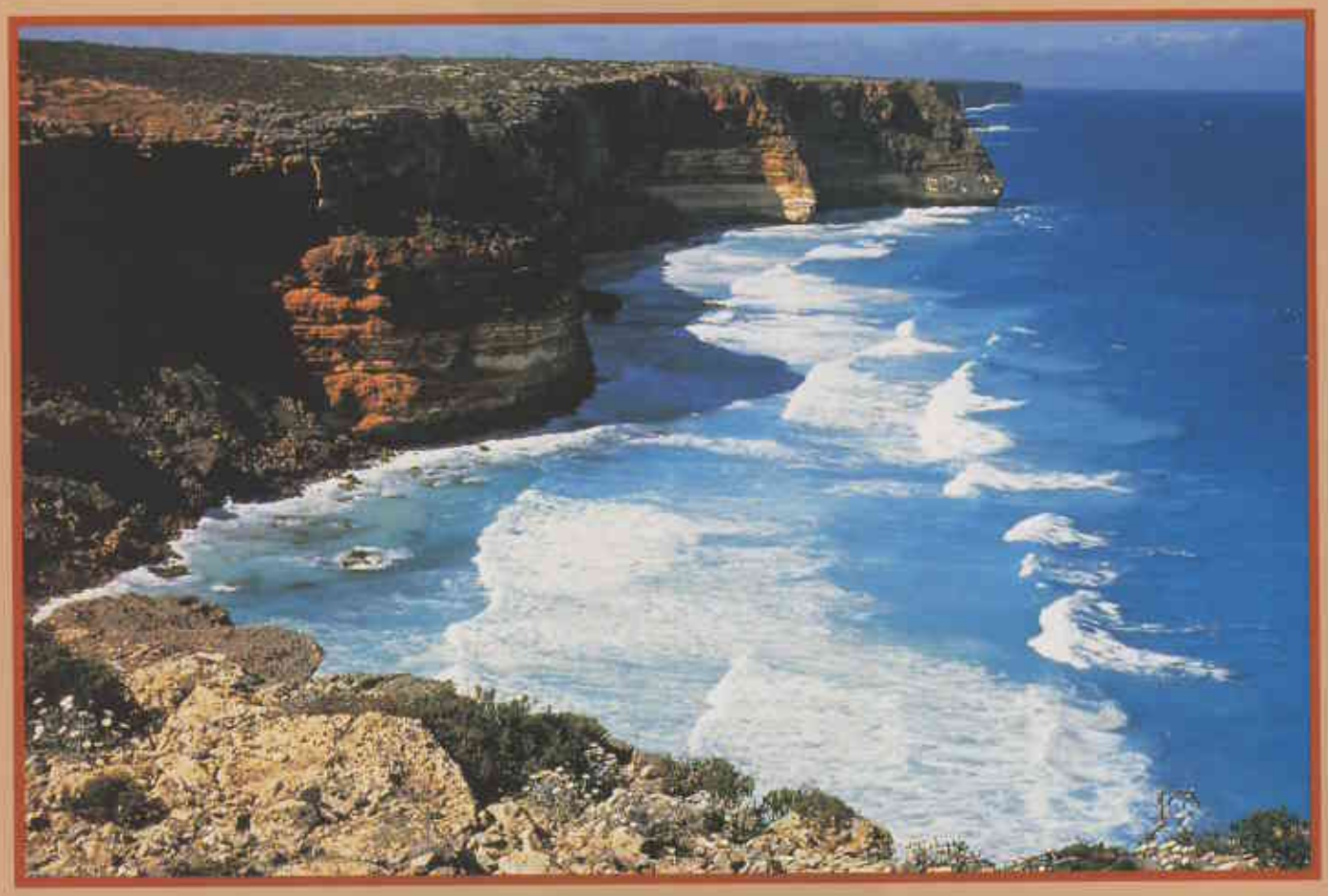


Scouting the Treeless Plain

By N.L. McKenzie

The Nullarbor region of Australia is a typical example of the Western Australian dilemma: large, remote, with a long history of pastoral use, and invaded by exotic weeds, herbivores and predators. Yet its biology is poorly known. What is happening to the native flora and fauna? Which areas should be set aside as examples of Nullarbor ecosystems? What is needed to retain their richness and intricacy?

ALL over Western Australia, changes are happening to the land. Huge pastoral areas are degraded to a fraction of their former productivity. Weeds are invading tracts of the few remnants of vegetation left in the Wheatbelt, while salinity is poisoning others. Exotic predators are everywhere, and many native species are endangered or vulnerable. Our ignorance of patterns and changes in plant and animal communities is almost as big as the State.

We urgently need to take an inventory of the Western Australian biota, and to document its distribution before the patterns are further disrupted. We need to identify the optimum positions for reserves, and find out what is happening, and where, so that we can make the best use of our limited conservation funds.

Nowhere is this more true than on the Nullarbor Plain. It is as big as the United Kingdom, yet the gradients of its geology, soils and climate are so gentle that monotony will confound any impatient traveller. The night sky and the silence are endless.

The gentle undulations that barely texture its surface conceal one of the largest limestone karst structures on Earth. The limestone strata are honeycombed with underground drainage systems, often widening into caverns. These contain rare halite speleothems, new mineral species, large lakes, important fossil deposits, Aboriginal sites, and an endemic cave-dwelling fauna. The underwater passages of caves such as Cocklebiddy and Weebubbie are among the largest known and are unequalled for recreation anywhere; Cocklebiddy Cave has been referred to as the Mount Everest of cave diving, with more than six kilometres of underwater passages explored so far.

Until 1984, thanks in no small part to the caving activities of the WA Speleological Group and other cavers, more was known about what was under the Nullarbor than what was on top.

NULLARBOR SURVEY

So what is happening to the Nullarbor's flora and fauna? Are there any places that contain such a wide variety of the Plain's plants and animals that they would make the best nature reserves? What else can we do to protect the region's highly complex ecosystems?

The Nullarbor Plain extends across two States. This section of the Plain is in South Australia, near the Nullarbor Motel.
Photo - Tony Robinson ▲

Previous page - The cliffs where the treeless plain meets the Southern Ocean; and a botanist looks at the damage done to the vegetation by the rabbits.
Photos - Peter Canty and Norm McKenzie

Native grasshopper at Muckera, camouflaged on a stick.
Photo - Peter Canty ▲

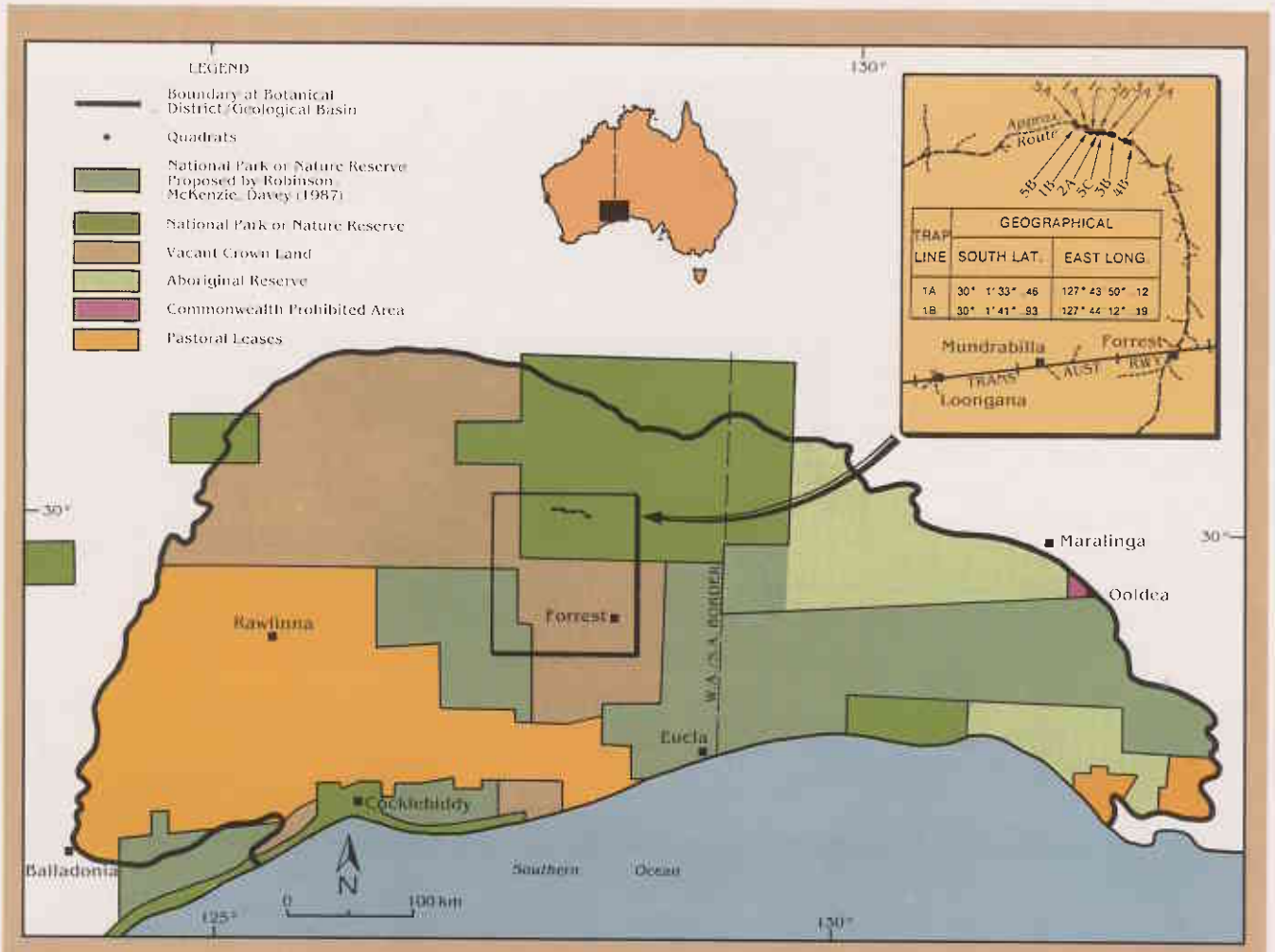
To answer these questions, an ecological survey of the Nullarbor Plain was carried out in 1984.

The area is far too large (220 000 square kilometres) for ecologists to survey everything everywhere. It includes many different communities, each with thousands of species in various combinations. Most of the species are minute. Consistent systems of classification have only been developed for the largest of these organisms - essentially, the plants and the vertebrates. Even though the survey team members could not survey the communities' every detail, they still had to develop a sampling method that could reveal their patterns of distribution across the landscape.

First, we selected a number of sites (called quadrats) positioned throughout the region, so as to sample as many of its ecosystems as possible. These quadrats had to be replicated often enough to allow for variation within each ecosystem.

Second, we sampled an array of different types of species, in order to build a better picture of the intricacy of the ecological network on each quadrat. This meant, for example, that we would be aware of (say) a large shrub and a tiny lizard, whose presence in a network contributes to its complexity.

By March 1984, sites had been chosen for 82 quadrats. This was done during a long, hot and dusty field trip in February. The subsequent autumn and spring sampling programs were divided among



Australian Survey Office

MONITORING

The quadrats were permanently marked (see map) so that they can be re-sampled (monitored) in the future. Observed changes in the species composition of the quadrats can be analysed in terms of the various land management strategies being imposed on various parts of the region. This includes land use by humans, but also areas that are left alone; these can still suffer invasions (e.g. by weeds) and disturbances (e.g. by feral cats). Databases derived from region-wide networks of quadrats allow local fluctuations to be distinguished from regional trends. Such insights provide an objective basis for setting priorities among wildlife management options, especially because the sorts of species involved in the changes are likely to point to the causes.

four teams of biologists, each staffed by a botanist and several zoologists. At each quadrat they tried to make a complete list of trees, shrubs, grasses, lizards, birds and small ground-dwelling mammals.

Many of the 349 species they found were not previously known to occur in the region: 5% of the plants, 2.5% of the birds, 13% of the reptiles and 19% of the mammals. On the other hand, many of the mammals that were prominent through the region during the 1930s, such as bandicoots, native cats and hare-wallabies, have become extinct.

CHOOSING A RESERVE

Using a computer, we found that we could classify the species into 14 groups, based on how often we recorded them at the same quadrats. We gave equal weighting to every species, whether large shrub or tiny lizard. A computer program produced regional "contour" maps to show how the species composition changes in each of the 14 groups.

In October 1986, we tested our 14-layer ecological model of the Nullarbor by sampling another 10 quadrats far from any of the original quadrats. We wanted to know if our maps, derived from only 0.15% of the Nullarbor's total area during just 3% of a single year, could really be used to predict the presence or absence of such a wide array of species. With 14 groups per quadrat over ten

Pogona nullarbor, a lizard endemic to the region and an inhabitant of the treeless plain.
Photo - Ron Johnstone ▲

Sunset and bore at Catacombs where the treeless plain meets the coast.
Photo - Peter Canty ▲

A blind spider found in Thampanna Cave on Mundrabilla Station. It lives only in the underground caves.
Photo - Norm Poulter ▶

quadrats, our finding was remarkable: in all but 13 of the 140 cases, the predictions were better than 80% correct.

Our 14 maps could then be used to decide the optimum positions for reserves. These would best represent the biodiversity of the Nullarbor. An ecologist would describe the positions as the places where the fewest, smallest reserves would be most likely to represent the region's biological complexity. The existing network of reserves in the Nullarbor was assessed using these maps; the network apparently includes the complexity of only about six of the 14 groups. The reserves proposed as a result of the Nullarbor survey encompass all but two of the remaining eight areas.

THE CAVES

The caves of the Nullarbor are renowned around the world for their size, complexity and beauty. The cave fauna is rich in endemic invertebrate species specialised to cave living. Some provide roosts for breeding colonies of chocolate bats. Others are treasure houses of sub-fossils, great deposits of bones that preserve a history of the region's fauna. The low humidities and constant temperatures of the caves preserve animal tissues. For instance, two mummified thylacines about 4 000 years old were found in Murra-el-elevyn and Thylacine Hole caves in the 1960s.

The caves were not included in the survey, as there was a considerable amount known about them already. Conservation strategies mainly involve protecting the cave entrances and controlling access by people. Cave entrances have been eroded by people and stock; in many caves, careless or thoughtless visitors have eroded sand dunes, trampled crystal deposits at lake edges and rare mineral crusts, disturbed bat maternity colonies, removed fossils and broken speleothems.

PESTS

The Nullarbor survey has also provided data on exotic species. Foxes, cats and rabbits are found almost everywhere in the region and, along with grazing by domestic stock, are the most prominent causes of degradation. The extent of the damage that can be caused by rabbits was dramatically illustrated by quadrats in the southern parts of the Nullarbor's largest nature reserve, an area that has never been used for pastoral purposes. Only a scatter of rotting stumps remained, mute evidence of the myall woodland

The abandoned telegraph station at Eucla with sand blow.
Photo - Stephen Kelly ▲

Dingo on the treeless plain amongst the blue bush. They eat rabbits, young cats, mice, lizards, insects and road kills.
Photo - Tony Robinson ▲

Master's snake *(Notechis mastersii)*, near Cocklebiddy, a snake common in the marine dunes of the southern margin of the Nullarbor.
Photo - Ron Johnstone ▲

The Nullarbor survey was conducted by CALM and the South Australian Department of Planning, with financial assistance from the Australian National Parks and Wildlife Service.

and bluebush shrubland that covered this landscape 25 years ago.

The exotic weed *Carrichtera annua* has become alarmingly common on the treeless plain. It is especially common along the edge of tracks and roads, suggesting that it is being dispersed partly by vehicles. Even more worrying, it's about the only plant that rabbits won't eat - the healthiest patches were found on top of the rabbit warrens. Its prevalence next to the mill-troughs where the stock drink suggests that even sheep and cattle avoid it.

Yet another factor appears to favour this weed. Unlike the other ephemeral plants of the region, it dries as brittle sticks that take years to decay, withholding plant nutrients that are likely to be limiting in these calcium-rich, but nutrient-poor soils. Combined, these observations could explain why quadrats infested with this invasive weed were so poor in species compared with equivalent, but uninfested, quadrats elsewhere on the plain.

THE DISTINCTIVE PLAIN

The Nullarbor's indigenous communities comprise species adapted to this low-nutrient environment with its harsh climate. Many vertebrates and plants are known to be endemic to the Plain, or have their geographic distributions centred on it. Others are endemic to the marine sand dunes that were isolated on its coast by rising sea levels some 10 000 to 12 000 years ago.

The peculiarly stunted types of vegetation of the treeless plain give the central Nullarbor its distinctive character. Despite their sparse, apparently species-poor appearance, we have as much obligation to conserve these communities as to conserve the richer, superficially more attractive ecosystems, such as rainforests, found elsewhere in Australia.

Norm McKenzie is a Principal Research Scientist at CALM's Wildlife Research Centre at Woodvale. His interests include the design of ecological surveys. He can be contacted on 09 405 5100.

In the central Kimberley, a screw-pine-surrounded creek - just one of the threatened areas in this fragile frontier. Turn to page 22.

LANDSCOPE

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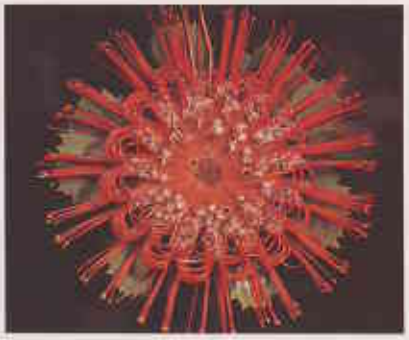

Public awareness and involvement is vital in the conservation of WA's rare and endangered flora. Page 49.

Ten WA mammal species have become extinct in the last 200 years. What can be done to ensure no more are lost forever? Page 28.

Until 1984 more was known about what was underneath the Nullarbor than what was on top. But with such a vast area to study, where do we start? See page 16.

Forests protect our environment. They also provide timber. How do we strike a balance? Turn to page 35.

FEATURES

REGULARS

SPECIALS

COVER

Dolphins and whales are perhaps the best-known inhabitants of Western Australia's coastal waters. But this unique area is also home to an astonishing range of marine flora and fauna, from sea-turtles and coral reefs in the north to sea-grass banks and great white sharks in the south. See page 10.

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