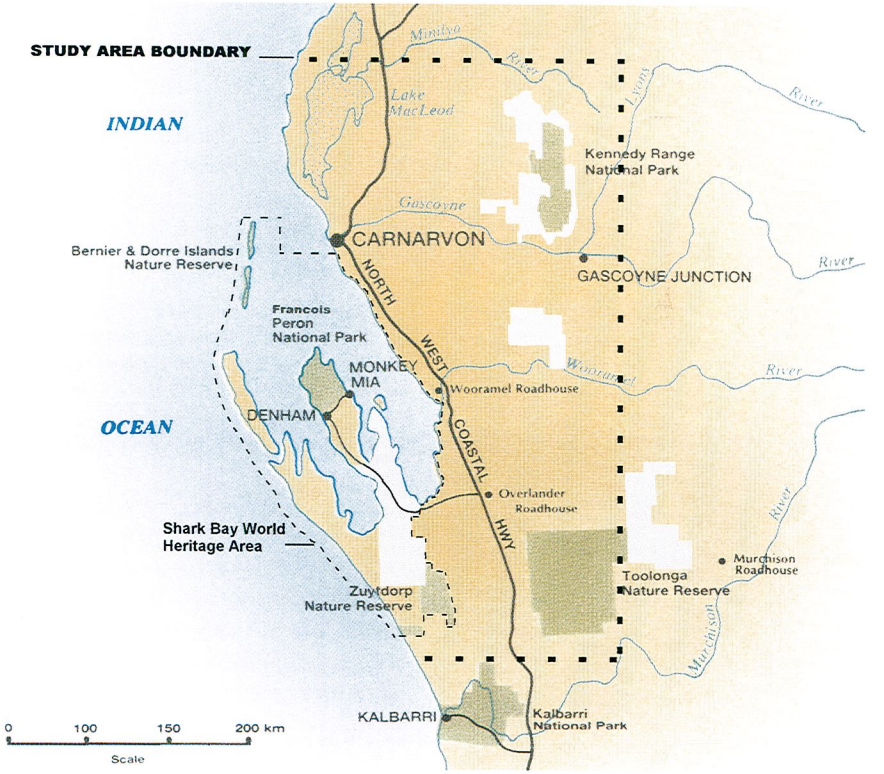
Companion to

Biodiversity

OF THE SOUTHERN CARNARVON BASIN



Map of the Southern Carnarvon Basin

Cover: Gascoyne River
Photograph – M.Lochman

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OF THE SOUTHERN CARNARVON BASIN

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Based on information in the book 'Biodiversity of the Southern Carnarvon Basin'
Edited by A.H. Burbidge, M.S. Harvey and N.L. McKenzie (2000)
Records of the Western Australian Museum Supplement No. 61.

Companion to Biodiversity of the Southern Carnarvon Basin
Published by © Department of Conservation and Land Management
December 2001
ISBN 0 7307 5521 5

What's this book about?

This booklet is a summary of the results and conservation implications of a broad-scale six-year biological survey of the southern Carnarvon Basin in north-western Australia which resulted in an environmental fingerprint being created for the 75,000 square kilometres it investigated.

To manage for nature conservation, we need to adopt an organism-centred view of environmental patterns using contemporary biological surveys to identify and quantify patterns in nature and to use them as the basis for sustainable management.

This booklet is designed to be used by educators, tourists, conservationists and land managers (including local and State government authorities and agencies, and the pastoral, horticultural and mining industries). It highlights the conservation values of the region and makes practical suggestions for their management.

Our aim is to provide information to enable local land managers to make decisions based on knowledge of conservation values. This is important because the future of the arid rangelands of the Carnarvon Basin lies in the hands of local communities.

Kennedy Range. Photograph – Andrew Burbidge

Australian rangelands

Nearly three-quarters of Australia's land mass is arid, and much of this area is used for rangeland grazing by domestic stock.

These vast and diverse landscapes are the setting for a rich heritage of culture and tradition. They have supported a pastoral industry for more than a century, and new industries such as tourism are making increasing use of these lands. They also support varied and unique assemblages of plants and animals that are a significant part of Australia's biodiversity.

However, the rangelands are under pressure. Nationally, at least a third of our rangelands have suffered degradation associated with the grazing of domestic stock. In addition, various social and economic pressures have been acting to limit efforts at recovery.

For the long term future of all Australians, the use of rangelands should be sustainable in the three key areas of environment, society and economy. Sustainable environmental management (in terms of avoiding degradation of land or water resources) is a necessary basis to enable the existence of a sustainable society and economy in the rangelands. This booklet is a companion volume to the larger work, giving scientific results of the recent biological survey of the southern Carnarvon Basin. Its purpose is to communicate and elaborate on some of the nature conservation issues so that they can be included in the wider debate about the environment, society and the economy.

Acacia Woodland Near Gascoyne Junction. Photograph – N. Gibson

The Carnarvon basin

The Carnarvon Basin extends from near Cape Range in the Exmouth area, south to the Murchison River and inland to the Kennedy Range. It contains inland rivers, red dune systems, 'sunburnt' plains, inland ranges, sweeping beaches and spectacular coastal cliffs. It is one of the major sedimentary basins of Western Australia and has a 450-million-year geological history.

Because of its geographical position, the region is influenced by the winter rainfall of the south-west and the summer rainfall of the north. It has an arid to semi-arid climate, with a mean annual rainfall as low as 200 millimetres in places. Severe droughts are a prominent element of the climate.

The region is dominated by extensive alluvial plains traversed by the Minilya, Gascoyne, Wooramel and Murchison Rivers. These rivers flow intermittently. Low, open woodlands of Acacia species, such as Snakewood *(A. xiphophylla)* and Bowgada *(A. linophylla)*, over shrubs such as Poverty Bush *(Eremophila)*, cassias *(Senna)* and saltbush *(Atriplex)*, occur on these plains. Shrubs and hummock grasses grow on the low sand ridges that are scattered across the plains.

Trodia *on Dunes and Swales, Kennedy Range. Photograph – M.Lochman*

In northern parts, the plains grade into red sand dune fields, supporting spinifex *(Triodia)* and mulga *(Acacia)* communities that are reminiscent of Australia's red centre. In the south, the plains support woodlands of mallee eucalypts and cypress pine (*Callitris*) on yellow sand dunes.

Intermittently flooded claypans are common and, close to the coast, birridas (evaporite pans) occur in interdunal depressions. Low-lying areas, such as the birridas, the fringes of Lake MacLeod and the coastal flats, support rich samphire (*Halosarcia*) communities. In the east of the study area, erosional uplands such as the Kennedy Range provide a contrast to the surrounding plains.

The southern part of the region is dominated by heaths and scrub-heaths near the coast. Extensive areas of coastal limestone, partially mantled by pale yellow to grey sands, support low heaths with emergent thickets of banksia and mallee eucalypts, such as Illyarrie (*Eucalyptus erythrocorys*). A particularly impressive feature of the area to the south of Shark Bay is the Zuytdorp cliffs, which are topped with windblown, almost prostrate shrubland. Further inland, these are replaced by mallee or banksia scrubs and heaths, with wattle-sheoak thickets still further inland. Small areas of eucalypt woodlands occur, mostly in the southern part of the region.This area is mostly covered with sand, with some limestone outcropping near the coast, and extends south to the Murchison River.

Zuytdorp Coast. Photograph – G. Keighery

Land-use in the area is predominantly for pastoral purposes, with significant areas on the margins being set aside for nature conservation.

Evidence of Aboriginal occupation at Shark Bay goes back at least 18,000 years.

Cape Range, north of our study area but still within the Carnarvon Basin, was occupied by Aboriginal people more than 30,000 years ago and the range has a continuous history of occupation since that time. Presumably the remainder of the Carnarvon Basin has a similar history, at least along the river systems.

Seven Aboriginal groups lived in the southern Carnarvon Basin, occupying more or less non-overlapping parts of the region, but little seems to be recorded of their traditional way of life or customs.

The people subsisted on native plants and animals, including crabs, gastropods, dugongs, turtles, kangaroos and emu eggs. Aboriginal Peoples in the area probably used fire as a tool of land management but the impacts of their activities on the flora and fauna of the Carnarvon Basin are unknown.

The best known group is the Yammatji People who inhabited the Gascoyne region. Historically, they played a significant role as workers on early pastoral properties and, in some cases, still do.

Long – tailed Dunnart.
Photograph – Babs & Bert Wells

European exploration and settlement

The first recorded landing by a European in Australia was at Cape Inscription, at the northern end of Dirk Hartog Island, where Captain Dirk Hartog landed in 1616. Other early Dutch sailors followed, including Antonie Caen, who made what appears to be the first recorded sighting of black swans by a European.

William Dampier explored the Shark Bay islands in 1699 and compiled the earliest botanical collections by Europeans in Australia. His illustrations of four birds he saw in the Shark Bay area (Red-necked Avocet, Pied Oystercatcher, Bridled Tern and Common Noddy) in his book *Voyage to New Holland*, are the earliest known illustrations of Australian birds. Dampier also described a Banded Hare-Wallaby, which later declined to extinction on the mainland, and referred to other animals at Shark Bay, including lizards, dugongs, fish and various marine invertebrates.

Exploration of the interior for agricultural and development reasons began in 1839, when Captain George Grey discovered the Gascoyne River and explored the coast in the vicinity of the river and the present day Carnarvon, where he reported the presence of fertile soils.

Francis Thomas Gregory explored the length of the Gascoyne River in 1858 and, on his return to Perth, reported that there were several tracts of well-watered land along the river admirably suited for pastoral purposes.

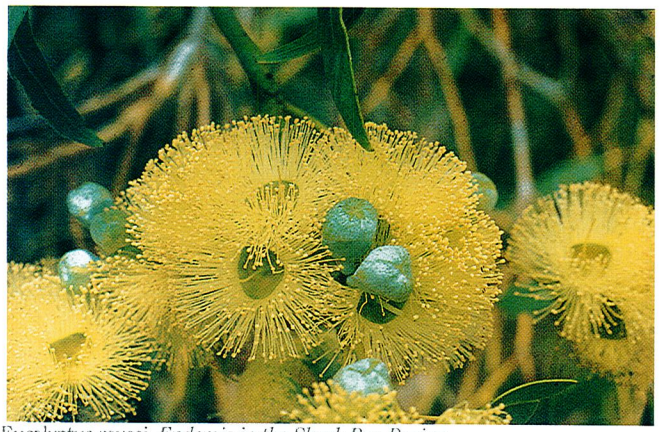
Pastoral settlement followed in the 1860s, initially near the Gascoyne, on Dirk Hartog Island and near Freycinet Harbour.

Flowering Cephalipterum, *Yaringa. Photograph – G. Keighery*

These early attempts apparently failed; the first successful attempt in the area appears to have occurred when Aubrey Brown and John Monger took up land at the mouth of the Gascoyne River, Brown having overlanded 4000 sheep from York. In 1876 Brown established the pastoral property that later became known as Brickhouse. Boolathana, north of the mouth of the Gascoyne River, was established by Charles Brockman in 1877. Lyons River, east of the Kennedy Range, was taken up before 1877 and Jimba Jimba, at the junction of the Gascoyne and Lyons Rivers, in 1878. Stations away from the coast or river frontage were established later; for example, Mardathuna was established in 1902.

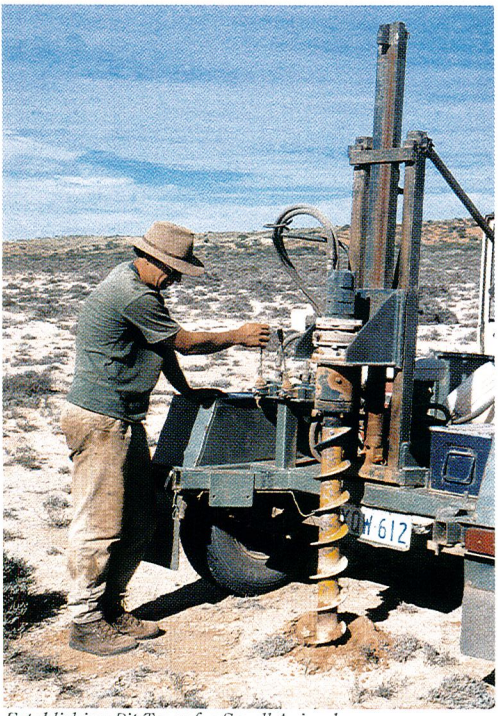
Sheep numbers in the Carnarvon Basin peaked at more than 1 million in the mid-1920s but dropped sharply to less than half this number by about 1940. In the following 40 years sheep numbers did not exceed about 730,000, but the number of goats increased dramatically.

Other exploitative activities (guano mining, pearling, sandalwood cutting) began in the late 1800s. American and French whalers probably operated in the area from about 1803, and in the 1950s and 1960s whaling stations were operating first from Point Cloates and later from Carnarvon. Fishing (for a variety of seafoods) has also been carried out over a long period. Apart from fishing, none of these industries has persisted, but salt extraction now occurs at Useless Loop, Shark Bay and Lake MacLeod.



Eucalyptus roycei, *Endemic in the Shark Bay Region. Photograph – G. Keighery.*

Plants and animals of the Carnarvon Basin



Establishing Pit Traps for Small Animals. Photograph – Allan Burbidge

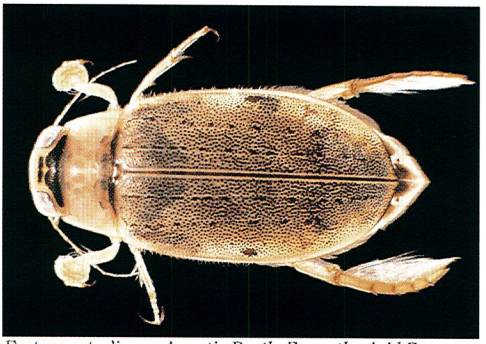
The Biological Survey

A broad-scale survey was carried out in the 1990s by the Department of Conservation and Land Management and the Western Australian Museum in collaboration with a number of scientists from other institutions. The survey was restricted to a 75,000 square kilometre area from the Murchison River north to the Minilya, and inland to Gascoyne Junction and the Kennedy Range.

We surveyed 63 terrestrial sites and 56 aquatic sites to document the biodiversity of the region. Numerous additional sites were surveyed for specific purposes, particularly for botanical sampling. We determined environmental factors related to plant and animal distribution patterns and developed models to predict the occurrence of the ecological communities identified.

Plants

We recorded 2133 different kinds of plants (species and subspecies) in the study area. Much of this richness comes from the south-western part of the study area, which includes many species more typical of southern parts of the State. Many of these species, especially plants of wetlands (swamps, claypans, lakes and rivers) are not present in the existing reserve system. Clearly, private landholders can make a valuable contribution to the conservation of these plant species.



Eretes australis, *an Aquatic Beetle From the Arid Zone. Photograph – J. McRae*

Aquatic invertebrates

We collected a range of aquatic invertebrate animals including water boatmen, whirlygig beetles, backswimmers, water fleas, fairy shrimps and shield shrimps. At least 492 species of aquatic invertebrates were collected. About a third of these were collected at only a single site on only one occasion. Many of these species were therefore not recorded in the conservation reserve system, indicating again that private land managers can have a valuable role in helping to conserve the biodiversity of the Carnarvon Basin.

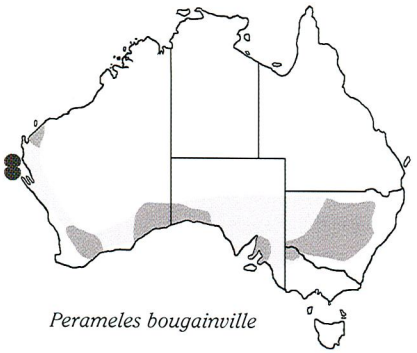
Many of the species found during the survey were undescribed and many range extensions were recorded, reflecting the lack of previous biological survey work in the region.

Five different classes of wetland habitat were distinguished, each with a different biological community: river pools, rock pools and larger flowing streams, seeps, springs and smaller creeks, freshwater claypans, birridas and Lake MacLeod.

Terrestrial invertebrates

Mygalomorph Spider. Photograph – B. Maryan

Various groups of ground-dwelling invertebrate animals were trapped. We recorded 10 scorpion species, 60 species of mygalomorph spiders (trapdoor spiders and relatives) from seven families, 33 families of araneomorph spiders (and more than 285 species), 15 species of centipedes and 11 species of millipedes. The number of species found was very high, and the majority of the spider species and three of the scorpions were new to science.



Perameles bougainville

Geographical Range of the Western Barred Bandicoot
Pale Grey = Late Holocene Sub-Fossil
Dark Grey = Historic (more than 30 years ago)
Black = Current

Vertebrate animals

Sixteen frog and 146 reptile species and subspecies are known from the southern Carnarvon Basin, including 19 reptiles we found that were new to science and yet to be described. The Carnarvon Basin is particularly rich in reptiles and includes geckos, legless lizards, dragons, skinks, goannas and snakes.

Of the 279 bird species known to occur in the southern Carnarvon Basin, 162 breed there, with the remainder being migrants, nomads or occasional visitors. No bird species is known to have become extinct here in the last century, but about 13 per cent have increased in abundance and 10 to 15 per cent have decreased. These changes are comparable to those in the upper Murchison catchment, but are less than in arid parts of New South Wales, which has a longer history of European settlement.

More than 29,000 waterbirds—25 species—were recorded on Lake MacLeod in October 1994. The lake sometimes supports more than 100,000 waterbirds, making it a site of international importance. River pools are also important for waterbirds, but many claypans were little used.

Western Barred Bandicoot.
Photograph – Babs & Bert Wells

Twenty-three of the original 48 indigenous ground-dwelling mammal species are now extinct in the Carnarvon Basin. Examples include the Golden Bandicoot, Red-tailed Wambenger and Crescent Nail-tailed Wallaby. The Western Barred Bandicoot became extinct on the mainland. This decline commenced well before the arrival of foxes. In contrast, none of the 12 species of bats is extinct. Bernier and Dorre Islands are nationally important reserves for mammals.

Introduced Plants

Introduced Buffel Grass Dominating the Herb Layer. Photograph – G. Keighery

We recorded a total of 88 weedy plant species that are naturalised in the study area. Most of these are annuals from the families Poaceae (grasses, 41), Asteraceae (daisies, 19), Brassicaceae (cabbage family, 12) and Caryophyllaceae (carnation family, 10). This is a low number compared to much of the State but does include a number of environmental weeds of some importance.

Many weeds displace native plants and reduce the food resources for our native animals. Among plant pests in the region, Buffel Grass (*Cenchrus ciliaris*) is known to be a serious environmental weed although it does have value as a pastoral species. There seems to have been little done to document its distribution or its environmental effects in the study area, or to develop management options.

Introduced Animals

Much of the study area is grazed by domestic stock (cattle and sheep) and in some areas the effects of grazing are obvious.

A number of vertebrate pests occur in the study area, with the main ones being rabbits, goats, foxes and cats. Goats have a major impact on the vegetation in some areas. Foxes and cats presumably impact negatively on the native fauna, but the decline of native animals appears to have commenced after pastoral activities began in the region and before the arrival of the introduced fox.

Goats can Have a Major Impact on Vegetation Communities Photograph – Allan Burbidge

Conservation of Carnarvon Basin Biodiversity

Why conserve?

The goal of nature conservation is to ensure that future generations have the same range of environmental resources and opportunities available to them as does the current generation.

The Carnarvon Basin contains many interesting, unusual and useful plants and animals, and many of the natural ecosystems they are part of occur nowhere else.

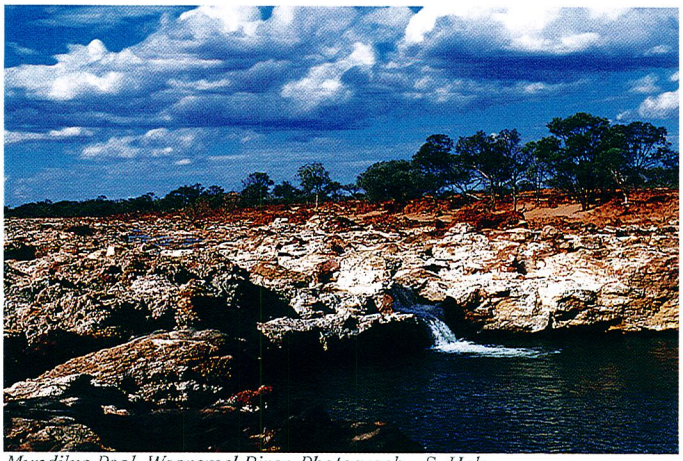
These plants and animals, and the soils and waters that support them, have been the basis for considerable economic activity, the scope of which is broadening to cater for an increased interest in tourism opportunities. This economic activity, and the life styles and opportunities provided with it, will only be sustainable if our entire community contributes to sound management of the natural resources on which it is based.

Flowering Calandrinia *on a Dry Claypan, Talisker. Photograph – N. Gibson*

What the Department of Conservation and Land Management is doing

The survey of the biodiversity of the southern Carnarvon Basin has provided a sound scientific base for conservation efforts by government as well as private individuals and companies. One of the outcomes has been the identification of gaps in the conservation reserve system.

Through the Gascoyne Murchison Strategy, the State Government is creating a series of new conservation reserves in the southern Carnarvon Basin. With financial assistance from the Natural Heritage Trust's National Reserve System Program, the State Government has bought more than 470,000 hectares of pastoral leases including wetlands, sandplains, alluvial plains, river frontages, coastal flats, salt lakes and limestone uplands. Planning of management for these areas, particularly those parts intended to be in the national park system, began immediately. Major issues include the removal of domestic stock, feral plant and animal control, and visitor management. Aboriginal people will have hands-on involvement in conserving sites and, in particular, protecting culturally significant sites.



Mundilya Pool, Wooramel River. Photograph – S. Halse

Reserves alone will not protect the plants and animals of the Carnarvon Basin—community action is also required.

Everyone Can Help

Nature conservation is a task for the entire community. The following suggestions need to be taken up by individuals, local government and industry to protect the Carnarvon Basin rangelands. Some suggestions can be taken up by anyone, while others apply to particular groups.

- Take part in the debate about sustainable land management, including biodiversity management. The best management occurs when everyone is well informed about the relevant issues.
- Promote the high value of ungrazed or lightly grazed lands for biodiversity conservation.
- If you're a land manager, keep artificial water points well spaced to minimise concentrated grazing—ensure that water points are at least five kilometres apart in sheep country and 10 kilometres apart in cattle country.
- Minimise the adverse effects of adjacent land use on natural ecosystems, for example, by using fencing to prevent grazing stock from trampling springs or other natural water sources. This will be valuable regardless of whether the water is used for stock. In the case of large water bodies, it can assist in stock management.
- Manage burning regimes to prevent wildfires damaging vegetation.
- Contact the Natural Heritage Trust, the Gordon Reid Foundation for Conservation and other organisations for grants for fencing and conservation projects.

The Thick – billed Grasswren, Once Widespread, is Now Restricted to the Shark Bay Region. Photograph – Bab & Bert Wells

- See your local Department of Conservation and Land Management office for advice about land conservation and funding options. Local governments and mining companies may donate funds for transport, personnel and equipment in areas where natural ecosystems are part of their responsibility or part of land that they want to develop.
- Avoid land management practices that reduce or remove organic layers in the upper soil or reduce vegetation because leaf-litter and humus layers contribute to soil fertility and water-holding capability. Once these layers are lost, the physical environment becomes harsher for living organisms, and species are lost. Erosion of the soil's mineral-rich A-horizon by wind and water inevitably follows. This leads to loss of fine sediments out to sea, the filling up of river pools by coarse sediments, and increased erosion on stream lines and flood plains which can lead to increased weed invasion.
- Support efforts by landholder groups and government authorities to eradicate feral animals such as foxes, cats and rabbits, and to control environmental weeds such as Buffel Grass.
- Avoid fire regimes that accelerate the spread of weeds.
- Wash down earthmoving equipment to minimise the spread of weeds. Help ensure that goat numbers are reduced to a level that does not threaten the sustainability of any vegetation community.
- Avoid disturbing ecosystems in small patches when clearing easements such as grid lines, fire breaks and access tracks. It reduces their area and richness and opens them to invasion by weeds.
- Monitor the effect your management is having on the natural environment. Management of plant and animal communities is a dynamic process. By periodically recording information, long term trends can be evaluated and management adjusted in the light of that evaluation. An easy method is by using photographs, such as that carried out by the Department of Agriculture. Communicate results so that others can benefit from the experience.

- Take part in the collection and collation of information on conservation values. This can be done by becoming a Conservation and Land Management volunteer, by joining a suitable community group (such as the Western Australian Naturalists' Club, Birds Australia or the Wildflower Society of WA) or reporting interesting plant or animal sightings to the Department of Conservation and Land Management or the Western Australian Museum.
- Tell everyone how important biodiversity conservation in the rangelands is.
- Respect sites of cultural significance. Certain sites have significance in Aboriginal law and culture; enquire about their locations and always ask local Aboriginal communities before entering the areas. It is not only good manners, but avoids creating unintentional offence.
- Raise awareness of the value of regional conservation reserves through community education: use the local media, library displays and schools. Liaise with the Department of Conservation and Land Management.
- Encourage local government authorities to plant local plant species as ornamentals in parks, gardens and along streets. These species provide natural foods for our birds and leaf litter beds for our lizards. Use local species when re-vegetating disturbed areas.
- Let us know what you think about the contents of this booklet or sustainable management of Australian rangelands.

A Small Predatory Skink, Ctenotus schomburgkii. *Photograph – B. Maryan*

Acknowledgements

We thank all those pastoralists who gave us access to their properties during the survey, and provided much useful advice and assistance, and all those associated with the survey for allowing us access to their data and photographs.

Funding was provided by the Commonwealth through the National Reserves System Co-operative Program of the Australian Nature Conservation Agency, together with State funds provided through the Department of Conservation and Land Management and the Western Australian Museum.

Satellite Image of the Lower Reaches of the Gascoyne River Showing the Outflow of Sediment Shortly after Cyclone Bobby Crossed the Canarvon Basin in February 1995. Image From: DOLA W.A. SPOT, © CNES (1995) - SPOT Imaging Services Sydney.

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