

The Australian bush was once teeming with these small native mammals; unique animals that are part of our national DNA. Dozens of these once-common species have retreated to tiny pockets and without fenced areas like this, many would disappear. The perpetrators of this genocide are lurking just beyond the fence: feral cats and foxes, which have turned much of Australia into a marsupial graveyard. We've already lost 30 mammal species since European colonisation and a further 63 are in peril.

In response to this crisis an ambitious mammalian ark, like this one at Scotia run by Australian Wildlife Conservancy, is being constructed across the continent and on our islands. There are now six major fenced sanctuaries larger than 1000ha, 11 smaller projects and a further five large-scale sanctuaries under construction. Feral-proof fencing is being erected around tens of thousands of hectares of bush, which is then cleared of cats and foxes and repopulated with endangered species. A good percentage of Australia's furry

fauna is essentially living on life support in these intensive care units. They may recover to a degree but will they ever be able to leave hospital and return to the existence they once knew?

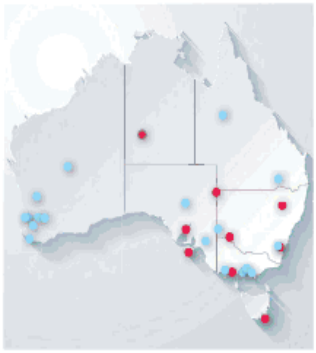
"These reserves are kinds of glorified zoos in many ways," says Dr Kath Tuft, who manages a research sanctuary in South Australia for the conservation group Arid Recovery. "Undoubtedly they are essential for the survival of many vulnerable species. But in the long term, maintaining these fences is a huge commitment." Are they forever viable? she asks.

"They're not a freaking zoos!" barks Atticus Fleming, CEO of Australian Wildlife Conservancy. "The whole of Australia used to be a freaking zoo, there was wildlife everywhere... and now much of the continent is a marsupial ghost town."

He argues that these reserves are simply returning the landscape to what it was like prior to European settlement. He's strident in his advocacy for building more and larger reserves. He wants to give us something akin to the great African wildlife parks, teeming with native species, with the poachers – cats and foxes – kept at bay and shot on sight. "There have been lots and lots of examples where native species have been reintroduced to areas without fences... and lots of those have been costly failures."

This bold plan for vast fenced reserves, backed by the federal and state governments, is not without its critics, or its problems. And while conservationists and scientists argue at the edges about the best way forward, everyone agrees that they are vital for the immediate survival of many species.

All these arguments would dissipate, of course, if something could be done about the essential problem. Is there hope on the horizon to combat the relentless marauding army of feral cats?



Fox and cat-free exclosures

Future feral-free areas

Advocate: AWC's Atticus Fleming

The appetite cats have for our native fauna is insatiable. The grim reality is that as one species becomes extinct, another is plundered. A major research project headed by Professor John Woinarski of Charles Darwin University estimated that feral cats, which number between 2.1 and 6.3 million, kill 272 million native birds a year; pet cats gobble a further 61 million. A new study looking at cat predation of mammals is due to be published soon, and will be horrifying. "Whenever you start doing the maths on cat predation the numbers are so massive, so horrendous, you think 'My God, that can't be right'," says Dr Sarah Legge of the Threatened Species Recovery Hub.

In 2015, this extinction crisis prompted the then environment minister Greg Hunt to "declare war" on feral cats. "By 2020, I want to see two million feral cats culled, five new [feral-free] islands and 10 new mainland 'safe havens' free of feral cats, and control measures applied across 10 million hectares," he said. He floated the idea of introducing a virus to combat feral cats, similar to the calicivirus for rabbits. Domestic cats would have to be inoculated to protect them, Hunt said.

Some of the flagged projects are now underway, including a massive expansion of AWC's Newhaven sanctuary outside Alice Springs to 100,000ha, the world's largest conservation project of its kind. Many of the states are also embarking on large-scale feral-free fencing projects – there are now 17 fenced reserves on the mainland, according to Dr Legge. Feral eradication programs have begun on five large islands, including one to rid our third largest, South Australia's Kangaroo Island, of an estimated 3000 to 5000 feral cats. Inventive ways of killing them are being trialled, including traps that spray a poisonous gel onto the animal. A detector dog has been trained to flush them out of bushland so they can be shot. It will cost millions and may take 15 years.

But is this Australian ark working? "I think it is," says the University of Sydney's Professor Chris Dickman, author of *A Fragile Balance: The Extraordinary Story of Australian Marsupials*. "It's just a great way of providing insurance populations for some of these smaller to medium-sized mammals that would otherwise go to the wall in the broader landscapes." Reintroducing animals into the wild has been "plagued with huge problems" – in many cases the animals have all been killed – but in fenced areas the survival rate rises above 80 per cent, he says. "We can't yet control foxes, and particularly cats, very effectively over large areas, so I think until we can, [fenced sanctuaries] remain one of the very important tools in the tool kit." Most importantly, he says, "it buys us time".

Dickman admits there are problems with this model: "You've got a constrained population so you need to manage the genetic base... Also, if you're isolating these populations from predators they'll become even more predator-naive the longer they're behind the fences." And releasing captive-bred animals into the sanctuaries is not always a complete success. AWC released a group of captive-bred numbats at Scotia in a drought year and a third of them died because they didn't have the ability to forage in harsh conditions. But, says Dickman, from the perspective of saving species the fences have been a great success.

At South Australia's Roxby Downs, Arid Recovery has a 12,000ha fenced area, half of it cat and fox free. In a 6000ha zone it reintroduced the western quoll, a native predator, to keep native species, particularly the bettongs, in balance and instil a fear of predators. In another 3000ha fenced area it introduced four cats in an attempt to breed species that are cat-resilient.

Dr John Read, Arid Recovery's co-founder, says fenced areas should not be seen as the endgame. "I think that relying on huge fenced areas is problematic," he says. "The bigger the area, the harder it is to maintain." Are we prepared to fund them for the next 100 years? The fences are expensive to build – up to $50,000 per kilometre – and each year Arid Recovery, a not-for-profit organisation, spends between $20,000 and $40,000 on materials. "We need to look at other solutions as well – there's more than one way to skin a cat," says Read.

"We've got to be careful about being risk-averse. The most risk-averse approach is to build totally cat and fox free areas – we know they are going to thrive in the short term; it is far riskier

to introduce predators in there," he says. "These reserves are super important as insurance populations and important for research but they shouldn't be seen as the end point – the ultimate aim has got to be getting these animals out, living in the broader landscape."

But this goal of reintegration remains extremely difficult to achieve. Arid Recovery released hundreds of bettongs and bilbies into an unfenced area where it had conducted an intensive program of trapping, shooting and baiting cats and foxes. The result? "Well," says Read, "none of them survived."

And there can be unintended consequences. In 1985, on the World Heritage-listed Macquarie Island – halfway between New Zealand and Antarctica – scientists began a program to eradicate the feral cats that were decimating its native fauna. But when the cats were removed, the rabbit population exploded. The wildlife on the island is now recovering after $24 million was spent eradicating the rabbits.

Despite these hurdles, most states are planning or building feral-free areas. Dr Legge of the Threatened Species Recovery Hub says there are large holes in this great conservation ark that need plugging and 29 threatened species remain unprotected – mainly in northern Australia, where there are feral-free islands but, as yet, no large fenced areas on the mainland.

Clinging on: burrowing bettong

Predator naive: numbat at Scotia

As we bump along a dirt track on the way to Scotia, AWC's Atticus Fleming tells me the large fenced areas are the only thing saving many species from total annihilation. "These large feral-free areas provide a better ecological return on investment than all of the alternatives, daylight second." We spend tens of millions trying to control cats and foxes in the landscape but nothing is as cost-effective as fencing, he says.

AWC, which is funded through donations and philanthropy, now owns or manages 4.65 million hectares for conservation purposes, with a budget of more than $20 million and a staff of 120, including more than 50 scientists. It is the largest private manager of land for conservation in the world and it will soon own or manage six of the large fenced sanctuaries on the mainland.

"Ideally we need to come up with something that is close to a silver bullet and you know that's where the gene drive technology comes in," Fleming says. "It is the only thing on horizon."

In an ancient landscape that's become a dystopian world for the small native mammals that evolved in it, that silver bullet may be a dystopian hi-tech solution: a genetically modified feral cat. There is great excitement in conservation circles that this new biological control could be the saviour of our native mammals. Gene drive is an engineering technology in which the genetic code of a species is "edited" or modified to produce a particular outcome. In the case of feral cat control, cats would be engineered with a gene that produced only male offspring. Many of these cats would be released into the wild over a wide area and, in theory, within a few generations this male-only gene would spread throughout the entire population and feral cats would breed themselves out of existence. AWC and the CSIRO have just signed an agreement to investigate how this could be done.

Dr Owain Edwards, head of Environmental & Synthetic Genomics at the CSIRO, who will oversee the research, says it is a humane solution for feral cats, as they would simply die of natural causes, unable to reproduce. It would not affect domestic cats unless they bred with ferals. "I think it is an exciting thing for us as a long-term strategy," Edwards says. But it is many years from being proven viable and there are the thorny issues of regulatory approval and community acceptance.

The technology has potentially broad applications: in his push to eradicate malaria, for instance, Bill Gates is spending hundreds of millions of dollars on research into gene drive in mosquitoes. "I'm very energised about the potential of gene drive," Gates said recently. "It's the kind of breakthrough we need to support as it may prove critical." It has been proven to work on mosquitoes in the laboratory, but not yet released into the environment.

In New Zealand, similar methods are proposed to combat rats and stoats, which have decimated the country's unique ground-dwelling birds, and the brushtail possum, introduced from Australia, which causes great destruction to its forests. The New Zealand government has announced a goal of being "feral free by 2050" and scientists and environmentalists have been enthusiastic proponents of adding gene drive to their arsenal.

But others are urging caution. Among them is Dr Kevin Esvelt, head of the Sculpting Evolution Group at the Massachusetts Institute of Technology in the US. "New Zealand could greatly benefit from releasing gene drive within its borders," he wrote in a paper. "However, without the permission of every other country harbouring the target species it would be highly irresponsible." In other words, how would Australia respond if New Zealand developed a genetically modified possum that, if bred with our native species, had the potential to obliterate all of our brushtail possums?

It seems unlikely but such biosecurity breaches are not unknown. New Zealand and Australia are separated by 2000km of water but that didn't stop the calicivirus hopping the ditch. In 1997, a group of disgruntled New Zealand farmers, frustrated by their government's tardy response to a severe rabbit plague, illegally imported the virus from Australia. In a coordinated and clandestine effort involving many farmers, the livers of infected rabbits were harvested and blended in kitchen food processors to, as one farmer put it, the consistency "of a fine Central Otago pinot noir" and then injected into wild rabbits they had captured. Many dozens of the infected rabbits were then released across a wide area; the virus bolted before authorities even knew it was in the yards.

In an email, Esvelt says: "In my opinion, developing feline population control measures expressly for conservation is a profound mistake... I am far more interested in ensuring that every kitten is born destined for a welcoming home than in the potential conservation benefits...

people elsewhere in the world feel very strongly about cats in ways that may not be fully apparent to many Australians... nor are they familiar with the dire invasive species situation of Australia."

Esvelt is right: many Australians are very aware of the immense damage caused by feral cats and would love to eradicate them, but they will be up against a worldwide cat and animal rights lobby that believes every kitty should be "destined for a welcome home" and, presumably, every rabbit a warm burrow and every cane toad a tepid swamp. The science, it seems, may be the easy part.

Out here at Scotia, it's a long walk to the nearest bowl of warm milk. This was once a 65,000ha sheep station but not a very good one. In summer the temperature climbs to 49°C and in winter it drops to −8°C. Due to its isolation, poor rainfall and sandy soils, it was one of the last areas in NSW leased for grazing; its short grazing history meant it had a high conservation value.

The property was purchased by eccentric environmentalist Dr John Wamsley in the mid-'90s and cleared of stock. AWC purchased it in 2002 and has erected feral-proof fences around 8000ha and eradicated all foxes and cats inside the fence. This is one of the oldest and largest cat and fox-free sanctuaries in Australia and the results are stark. Just walking along the fence you can see the difference. The trees and shrubs are the same, but outside the sand and soil is flat. Inside, it is pockmarked and ploughed by the diggings of thousands of small mammals.

AWC has reintroduced five species that were locally extinct: bilbies, numbats, bridled nailtail wallabies, brush-tailed and burrowing bettongs. They've all thrived. There are only 1000 numbats left in Australia – 600 of them are here at Scotia, along with 75 per cent of the world's population of bridled nailtail wallabies and 10 per cent of its greater bilbies. If we are to repopulate the continent this will be the breeding stock.

Ecologist Felicity L'Hotellier takes me through the different outcomes for natives that live inside the fence, compared to those in the big bad world beyond. She's conducted trapping surveys of the native Bolam's mouse and small marsupials the common dunnart and southern ningaui, finding 156 inside the fence and just 44 in a comparable survey area outside. A survey she conducted in 2014 of the nests of malleefowl, a unique ground-dwelling bird that incubates its eggs in large earthen mounds, found that only three per cent of nests outside were active, compared with more than 30 per cent inside. In 2016 and 2017 she could find no signs of life in the malleefowl nests outside the fence.

On the hunt: Andrew Carter

AWC is also studying the behaviour of cats and foxes in the wild – something science knows surprisingly little about. "We have scientific consensus that feral cats are the greatest threat to our mammals and yet there's been so little investment in feral cat management and feral cat ecology," says Fleming. "It is staggering to think we spend billions each year on conservation and we know bugger-all about the greatest threat."

The man who has taken on the task of knowing the enemy in this ecological war is Dr Andrew Carter, a softly spoken scientist who carries a big stick in the form of a hand-held radio receiver. One day at Scotia, I head outside the wire with Carter on the hunt for feral cats. If the CSIRO scientists develop a gene drive for feral cats, the field research he is doing will be vital in determining how it would be deployed.

On the back of his truck he has a contraption that looks like an old television antenna. He pokes his hand through the window to rotate the antenna using a handle attached to bicycle cogs and a chain. When he was doing his PhD, tracking ferals along the Murray River, some people thought he was searching for UFOs. One woman was worried he was patrolling for illegal pay TV setups. But he was hunting foxes, not Foxtel.

We drive off into the mallee scrub in search of cats. A couple of years ago, Carter and his colleagues spent months trapping feral cats and foxes in the 57,000ha of Scotia outside the fence and fitting them with GPS collars. They've been tracking the behaviour of both using field cameras and sand plots and matching that against the information they receive from the GPS. But getting that information is not easy. Carter has to pick up the signal from the antenna on his truck and then walk through the scrub carrying the hand-held antenna to get within 50m of the cat or fox in order to download the information from its GPS.

We drive along sand dunes until he picks up a signal. "It's Ben." His cats have names? "I only do it for easy reference in the field," he says sheepishly. We stop the vehicle and he loads up his equipment and then we come face to face with the killer. Ben, a large black cat with collar, wanders across the track about 30m away, looking at us warily before disappearing into the scrub. Carter says in all his years working at Scotia he's only ever seen three or four cats, apart from those he's trapped, which is an incredibly time-consuming and difficult task. It highlights how difficult it would be to shoot one. We find Ben's footprints and follow them into the scrub with Carter listening to a radio signal through headphones. We occasionally spot the cat's tracks, but after half an hour there's no sign of Ben and we head back to the base.

Carter's work is vital: for the first time cats and foxes in the same area are being monitored to discover what happens when you remove foxes: do cat numbers go up, and is that worse for native species? He is also researching the effects of cat and fox control – can the numbers be reduced to a level where natives can be reintroduced, or is there no hope for some species when exposed to cats and foxes?

Carter has been working with a US company to develop a hi-tech collar for cats. "It will send the data straight up to a satellite and every few days we'll get an email with all the data." The collars, each costing $4000, will be deployed in the field this year. It will revolutionise the understanding of cat and fox behaviour in the wild. "We spend millions and millions of dollars controlling cats and foxes but we don't really know how effective our current methods are for reducing their impact," he says.

That night, as we sit on a balcony at Scotia, sipping a cool beer, Carter tells me he grew up near the Grampians in Victoria. He's always loved the bush and its native wildlife and he feels that in trying to protect these unique animals he's doing something important. And he's "cautiously optimistic" about gene drive. "There are so many species just hanging on by the skin of their teeth," he says. "These fences are buying us time but if we don't sort something out in the broader landscape to stop cats and foxes, it's not going to be a happy ending for many of our native mammals." ●

PHOTOGRAPHY: AUSTRALIAN WILDLIFE CONSERVANCY; AMOS AROMAN; STEFANIE ZINGSHEIM; WAYNE LAWLER/ AWC; MAP COURTESY THREATENED SPECIES RECOVERY HUB