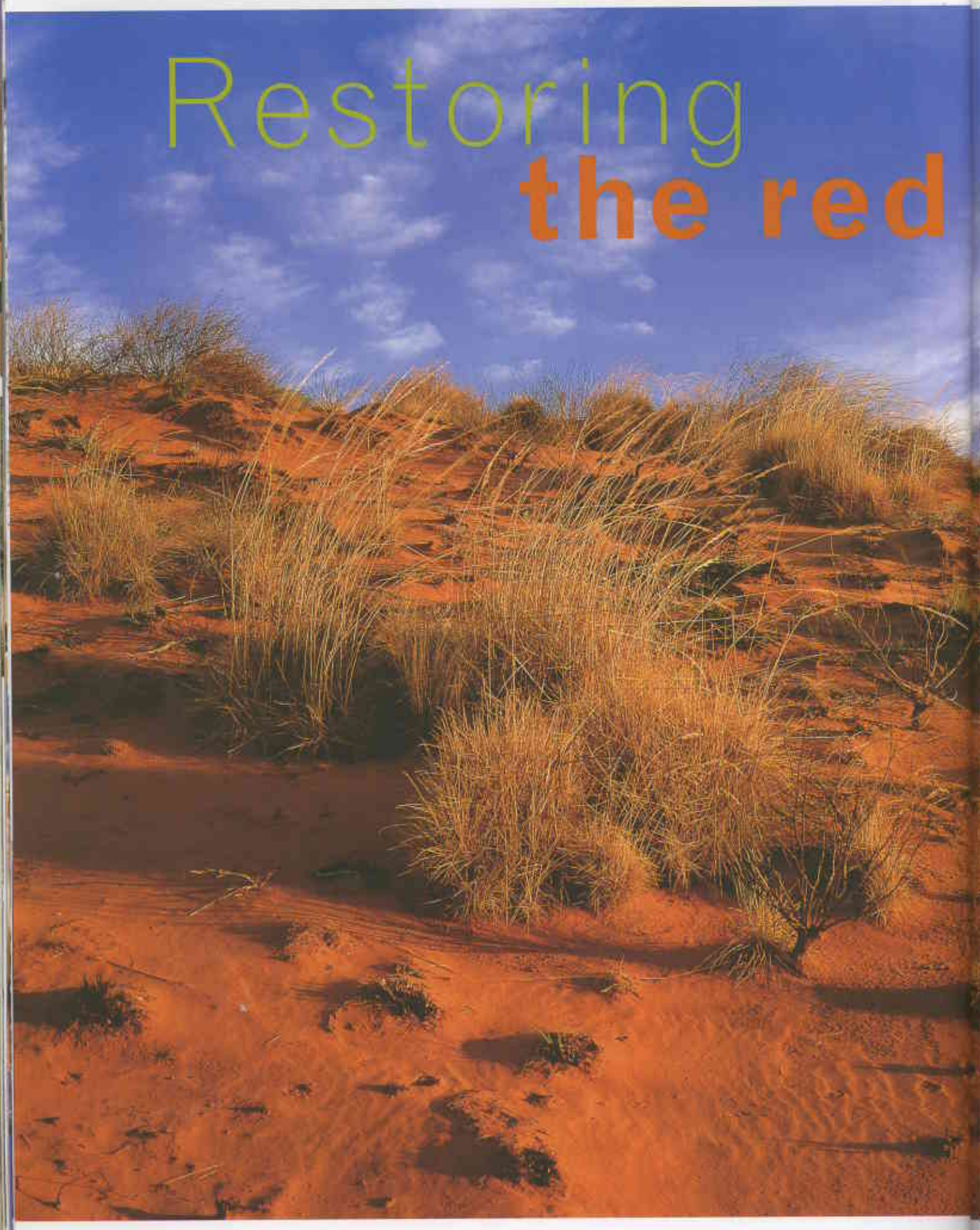
Restoring **the red**



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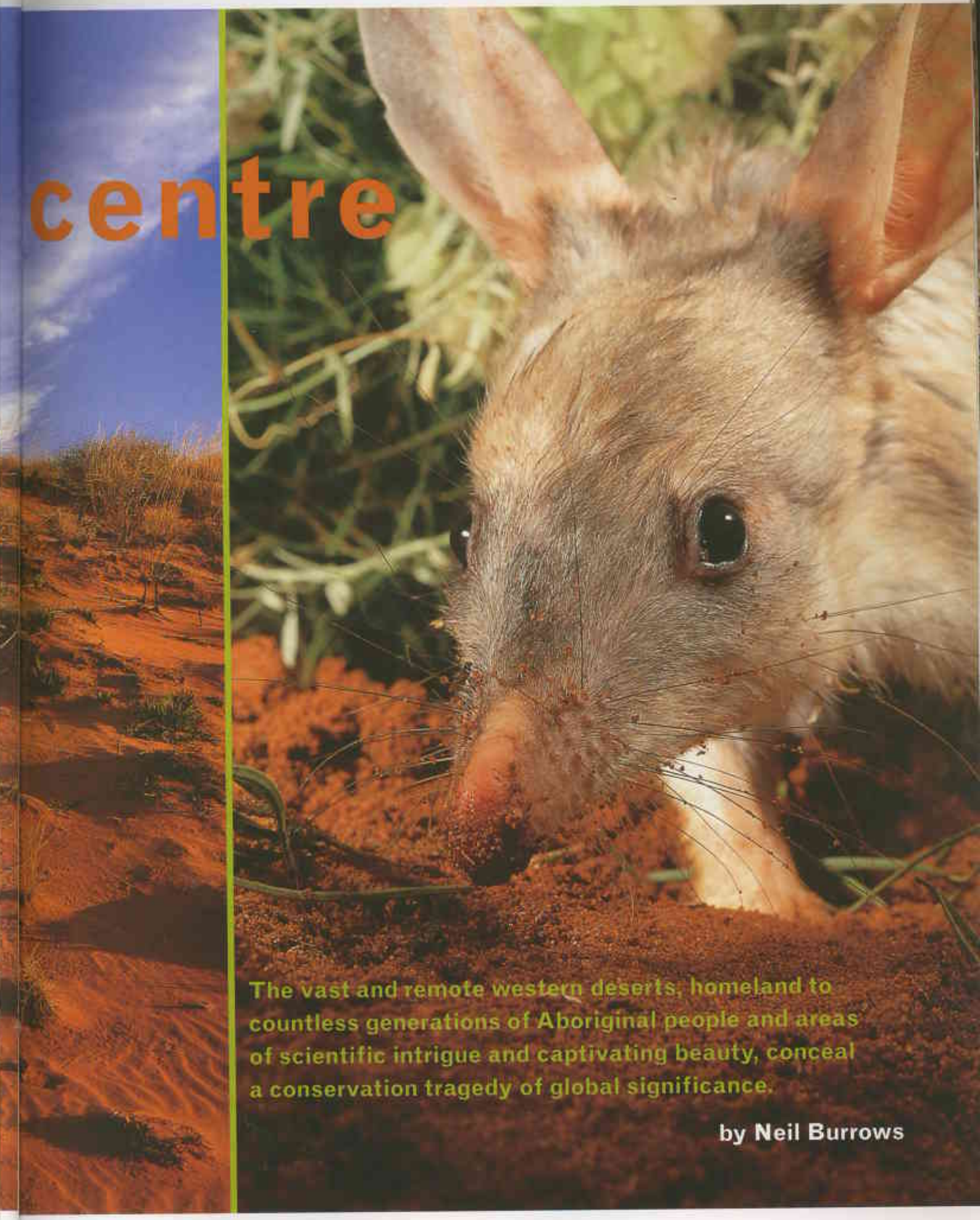
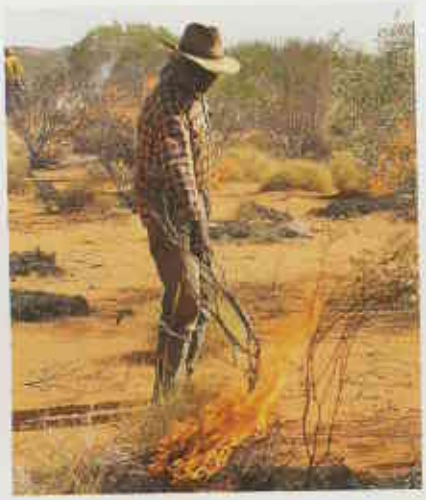


The vast and remote western deserts, homeland to countless generations of Aboriginal people and areas of scientific intrigue and captivating beauty, conceal a conservation tragedy of global significance.

by Neil Burrows

Australia's 'red centre', the desert, has suffered a recent loss of mammal fauna, unparalleled anywhere in the world. By the 1950s, almost a third of the native mammals once widespread there were extinct, with many others endangered or much less common (vulnerable or locally extinct) than they once were. Far from the densely populated urban centres along the coast, more than a dozen mammal species quietly slipped into extinction, never to grace the Earth again. While this conservation catastrophe was hardly noticed by most Australians, desert-dwelling Aboriginal people witnessed the unfolding tragedy with great sadness.

In all, there are 24 species that are presumed extinct, or that have seriously declined or disappeared from the arid zone. The list is alarming (see the box on page 44).



Finding reasons

Wildlife losses are usually associated with activities such as land clearing for agriculture and urbanisation, grazing or excessive hunting. However, much of the arid interior has been little affected by these activities. Why then have the mammals declined and, in many cases, become extinct in a seemingly pristine environment?

Aboriginal elders will tell you that the animals have "finished" because the land is not being looked after as it was in the old days. In the absence of Aboriginal stewardship and in response to benign management, wildfires consume the desert vegetation, and foxes and feral cats consume the desert fauna.

First came the cats, more than 100 years ago, then the foxes, about 70 years ago, and, more recently, the large and intense wildfires. This 'terrible trio' of cats, foxes and wildfires, that was introduced with the coming of European settlement, has destroyed the status quo over a mere few decades (see 'The disappearing mammals', *LANDSCOPE*, Spring 1990). Islands off the coast of Western Australia—free of foxes, cats and devastating wildfires—are the last refuges for many mammals that were once common and widespread on the mainland. But it is too late for many others; they have "finished up".

To reverse this trend of extinction and decline, fire needs to be reigned in and managed, and feral predators controlled. More than a decade ago, in 1987, a team of Department of Conservation and Land Management (CALM) researchers embarked on a novel but risky project in the Gibson Desert. The Desert Dreaming project —sponsored by WA Petroleum (now Chevron Texaco)—attempted to reintroduce two locally extinct mammals to the mainland deserts (see 'Desert Dreaming', *LANDSCOPE*, Autumn 1990). The plan was to reconstruct the habitat mosaic using fire, to control introduced foxes and cats, and to reintroduce golden bandicoots (*Isoodon auratus*) and boodies (*Bettongia lesueur*) from Barrow Island off the north-west coast.

Fire—friend and foe

The desert vegetation is dominated by spinifex (*Triodia*), a hummock-forming, spiky grass able to survive long periods of drought, searing summer heat and bushfires. With its clusters of fine, well-aerated needle-like leaves, often laden with

Previous page
Main left Red sand exposed by a recent fire in the Little Sandy Desert.
Photo – David Bettini
Right The dalgyte (or bilby), one of a few medium-sized mammals hanging on in the western deserts.

Top left An old warren system once used by boodies (or burrowing bettongs), which are now extinct on the mainland.

Above left An Aboriginal man uses a fire stick to burn the bush.
Photos – Jiri Lochman

Left Foxes invaded the western deserts around the 1930s.
Photo – Neil Burrows

Above Wildfire sweeps across a spinifex plain obliterating the patch-burn mosaic that existed for thousands of years.
Photo – Neil Burrows

turpentine-like resin, spinifex is the perfect bushfire fuel. When spinifex is the colour of straw, which is most of the time, it is dry, highly flammable and generates tremendous heat when it burns. Under hot, windy conditions, fire can travel through spinifex faster than you can walk. It is almost as though it has evolved to burn, as though its contribution to the rhythm of life in the desert is to feed termites and carry fire. Fire is on the one hand destructive, but on the other hand essential for regenerating the hummock grasslands and their inhabitants. Fire and rain work in tandem to rejuvenate and replenish parched and ageing spinifex sandplains and dunefields. Variation in climate, landforms and soils drives the broad vegetation structure and species assemblages. Fire is the agent that can create the finer-scale diversity of habitat within these broad patterns.

Recognising the vital role of fire in desert ecosystems, researchers investigated the flammability of spinifex grasslands and attempted to understand if and how fire regimes had changed since European settlement. To do this, they utilised both western science and indigenous knowledge. In the absence of a sound ecological understanding of the role of fire, perhaps the wisest course of action was to attempt to mimic the way Aboriginal people used fire, or at least use this knowledge to set fire management targets such as the scale and frequency of fires. After all, traditional fire management had been applied for thousands of years and could legitimately be declared sustainable.

For thousands of years, Aboriginal people used fire for many reasons, but most importantly to "clean up and care for country", to hunt and to obtain food. Fortunately, older people in the Western Desert Aboriginal communities knew how fire was used in the old times, though their numbers were dwindling. Much knowledge was gathered by talking with and listening to them.

The researchers studied black and white aerial photographs taken over remote parts of the Great Sandy Desert in the early 1950s as part of the Blue Streak Rocket Project, a joint British-Australian military rocket development program. At that time, Pintupi people were using fire and living traditionally, as they had done for thousands of years. The results of their patch-burning stood out clearly on the aerial photographs, showing how the landscape looked under Pintupi stewardship. Their skilful and frequent use of fire resulted in a fine-grained mosaic of interlocking patches of vegetation at different post-fire ages across the landscape. Most of the burnt patches were less than 30 hectares, with the occasional large burnt patch up to 6,000 hectares. It was abundantly clear that, in this part of the desert at least, the fire regime had changed dramatically after Aboriginal burning ceased.

Today, in stark contrast, the vast spinifex plains and dunefields are burnt by very large and very intense wildfires, usually started by lightning. Multiple lightning-caused fires sometimes burn for several weeks and link up, resulting in burnt areas the size of Tasmania. Since 1997, satellite imagery shows that about 70 million hectares, or 70 per cent, of the hummock grasslands in the red centre of Western Australia have burned over the last five years or so.

As well as providing resources for Aboriginal people, the mosaic patches of vegetation provided habitat diversity and biological diversity. To understand the role of fire better, scientists began to study how desert ecosystems responded to fire. There is still much to learn, but there is growing evidence that, while small-scale patch-burning benefits biodiversity, large-scale hot summer wildfires damage fire-sensitive vegetation, such as mulga (*Acacia aneura*) and callitris, and reduce habitat diversity and thus biodiversity. The cycle of fire, the regeneration of vegetation and the return of fire is driven by rainfall. In the absence of regular burning, such as that carried out by Aboriginal people, periods of above average rainfall are usually followed by extensive, damaging bushfires.

Species that are presumed extinct, or that have seriously declined or disappeared from the arid zone.

kanytjilpa (or pig-footed bandicoot)	presumed extinct
golden bandicoot (or wintarru)	endangered, locally extinct
desert bandicoot	presumed extinct
dalgyte (or bilby)	vulnerable, severe range contraction
lesser bilby	presumed extinct
common brushtail possum	locally extinct
boodie (or burrowing bettong)	endangered, locally extinct
woylie	locally extinct
desert rat-kangaroo	presumed extinct
spectacled hare-wallaby	declined
mala (or rufous hare-wallaby)	endangered, locally extinct
crescent nailtail wallaby	presumed extinct
warru (or black-footed rock-wallaby)	vulnerable, declined
lesser stick-nest rat	presumed extinct
greater stick-nest rat	endangered, locally extinct
short-tailed hopping-mouse	presumed extinct
long-tailed hopping-mouse	presumed extinct
big-eared hopping-mouse	presumed extinct
Shark Bay mouse	endangered, locally extinct
central rock-rat	endangered, locally extinct
pale field-rat	declined
chuditch	endangered, locally extinct
red-tailed phascogale	endangered, locally extinct
numbat	endangered, locally extinct

Photos – Babs & Bert Wells/CALM

The feral peril

Cats were present in the red centre by the late 1800s, and may have arrived even earlier. The European red fox invaded the western deserts from the east and the south. By the 1930s, they were found in most parts of the continent south of the tropics. Over decades, these highly-tuned, exotic predators munched their way through the native desert animals, driving many species to extinction and pushing others to the brink.

Surveys by the researchers to estimate the density of feral predators initially paid particular attention to the fox, which had had a devastating impact on native mammals in the south-west of Western Australia. By 1992, the scientists were ready to take the first step to reverse the tide of decline and extinction in the arid zone. After detailed planning, a suitable site in the Gibson Desert Nature Reserve was prepared for the reintroduction of boodies—small quokka-like animals that lived in burrows, mostly beneath calcrete caps in ancient river systems—and golden bandicoots, which sheltered under spinifex clumps.

Though feral cats and foxes were in very low numbers, following a prolonged dry period, the area was baited using the standard bait that had so successfully controlled foxes in the south-west. The researchers did not expect such a low density of cats to be a significant problem and they believed the baiting would control or eradicate the cats from the study area. However, while the baiting virtually eradicated foxes, it had no impact on feral cats, which increased in density soon after the mammal reintroduction and following record-breaking rains. Despite the researchers' efforts, feral cats eventually killed the introduced animals. However, the researchers were able to ascertain that the habitat was suitable for the reintroduced animals, which had gained weight and were breeding before they were predated. They also demonstrated that it was possible to safely transport animals long distances from an offshore island to the interior. Most importantly, this study alerted biologists to the threat posed by feral cats to mammal reintroduction

Above CALM researchers preparing feral cat baits.

Above right Cat baits being loaded into an aircraft during a cat control trial in the Gibson Desert.

Right Controlling feral cats is critical to restoring and protecting wildlife in the red centre.
Photos – Neil Burrows

programs and increased suspicion about the role of feral cats in the demise of arid zone fauna.

Controlling cats

From 1992 onwards, investigations in the Gibson Desert focused on developing techniques to control feral cats. Using 'cafeteria' trials with penned cats and wild feral cats, CALM scientist David Algar and his colleagues eventually developed a bait that appealed to feral cats. The most successful bait was a small chipolata sausage, made of fresh-minced kangaroo meat mixed with various flavour enhancers and injected with a small dose of the naturally occurring toxin 1080. CALM staff at Harvey (in the State's south-west) developed a highly efficient, cost-effective process for manufacturing the baits, using a sausage-making machine and some innovative thinking.

This allowed trials to begin in various parts of the semi-arid and arid zones. Initially, the trials met with mixed success. Sometimes baiting was very effective at reducing feral cat abundance; other times it was not. Scientists discovered that, in addition to having an attractive bait, significant bait uptake by feral cats depended on two other factors. Firstly, baits had to be presented at times when feral cats were hungry (when abundance of live prey was at its lowest). Secondly, feral cats are not very good at finding the baits, so the greater the number of baits spread across the landscape, the greater the chance of feral cats finding a bait before they have killed and eaten a native prey animal.

It was also important to determine whether or not native animals were consuming cat baits, so trials using a harmless dye in the baits instead of a toxin were carried out. The dye is deposited in the whiskers of any animal consuming the baits or, in the case of reptiles, the anus is stained. This technique was also used to determine the rate of bait uptake by feral cats. About two weeks after baiting using this technique, both native animals and feral cats were trapped and examined for signs of the dye. During a trial in 2001, about 87 per cent of trapped cats had red bands in their whiskers, a telltale sign they had taken a bait. In trials conducted so far, no reptiles or small native mammals have consumed baits. Further trials are under way to test a wider range of native animals.

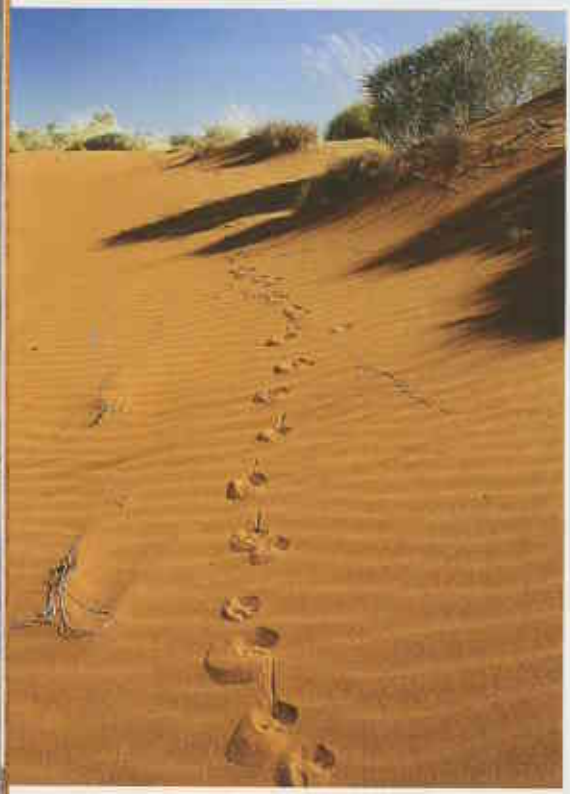
Large-scale trial

Finally, almost a decade of research culminated in a large-scale operational feral cat baiting trial over some 750 square kilometres of the Gibson Desert Nature Reserve in July 2002. Monitoring had shown that reptiles, mammals, birds and insects were least active in July—the coldest time of year in the red centre—hence, feral cats were likely to be hungry. The other secret to a successful feral cat baiting campaign was to deliver about 50 baits

Left The greater stick-nest rat is extinct from the arid zone.
Photo – Jiri Lochman

Below left A predator on the prowl—fox footprints in the sand.
Photo – Steve Sadler

Below A desert daisy (*Leucochrysum stipitatum*).
Photo – Tom Chvojka



per square kilometre, to increase the chances of feral cats finding baits.

Before baiting began, fox and feral cat abundance was estimated in the area to be baited, and in a nearby unbaited reference area. It is not possible to measure the actual number of feral cats in such a large, inaccessible area, so surrogates are used, such as the number of footprints observed or the number of animals trapped along a transect over a number of nights. This information allows a cat density index to be calculated before and after baiting, to assess its effectiveness. Prior to baiting, both areas were thought to contain about 36 feral cats for every 100 kilometres of road traversed, or about one feral cat every 2.7 kilometres. The toxic baits were dropped from an aircraft with sophisticated navigation and bait delivery equipment. About nine days later, the abundance of feral cats was again assessed.

To the delight of the scientists, the trial had resulted in an estimated 96 per cent reduction in the abundance of feral cats in the baited area. Follow-up assessments at regular intervals have shown that the feral cats had not increased in the baited area some seven months after baiting. Assessments will continue, to determine how long it takes for the feral cat population to recover from the baiting—information important for determining the required time interval between baiting to control feral cats.

Where to from here?

While these results have been encouraging, scientists are cautious. More baiting trials are planned over the coming years to further validate and refine the technique, to improve its cost-effectiveness and to minimise risks to native animals. Several questions need to be answered. How long will cats take to reinvade after baiting? How large does the bait buffer have to be and how often do we have to bait to protect a core area? How many baits per square kilometre are needed for effective control of feral cats? What is the risk to native animals?

While the desert trials have been extremely promising, attempts to control feral cats in other environments, such as the Shark Bay World Heritage Area on the mid-west coast, have met with mixed success. Where live prey —especially rabbits—is abundant, it appears to be more difficult to control feral cats by baiting, with baiting having to be timed when rabbits (and other prey) are at low densities.

For the red centre, at least, there are encouraging signs that we are on the brink of controlling a feral predator that has ruled the deserts for more than 100 years. With techniques to control both the fox and feral cat, and with sound fire management, there is a real possibility of reversing mammal decline in the arid zone. Far from the busy cities, the desert Aboriginal people will be able to witness, and rejoice in, the return of the animals.

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