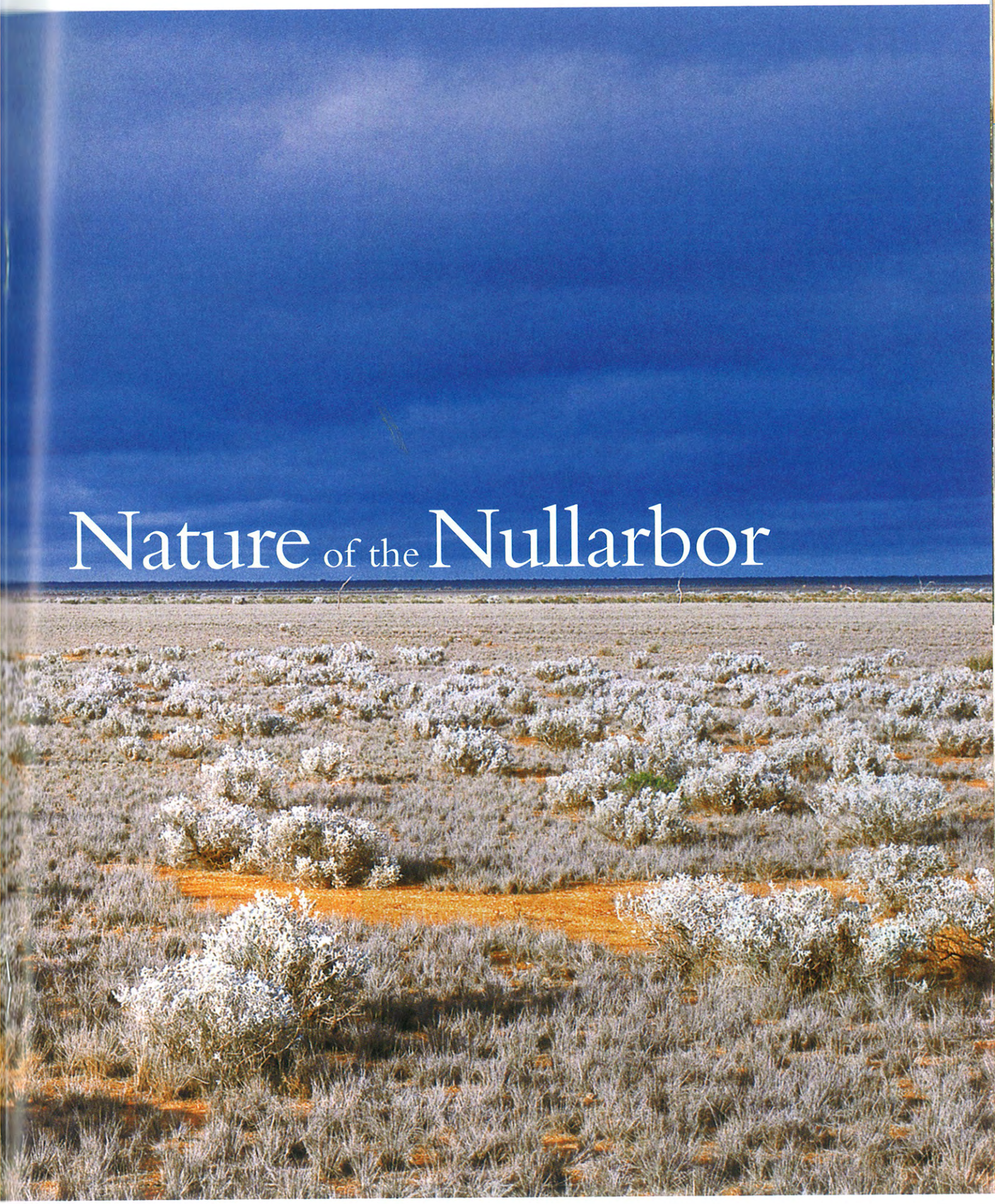
In 1984 a biological survey of the Nullarbor region in South and Western Australia identified 794 vascular plant species, 44 mammals (15 now extinct), 249 birds and 86 reptile species. Twenty-five years later, two people involved in this study returned and rediscovered that it is largely the hidden treasures that you don't normally notice, the small things like mosses and large underground caves, that make this place so special. **by Leanne O'Rourkes**



Nature of the Nullarbor

Far beyond the proverbial black stump, past the salmon gums, coastal cliffs and the few deserted homesteads of Western Australia's south coast, lies a largely treeless land that is distinctly Australian—the Nullarbor. A visit to the famous sweeping plain that straddles the Western–South Australian border is perhaps one of the best ways of experiencing the openness, serenity and big sky for which this country is famous.

But visitors are easily fooled by the flat and seemingly monotonous landscape when travelling by vehicle along the straight stretch of road that traverses it. Time spent looking deeper reveals that beneath, between and above the deceiving lack of visual features, is a highly active and unique ecosystem.

Discovering the desert

The Nullarbor region covers almost 200,000 square kilometres of arid country between Norseman and Ceduna. Two-thirds in Western Australia and one-third in South Australia, it is flanked by the Great Victoria Desert in the north, the Eastern Goldfields in the west and undulating plainland in the east. To the south, the Hampton Scarp drops away to the Roe Plain and Southern Ocean and the stunning cliffs of the Great Australian Bight near the State border. Under the Interim Biogeographic Regionalisation for Australia, the Nullarbor is broken up into two bioregions. The Nullarbor Bioregion is characterised by the well-developed soil profiles of the Carlisle Plain in the north, but centred on the vast limestone plain of the true Nullarbor. Low woodlands dominate the Hampton scarp and Roe Plain of the Hampton Bioregion.

Early attempts by European settlers to cross the Nullarbor, home to the Spinifex Wangai Aboriginal people for thousands of years, were hampered by dehydration, mutiny and general hardship. Overcoming these challenges, Edward John Eyre was the first to successfully conquer the crossing in 1841, paving the way for much-needed communication between the colonies. In 1877, a 2,500-kilometre telegraph line extending across the plain from South Australia was completed linking WA to the rest of the world. For the past 92 years, the Trans-Australian Railway line has helped combat WA's physical isolation, transporting passengers and supplies from Kalgoorlie to Port Augusta across the Nullarbor. Since the Second World War the current route of the Eyre Highway has done the same in the south. Despite these transport links, so much of the plain is still very remote and most people just drive through without fully appreciating its fascinating ecology.

A groundbreaking survey

Beautiful in its own right, the Nullarbor Plain is little understood. Two people who hold some of the greatest biogeographical knowledge of the area are Department of Environment and Conservation (DEC) research scientist Norm McKenzie and botanist Greg Keighery. They were part of the team from WA and South Australia that originally recorded the biodiversity of the entire Nullarbor region some 25 years ago.

On a summer's day in 1984, Norm and Greg jumped in a truck with a small group of scientists and headed into the great unknown. Their mission: to set up a survey that would enable

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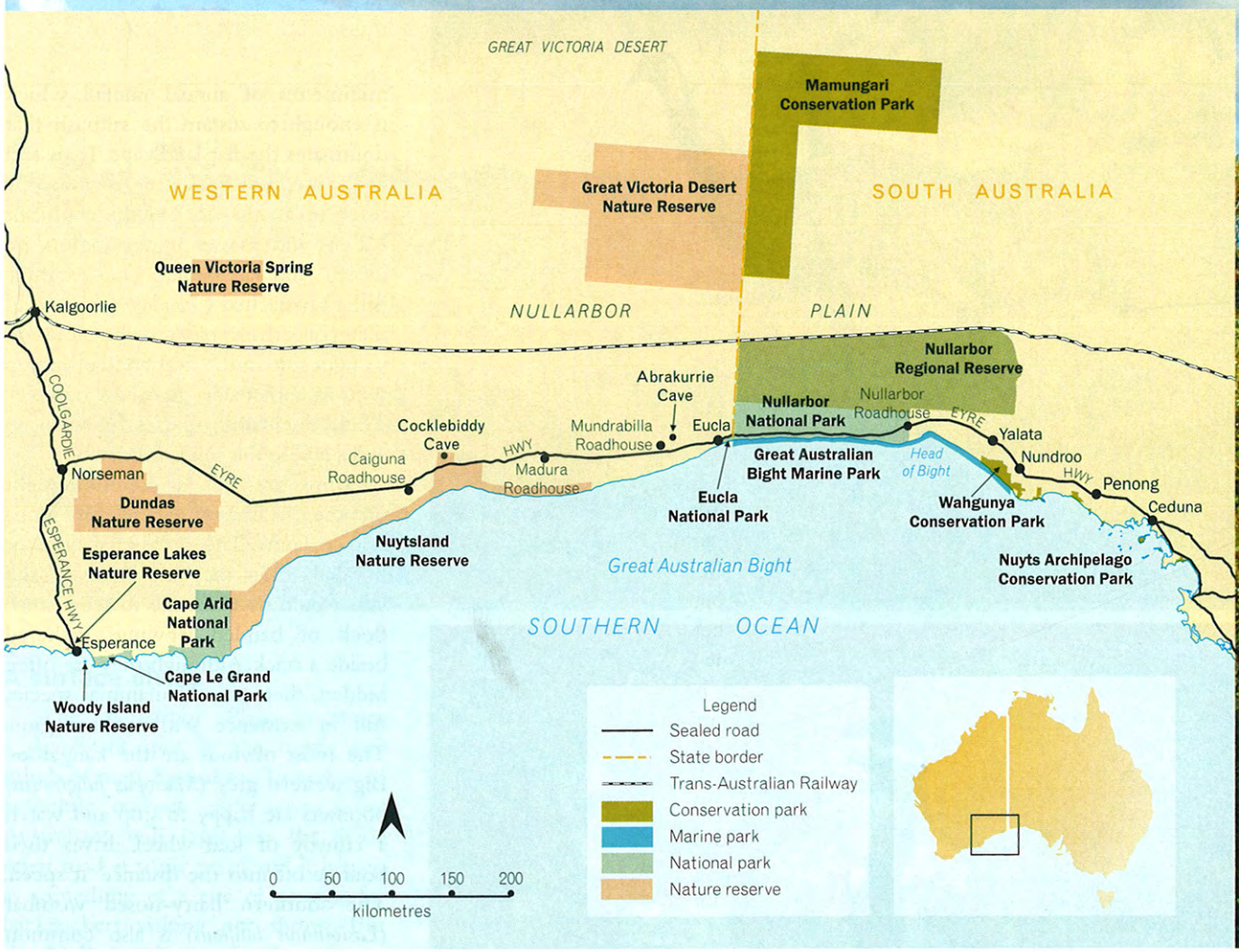
Main Baxter Cliffs near Caiguna, Nullarbor. *Photo – David Bettini*
Inset Abrakurrie Cave.

Above Sand dunes, Eucla National Park.

Left The Kutowalla Doline is one of many collapsed cave entrances on the Nullarbor Plain.
Photos – Leanne O'Rourkes



them to document the diversity of the Nullarbor Plain and Hampton region. They carefully selected a number of sites to establish full geographical coverage of the area and hammered in stakes to form their survey quadrats. It was the beginning of the first major biological ground survey of the Nullarbor, a survey that would consolidate earlier findings to become the only comprehensive source of information for years to come.

Their collections revealed undiscovered species including the small carnivorous marsupial *Sminthopsis dolichura* and some, like the Toolinna bunny orchid (*Eriochilus dilatatus* subsp. *orientalis*) and the Eucla daisy (*Senecio eulaensis*), are still being described today from the samples taken during their autumn and spring trips in 1984. At the time, the scientists redefined some of the biogeographical boundaries of the Nullarbor so they better reflected reality. Their newfound knowledge about local biodiversity informed the design of a Nullarbor reserve network that would lead to appropriate management of the area on a landscape scale. And the research was to benefit more than just the region: broad-scale biological surveying would never be the same.

They realised that, even in a large survey such as this one, by studying species composition in small areas they could predict composition between study sites—the spaces where they did not sample. To test the theory, the scientists formulated comprehensive lists of what should be in the gaps and when they went out and actually collected the data, they found that their modelling was up to 90 per cent accurate. This pioneering prediction modelling continues to inform large survey design today.

Not only was the survey itself highly innovative, the extent of the collaboration between WA's Department of Fisheries and Wildlife, as it was at the time, and South Australia's Department of Environment and Planning was, and still is, unmatched. And it makes sense; biodiversity patterns do not recognise State boundaries after all.

Life on the land

Taking the Old Coach Road at the base of the Hampton Scarp from Burnabbie to Madura is an exhilarating experience. The 1984 survey was the first time its features were scientifically recorded in detail. The vegetation is primarily made up of low woodlands consisting of western myall (*Acacia papyrocarpa*) over bluebush (*Maireana sedifolia*) creating cascading layers of green and blue hues. This is one of the only places in the world where you will find woodlands in such dry, sandy conditions. Hundreds of different eucalypts including spectacular salmon gums (*Eucalyptus salmonophloia*) fan up to the sky with flashes of orange exposed by peeling bark contrasting with the tufts of bluebush in the understorey.

Over the top of this striking escarpment is the Nullarbor Plain. This is the sunburnt country famed in the Dorothy Mackellar poem. But the sun is not always out and it is not uncommon to experience four seasons in one day. The Nullarbor averages 200

millimetres of annual rainfall which is enough to sustain the saltbush that dominates the flat landscape. Trees and collections of sticks very occasionally reach up to the sky but the abundant lichens and mosses in the region are diverse and fascinating. One example is the unattached *Chondropsis semiviridis* that collectively drifts, rolling out on its light side in the heat and curling up with its darker side exposed when wet. These fascinating species fix nitrogen and stabilise the soil's surface.

Birds are not a common sight on the Nullarbor except for semi-arid avifauna. The occasional emu or hooded robin may be observed and you would be fortunate to see a small flock of banded lapwings gathered beside a track. Although they are often hidden, there are 29 mammal species still in existence within the region. The most obvious are the kangaroos. Big western grey (*Macropus fuliginosus*) boomers are happy to stop and watch a convoy of four-wheel drives then bounce off into the distance at speed. The southern hairy-nosed wombat (*Lasiorhinus latifrons*) is also common around the Western Australian border but you would be lucky to catch a glimpse of a live animal. For much of the year these nocturnal creatures seem to huddle in the warmth of their warrens during cold desert nights. This is the biggest stronghold of the species and it is slowly migrating further west.

As in many parts of Australia, native mammals have severely declined in the Nullarbor region. Since the beginning of the 20th century, about 15 mammals have become extinct there. With efforts over the past 100 or so years to manage threats like altered fire regimes, introduced predators and weeds, it is now a slower process but still of major concern.

Top left Emus.

Centre left Banded lapwing.

Left Southern hairy-nosed wombat.
Photos – Jiri Lochman

Top Wombat warren, north of Eucla.

Above Entering Cocklebiddy Cave.
Photos – Leanne O'Rourkes

A surface divide

The Nullarbor Plain occupies a significant spot in the hearts and minds of most Australians. Touted as an authentic outback experience, many Australians will cross via the wide open road at some point and it is seen as something of a rite of passage for backpackers visiting our shores. But the Nullarbor has, and still performs, a much more important function than just that of a massive gateway between east and west. It is not just a barrier for people, but also for pests.

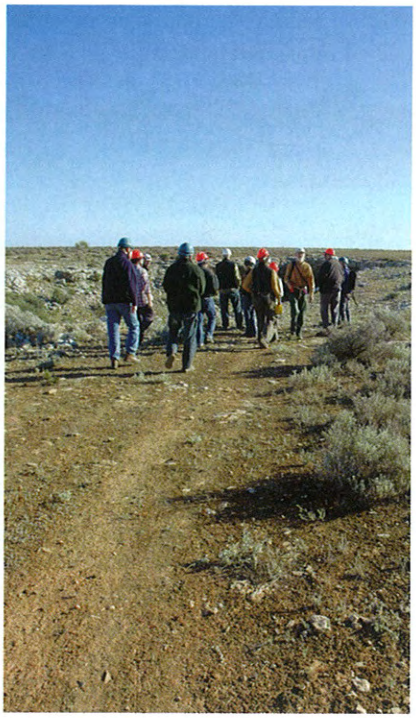
The Nullarbor is one of the reasons WA is so different from eastern Australia. In recent geological time, it has been a major obstacle for plants and animals trying to make their way here and it is widely credited as one of the factors responsible for the rich biodiversity of the State's south-west. It has managed to keep species like European starlings and weeds out for a very long time and continues to act as a protecting force for native flora and fauna.

Unfortunately, the plain has not successfully prevented the spread of all pest plants and animals. Surprisingly, rabbits thrive in the arid zone and are a major threat for plants because they selectively graze seedlings like nitrogen-rich wattles that feed the soil, robbing the plants of essential nutrients (see 'Rabbits on the rampage for 150 years' on page 29). They select palatable species and compete with native species for food and consequently have contributed to the loss of a number of mammals in the area. The first rabbits in WA were spotted in the late 19th century prompting construction of the costly and ineffective rabbit-proof fence. Sadly, the pests have now been there long enough to prevent even the long-lived shrubs and trees from regenerating.

Plant regeneration improved markedly when the calicivirus was released in the region to test its effectiveness. It was quite a successful trial that used the same plots as the 1984 survey knocking out nearly all of the rabbits in some areas. However, on the flipside, the wedge-tailed eagles that can be seen soaring above the escarpment looking for prey used to feed on the rabbits and their numbers took a tumble when calicivirus went through. Once upon a time they would have fed on small mammals like numbats (*Myrmecobius fasciatus*) when they were abundant. Now they have to look harder or eat road kill and risk being hit by vehicles and being killed themselves.

Karsts and cave dwellers

Extensive as it was, the 1984 survey only just scratched the surface. But it is what lies beneath the surface that



Left Abrakurrie Cave.

Above Road to Cocklebiddy Cave.

Below left Along Eyre Highway near Caiguna.
Photos – Leanne O'Rourkes

in many ways makes this place so interesting. The Nullarbor Plain is one of the world's biggest pieces of limestone, housing the largest continuous karst system on the planet and some of Australia's biggest underground caves.

Shaped by dissolved limestone or other carbonate rocks, karst landscapes account for as much as 15 per cent of the Australian continent, with only four per cent visable at the Earth's surface. Their features include steep-sided dolines or sinkholes, towers and pinnacles, cave entrances and subterranean caves. Standing at the edge of a massive doline in the Nullarbor, some up to 35 metres deep and more than 200 metres across, is dwarfing. But the caves themselves are even bigger, ranging up to 120 metres deep and a staggering 28 kilometres long, like Old Homestead Cave. The largest chamber is found in Abrakurrie Cave and is 300 metres long, 30 metres wide and 15 metres high. Some have extensive water-filled passages that are popular with cave divers, including a six-kilometre stretch in Cocklebiddy Cave.

Clambering over rocks into the dark, echoing humidity of a Nullarbor cave is like descending into a mysterious new world. They may appear empty at first glance but in reality they are teeming with life and activity. Many small critters, adapted over millions of years to life without light, find refuge here. Spiders, crustaceans, centipedes and many more troglobites and troglophiles share this subterranean world with larger creatures like masked owls and chocolate bats (*Chalinolobus morio*). Specific bat maternity caves like Murra El-elevyn come alive at night like overcrowded hospitals.

The karst system was beyond the scope of the 1984 biological survey of the Nullarbor which was designed only as a ground survey. The scientists were, of course, aware of the karsts and results of previous studies like a 1978 resource management survey, but it

Above Baxter Cliffs, near Caiguna.
Photo – David Bettini

Right Eucla Telegraph Station ruins.
Photo – Leanne O'Rourkes

would not be until many years later that interest in cave-dwelling troglofauna and stygofauna and the role they play in various ecosystems would pique the interest of scientists carrying out major biological studies. These days, cave organisms and the Nullarbor caves themselves are extremely attractive to scientists, adventurers and tourists. With this popularity comes a whole swag of management challenges, complicated by the caves' remoteness, that need to be considered to ensure that current and future generations can enjoy them in a safe and sustainable way.

Down memory lane

In June 2009, Norm and Greg, together with some of DEC's leading nature conservation specialists, scientists and regional ecologists, journeyed to the Nullarbor once more on a week-long trip, which also visited the Hampton region.

Times have changed significantly since the mid 1980s when only half a dozen DEC (then Department of Conservation and Land Management) staff serviced the Esperance district which covered the entire south-eastern coastal section of the State including the Nullarbor. Now, there are about 20 staff in the district with a remarkable passion for their patch, enabling better and more effective management of the area's environmental values.

But that is not the only thing that is different about the region. Although biologically the Nullarbor changes quite slowly, there is evidence of tree and shrub loss and it is likely that the plain is growing and becoming more treeless. Some of the defining features around the edges are under threat, such as trees that are up to 200 years old and only reproduce very occasionally and the endemic species along the clifftops that are found nowhere else in the world.

But there is hope. According to Greg, there are still very few weeds in the Nullarbor and it does not suffer from the major disease issues that exist elsewhere. With good quarantine, sustained efforts to control weeds and rabbits, existing rehabilitation technology and sound management practices, it is possible to retain the simple yet intriguing Nullarbor community and slow down the landscape changes that threaten to alter the nature of this astonishing landscape.

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This article is based on interviews with DEC principal research scientists Norm McKenzie and Greg Keighery.

Since 1984, DEC has carried out a number of systematic biological surveys to build an inventory of WA's rich species diversity, recognised nationally and internationally. For information visit www.dec.wa.gov.au/science-and-research/biological-surveys/index.html.

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