

SUMMER 93/94

\$5.75

LANDSCOPE

W.A.'s CONSERVATION, FORESTS AND WILDLIFE MAGAZINE



Philippa Nikulinsky '93

YANCHEP

The rebirth of a National Park

BIRDS IN OUR GARDENS

Making our gardens attractive to birds

WONGAN HILLS

An 'island' sanctuary in the Wheatbelt

We have a place for you at the frontier of discovery.

LANDSCOPE EXPEDITIONS for 1994

Go to sea or go bush with *LANDSCOPE*! You'll join CALM scientists on one of several study or research projects, working with birds, plants or animals.

SEABIRD BREEDING ISLANDS

17–30 June — 14 days ex Broome

Visit the major seabird breeding islands off the Kimberley coast. We visit and count birds on the Lacepede Is., Adele I., Browse I., Cartier I., and the Ashmore Reef National Nature Reserve on the outer edge of the Sahul Shelf in the Timor Sea. An exciting voyage aboard a spacious, comfortable 28-metre ocean-going schooner built for Kimberley conditions.

EAST KIMBERLEY WILDLIFE AND WILDERNESS

3–11 July — 9 days ex Kununurra

Help snare and swab freshwater crocodiles at Pannikin Bay on Lake Argyle. Journey to the mouth of Cambridge Gulf: helicopter in to walk Cape Domett's tropical beaches after dusk to see nesting flatback turtles. Other tasks include dawn birdwatching on the misty reaches of Lake Argyle, counting Gouldian Finches in the Deception Range, botanical collecting, and rainforest monitoring. We also cross into the Northern Territory to see Aboriginal rock art in the Keep River National Park.

MONITORING ENDANGERED MAMMALS

31 August to 11 September 1994 — 12 days ex Perth

What are the reasons for native mammal extinctions on the mainland? Work alongside CALM research scientists pit-trapping, handling and identifying small mammals and reptiles, surveying vegetation, studying feral animals, and seeking signs of golden bandicoots released into the Gibson Desert Nature Reserve from Barrow I. in 1992.

BIOLOGICAL SURVEY OF MOUNT ELVIRE

September 1994 — 7 days ex Kalgoorlie

Mt Elvire Station in the northwest Goldfields was bought by CALM in 1991 for sandalwood conservation and regeneration. Help us survey vertebrate fauna and vegetation. The project may extend to a water fowl survey of Lake Barlee. Bring your own vehicle and journey safari-style from Kalgoorlie.

FAUNA OF THE BATALLING FOREST

14–18 November 1994 — 5 days ex Perth

The Battalling jarrah forest contains many small and medium-sized mammals, and is also home to a high diversity of lizards and other reptiles. The mammals include the brushtail possum, quenda, brushtail wambenger, pygmy possum, echidna, woylie, chuditch, mardo and western grey kangaroo. This expedition will contribute to a major new study of the effects of disturbance in the forest and of fox baiting on mammal abundance.

These expeditions are offered by *LANDSCOPE*, a quarterly magazine devoted to wildlife, conservation and environmental issues in Western Australia. They are run in association with UWA Extension from The University of Western Australia.

These absorbing expeditions provide opportunities for self-supporting volunteers to join CALM scientists in field-based research and study projects, often in remote areas of the State. They are not only exciting and fulfilling; they give you a chance to experience environmental research at the frontiers of discovery. Expedition fees are calculated to cover the considerable costs of the expedition, including food, accommodation, transport, camping gear and fuel, and to support further research. Fees do not cover personal expenses, such as travel costs to the departure point.

Enquiries/bookings

LANDSCOPE Expeditions, UWA Extension, The University of Western Australia, NEDLANDS WA 6009. Tel: (09) 380 2433; Fax: (09) 380 1066

LANDSCOPE EXPEDITIONS

Working on the frontiers of discovery



The galah is just one of the many bird species that visit our urban and suburban gardens. 'Birds in the Garden' shows us how we can attract more.



In spring, the Wongan Hills are ablaze with wildflowers, but this 'island' sanctuary is also a home to a wide variety of animals. See page 21.

LANDSCOPE

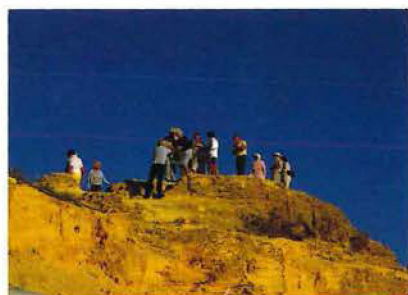
VOLUME TEN NO. 2 SUMMER ISSUE 1993-94



Yanchep National Park is having a facelift. Our story on page 28 examines the history and rebirth of one of Perth's closest and most visited national parks.



Banksia gardneri var. brevidentata is one of a number of plants named in honour of Charles Gardner. See 'Gardner's World' on page 41.



The Pinnacles is one of several destinations for licensed tours operating in WA's national parks. See 'Travel Companions'.

FEATURES

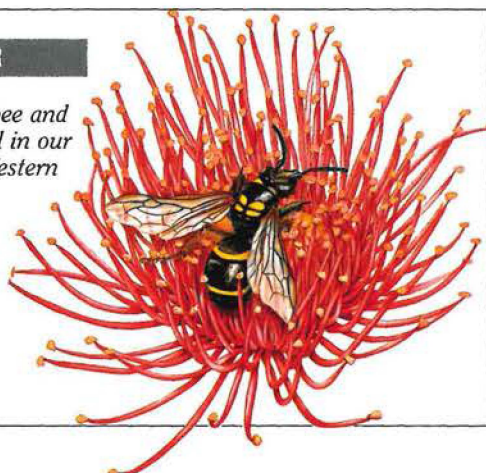
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COVER

Hyleoides zonalis is a solitary bee and one of the native bees described in our story about the 'real' bees of Western Australia on page 17. The illustration is by Philippa Nikulinsky.



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INTERPRETING NATURE

Probably the most satisfying part of a CALM employee's job is the regular, in many cases daily, contact with nature. This may take the form of a National Park Ranger patrolling firebreaks within the park, workers in jarrah forest managing an Autumn burn, scientists using radio-telemetry to record the nocturnal activity of a rare species of mammal, or Wildlife Officers stalking criminals raiding cockatoo nests.

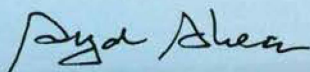
Familiarity with often traversed parts of CALM's estate leads, over time, to an appreciation of how illusory permanence is in the natural world. CALM's land managers are well aware of the perpetual flow inherent in Western Australia's plant and animal communities. This includes the more-or-less predictable sequence of flowering shown by plant species, the rapid response of plants to unseasonal climatic effects and even the subtle changes in colour of the bark on the trunks of conspicuous trees such as wandoo and karri.

CALM staff are also privy to successful changes initiated by fire. A long unburnt patch of bush is a darker green a few months after fire. Resprouts and seedlings are common. Kangaroos and wallabies move in to feed on the nutritious new growth. Ants are particularly active in foraging over the soil surface searching for seeds and other food.

I can recall, as a young forestry graduate based at Dwellingup, taking for granted most of what I saw happening in the jarrah forest. One day I realised how lucky I was to have the job I had and the fascination visitors had in the work I was being paid to do. One of my relatives was visiting for a picnic, and heard my explanation of why certain plants have nodules which extract nitrogen from the air. I had thought she would be bored by 'shop talk'. Instead, she was genuinely enthralled.

Management jargon for what I have just described is 'interpretation'. CALM takes its role in promoting community awareness and appreciation of the values of wildlife, lands, waters and resources entrusted to it very seriously. We do this in a range of ways; by issuing booklets, books, LANDSCOPE magazine and brochures. But none of these can replace the simple sharing of information when a member of the public encounters someone from CALM and asks them a question concerning the plants, animals or landscape.

However, this is a rather hit-and-miss affair. CALM has recently developed more structural arrangements, including the Interpretive Activities Program at Yanchep, the Geikie Gorge ecotourism venture with Aborigines and the Perup Forest Ecology Centre east of Manjimup. Good interpretation can add enormous value to a nature-based tourist product. Collaboration between CALM and professional tour operators to enhance value adding of tours is the basis of the story on page 46 by Gil Field and Kate Hooper. I am confident that many more partnerships will be put in place in the next few years.



The Publisher

CLEAN SWEEP
FOR LANDSCOPE

Regular readers of LANDSCOPE will be aware of the importance we place on providing you with a magazine that not only informs and interests but also enriches and delights you. One measure of our success is reflected in the letters we get after each issue. Another is in how the magazine fares in important awards programs around the country.

We were, therefore, delighted when LANDSCOPE made a clean sweep in the prestigious Alex Harris Medal Awards, presented annually for excellence in science and environmental writing. The medal honours the late Alex Harris, who worked for *The West Australian* for nearly 30 years and was well known for her ability to simplify complex scientific and environmental issues without trivialising them.

CALM's Chief Wildlife Officer Dave Mell and co-author John Wetherall of Curtin University's School of Biomedical Sciences won the medal for an article on DNA fingerprinting of rare cockatoos, entitled 'To Catch a Thief', published in the Winter 1992 issue of LANDSCOPE.

LANDSCOPE Editor David Gough was commended for 'In Search of the Perfect Pine' (Autumn 1992 issue), and CALM Wildlife Officer Trevor Walley and WA Museum head of anthropology Peter Bindon also received a commendation certificate for 'Hunters and Gatherers' (Spring 1992 issue).

The Alex Harris Medal is co-sponsored by the Australian and New Zealand Association for the Advancement of Science, the CSIRO, and *The West Australian*.

RON KAWALILAK
MANAGING EDITOR

LOOK, BUT DON'T TOUCH!

I'm very impressed with the quality of the articles and photographs that you print, and thoroughly enjoy reading the magazine.

I was concerned to see the photo (page 13 of the Winter 1993 issue) of a snorkeller touching live coral in the article regarding eco-tourism. Unfortunately, touching things underwater can cause significant destruction, particularly in a localised area surrounding a resort. Dive shops and magazines are now actively trying to encourage people to be environmentally friendly underwater by not touching things, by being aware of the importance of maintaining neutral buoyancy and avoiding kicking coral and the sea floor with their fins.

The message is getting through slowly and a magazine such as yours plays an important role in educating a wider group than just the ardent scuba divers. Particularly considering the article's content in this case, could you please try and ensure underwater shots are showing environmentally friendly behaviour in future.

Apart from this one small beef, keep up the good work!

CLAIRE ELLIS
CLOVERDALE

You are quite correct in saying that divers and snorkellers should avoid touching, kicking or resting on underwater formations.

The same applies to land formations such as granite outcrops, where people should avoid treading on or disturbing the delicate plant life there.

We will endeavour to ensure that future LANDSCOPE photographs featuring people will only show them doing things that are environmentally friendly. - ED

THE KIMBERLEY EXPOSED

Ian Oswald-Jacobs, a respected aerial photographer, is dedicated to capturing Australia on film. Equipped with his Cessna 210 aircraft, Fuji G617 Panorama and Hasselblad cameras, he simultaneously flies and photographs. His postcards and posters are a familiar sight in post offices throughout Australia.

When in flight, Ian decides where the aircraft should be, relative to the subject, to achieve the best angle for the shot. He then selects the camera and, on arrival at the destination, opens the window (which hinges upwards and is kept open by the propeller wash) and points the camera. To reduce vibration, the camera is kept inside the aircraft out of the slipstream. Simultaneously, fine adjustments to the flight path are made using the rudder and ailerons. "It takes only a few seconds to take the photograph and the aircraft provides a very stable platform at speeds of 160 to 190 km per hour," said Ian. To achieve consistently sharp results, Ian uses a shutter speed of between 1/500 and 1/2000 of a second. "The cameras I use are all hand held and



stored on a platform on the co-pilot's seat. Additional lenses are within easy reach from behind my seat," he said. "I prefer to use Fuji Reala and HG negative 200 film without filters."

Ian's recent Kimberley expedition involved 70 hours of flying, often as low as 150 feet (with Civil Aviation Authority approval), using the Omega and Global Positioning Satellite navigation systems to log the locations of his subjects.

"These new technologies allow more time to locate photo opportunities instead of tediously having to read maps at low levels when visual navigation becomes more difficult," said Ian.

Weather conditions always have a predetermining factor on aerial photography. A partly cloudy sky will throw black shadows on the ground and will often obscure key features. The weather in the Kimberley during May and June is perfect for aerial photography because of almost guaranteed blue skies. Ian prefers morning and afternoon photography, as colours are often warmer, and in a 360° orbit of the subject, the colours can change dramatically.

The Kimberley is a huge area, similar in size to the State of Victoria, and finding some of the most photogenic spots

Before taking an aerial photograph, Ian overflies the area a number of times to choose the best position and angle for the shot.

is not so easy. Local knowledge, provided by the Department of Conservation and Land Management's (CALM) Kununurra office, was invaluable in helping Ian locate some of the best places in the Bungle Bungle Range of Purnululu National Park and in Geikie Gorge, Mount Hart and many other areas. The result of this joint venture was the production of panoramic posters and postcards, which are now available from CALM offices in Broome (PO Box 65, WA 6725), Kununurra (PO Box 942, WA 6743), Geikie Gorge and Purnululu National Parks, as well as directly from Ian at 79 Chastons Road, Apsley, Victoria 3319.

The 350 mm x 540 mm posters of Geikie Gorge and the Bungle Bungle Range retail at \$5.00 (plus \$3.00 postage and handling).



A selection of postcards available from CALM offices in the Kimberley.

WATCHERS OF THE SKIES

The ingenuity of Western Australian bushies has long been a feature of the conservation of our native forests. For example, the network of fire lookouts using platforms among tree crowns throughout the karri forest (see story, right) was unique and served the State admirably until the early 1970s when spotter aircraft were introduced.

Now, WA ingenuity is again being used to take the State's conservation effort into the 21st Century. This time it is WA aviation technology.

The Henderson-based company, Eagle Aircraft, has been awarded a \$312 000 contract to supply six Eagle X-TS planes to the Department of Conservation and Land Management over the next two years to replace CALM's ageing fleet of Piper Super Cubs. The contract also combined aviation technology with a bushfire detection system that ranked among the world's best.

The first aircraft used for forest fire protection was a Cessna 150 back in 1972. This was trialled in the Pemberton district and its success led to a second plane the following year. By 1975 the spotter "squadron" had grown to nine and in 1979-80, Piper Super Cubs replaced the Cessna 150s. The Cubs and

the Cessna's together have notched up 135 000 hours of flying without serious mishap since 1972. This represents about 60 000 take-offs and landings.

The selection of the Eagle X-TS as the future aircraft for CALM was made on the basis that it is extremely easy to handle in the air, provides a very good viewing platform for fire detection, is 30 per cent faster than the Super Cub, and is a low maintenance aircraft incorporating the latest technology. This technology includes high-strength composite material; a light, powerful engine; high tech instrumentation and a satellite GPS.

The planes have a top speed of 130 knots and a take off distance of less than 500 metres. Wing span is 7.16 metres and the overall length is just 6.54 metres.

Aerial surveillance allows fire fighters to attack fires rapidly when they are small. For example, more than 95 per cent of fires attended by CALM fire fighters are contained before they spread across 20 hectares.

The planes also will enable CALM to continue aerial photography, surveys and search and rescue operations.

The Eagle X-TS aircraft sporting the CALM logo.



LOOKOUTS OF THE KARRI COUNTRY

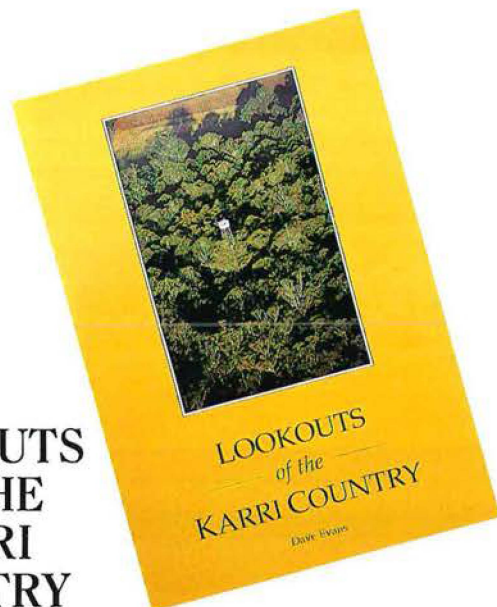
The Gloucester Tree on the outskirts of Pemberton is one of the karri forest's most famous landmarks. But it is only one of several trees that for 40 years played a vital role in protecting the karri forest from the devastation of wildfire.

The story of the karri tree lookouts is told in a new book published by the Department of Conservation and Land Management (CALM).

Lookouts of the Karri Country is written by former long-time Warren district identity Dave Evans.

The book covers the evolution of tree lookouts and is sprinkled with anecdotes that give an insight into the skill - and sheer courage - of the men who climbed 60 metres above the ground to lop the tree crowns. Men like foresters Don Stewart, John Watson and George Reynolds; expert axeman and bushman Dick Sproge and the bush carpenters, such as Laurie Jones, who built the tiny cabins among the lopped branches.

Using files from the former Forests Department and his own contacts, Dave Evans has produced a readable tale that intertwines official policy, ingenuity, skill, and bushmen's humour.



The book also covers the communications between forest gangs, district headquarters and the tower men and women. In the days before two-way radio, or mobile phones, single telephone wires strung between the trees in the forest were the links to contact fire fighting crews. These wires are in stark contrast to the two-way radio network CALM now uses throughout the South West.

The fire lookout towers today have mostly given way to aircraft and aerial spotting. But from the mid-1930s through to the 1970s, the tree-top towers, and the people who watched the forests from them for 12 to 14 hours a day, were the silent sentinels.

As Dave Evans writes: "Without doubt the lookout towers and trees of the karri country ... are unique; they involve the magnificence of our South West forests and they are to a large degree symbolic of the achievement of people involved in a toilsome and hazardous industry."

Lookouts of the Karri Country by Dave Evans. Published by the Department of Conservation and Land Management. RRP \$14.95.

NANNUP FOREST EXPERIENCE

A new nature-based tour, on which visitors may get hands-on experience in helping forest managers find out more about Western Australia's wildlife, has been launched in the South West.

Called the Nannup Forest Experience, the tour is a collaborative effort between the Nannup Tourist Centre and the Department of Conservation and Land Management (CALM) and builds on Western Australia's natural advantage in offering

visitors an insight into the State's unique environment.

CALM Executive Director Syd Shea, who launched the tour in Nannup, said it enabled people to go into the forests and to join in the day-to-day work of CALM forest managers, who study and monitor wildlife and their habitats.

The tour comprises an evening in the forest spotlighting native animals, followed by a morning inspecting traps and weighing

and measuring animals. CALM staff also give talks on other aspects of the forest environment such as dieback, feral animals and fire.

The jarrah forest around Nannup has a diverse array of wildlife that includes dunnarts (small mouse-sized marsupials), phascogales (also known as wambengers), bandicoots, chuditch and brushtail possums. CALM monitors animals such as these to gauge the impact of forest use on wildlife.

The Nannup Forest Experience also blends the skills of the private sector's tour operators with the scientific knowledge of CALM. In this way CALM helps the private sector in creating new tourism ventures. Wildlife Walkabout Safaris, a private operator from Busselton, has been engaged by Nannup Tourist Centre to take people on the tour.

The Nannup Forest Experience is a pilot program that could become the model for co-operative, ecologically sustainable tourism in other parts of the South West.

Wildlife is only one aspect of the forest that can be developed for tourism ventures. Others include general forest management, timber harvesting, culture and heritage. The development of ventures such as these will help conserve the forests as they stimulate a greater conservation ethic among tourist operators and tourists.



Left: CALM officers Karl Beck (left) and Jim Green measuring a quenda (*Isodon obesulus*).
Photo - Shann Low



Below left: Adult female chuditch (*Dasyurus geoffroii*).
Photo - Peter Marsack/Lochman Transparencies

Below: Brushtail possum (*Trichosurus vulpecula*).
Photo - Geoff Taylor/Lochman Transparencies



STEPPING OUT

Staff from the Department of Conservation and Land Management (CALM) and several volunteers covered almost 300 kilometres in two weeks to research CALM's latest publication *Family Walks in Perth Outdoors*.

The 52 walks (one for every week of the year) in the book range in length from a few hundred metres to about 18 kilometres and have varying degrees of difficulty. Most have picnic facilities nearby and can be completed within half an hour to half a day.

Each walk listed in the book has a map, details of length, average time to complete the walk, facilities provided at the start or finish, information boards and direction signs, and how to get there. Stage-by-stage descriptions give information about the natural environments through which the walks pass, details of plants and animals you can expect to see and, occasionally, historic facts about the areas.

The book is divided into four regions: 'The Hills' is essentially the Darling Range and Scarp; 'The North' is that area of the coastal plain lying north of the Swan River; 'The River' covers walks along or overlooking the Swan River; and 'The South' covers the remaining area south of the Swan River. Interspersed throughout the book are frequent fascinating features on the plants and animals of the Perth Outdoors area.

There are three indexes listing the walks alphabetically, by length and by ecosystem. This latter categorisation ties in with the four ecosystems (or natural communities) that make up the Perth region: the forests and woodlands of the Darling Range and scarp; the

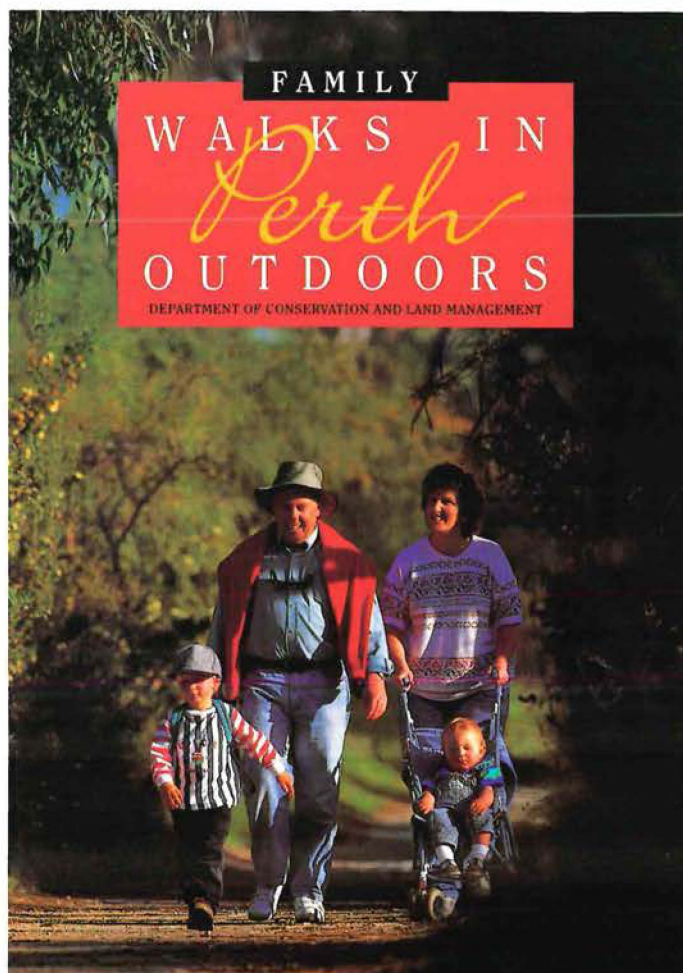
woodlands of the coastal plain; the wetlands of lakes, rivers, streams and estuaries; and the coastal and marine environments.

Family Walks in Perth Outdoors provides another excellent source of things for families to see and do at weekends or during school holidays. Using the book to help you plan your days out is like having your own private guided tour of some of the most beautiful and interesting places in and around Perth. It provides a wealth of additional information and new ways of looking at what is around you.

The book continues the philosophy of the highly successful *Perth Outdoors: A Guide to Natural Recreation Areas in and around Perth*; that is, getting people out and about and enjoying nature. But it goes a step further.

Family Walks in Perth Outdoors provides positive encouragement to walk for both exercise and pleasure. You can start by walking one of about a dozen routes of less than three kilometres. When you've mastered those, you can move on to the bulk of the walks, which are between three and six kilometres. If you really want a challenge, you might like to attempt the two longest walks, Nanga Circuit (17 km) and the King Jarrah Trail (18 km), that pass through the beautiful Lane Poole Reserve near Dwellingup.

For some of the people who helped to gather information for the book, it was their first venture into the beautiful parks, forests, riverside and bush areas in and around Perth. Others were regular walkers, but having to describe what was around them gave a new perspective on familiar areas.



About a dozen walks have already been researched for a future volume, which will include areas such as Lake Monger, Canning River Regional Park, Yellagonga Regional Park, the Beeliar Wetlands, the Shoalwater Islands, Woodman Point and Avon Valley Catchment.

But we still need more, and that's where *LANDSCOPE* readers can help.

If you know of any walks in the Perth Outdoors area - which stretches from Lancelin to the Peel-Harvey Inlet and east to the edge of the Wheatbelt - write and tell us about them giving the locations and names (if any) of the walks, the approximate lengths and how long it takes to walk them. We also need

your name, address and telephone number so we can follow up later. Information from local government authorities will also be welcome.

Please write to:

More Family Walks in Perth Outdoors
Corporate Relations Division
Department of Conservation and Land Management
PO Box 104, Como 6152

Family Walks in Perth Outdoors

is now available from bookshops, newsagents and CALM offices. Priced at \$14.95, it makes an excellent gift for yourself and, possibly, for your more sedentary friends!

GETTING THEIR GOATS

While the rugged gorges of the Kalbarri National Park are the main attraction for tourists they are also home to highly destructive feral goats.

The abundance of goats in the State's pastoral regions has resulted in widespread degradation of soil and habitat; destruction of crops, fences and native plants; competition for food and habitat with native animals; and the spread of weeds and disease.

In the past, goats in Kalbarri National Park have been shot whenever possible, and while this has accounted for an annual average of 500, the inaccessible terrain has limited the potential of this method. To significantly reduce goat damage, at least two-thirds of the population must be removed annually, which means extra effort is required.

The problem is now jointly being tackled by CALM, the Agriculture Protection Board (APB) and the Land Conservation District Committee comprising Kalbarri National Park and adjacent landholders. As a result, an experimental aerial shooting program took place in late April in the gorges of the park. The program was funded by CALM, and rifles, ammunition and shooters

supplied by the APB.

About 15 000 ha, extending from Hardabut Pool in the east to Hawks Head Lookout in the west, was selected as the site where the funds could be used most effectively used.

Public safety was of the utmost importance, and the area was cleared and secured the day before. Constant vigilance of all access ways by CALM staff not only ensured a safe operation, but also gave would-be visitors an opportunity to express their opinions. Additionally, the event was advertised both locally and throughout the Northampton Shire, with good public response confirming the community's awareness of the problem and the need for action.

The aerial shooting program allowed good coverage of the area and the total of 357 goats and one pig represented an excellent return for nearly six hours flying time.

Following the operation, it was clear that not only was the trial a resounding success, but that it was the best option currently available for goat control in the park.

Feral goats.

Photo - Jiri Lochman



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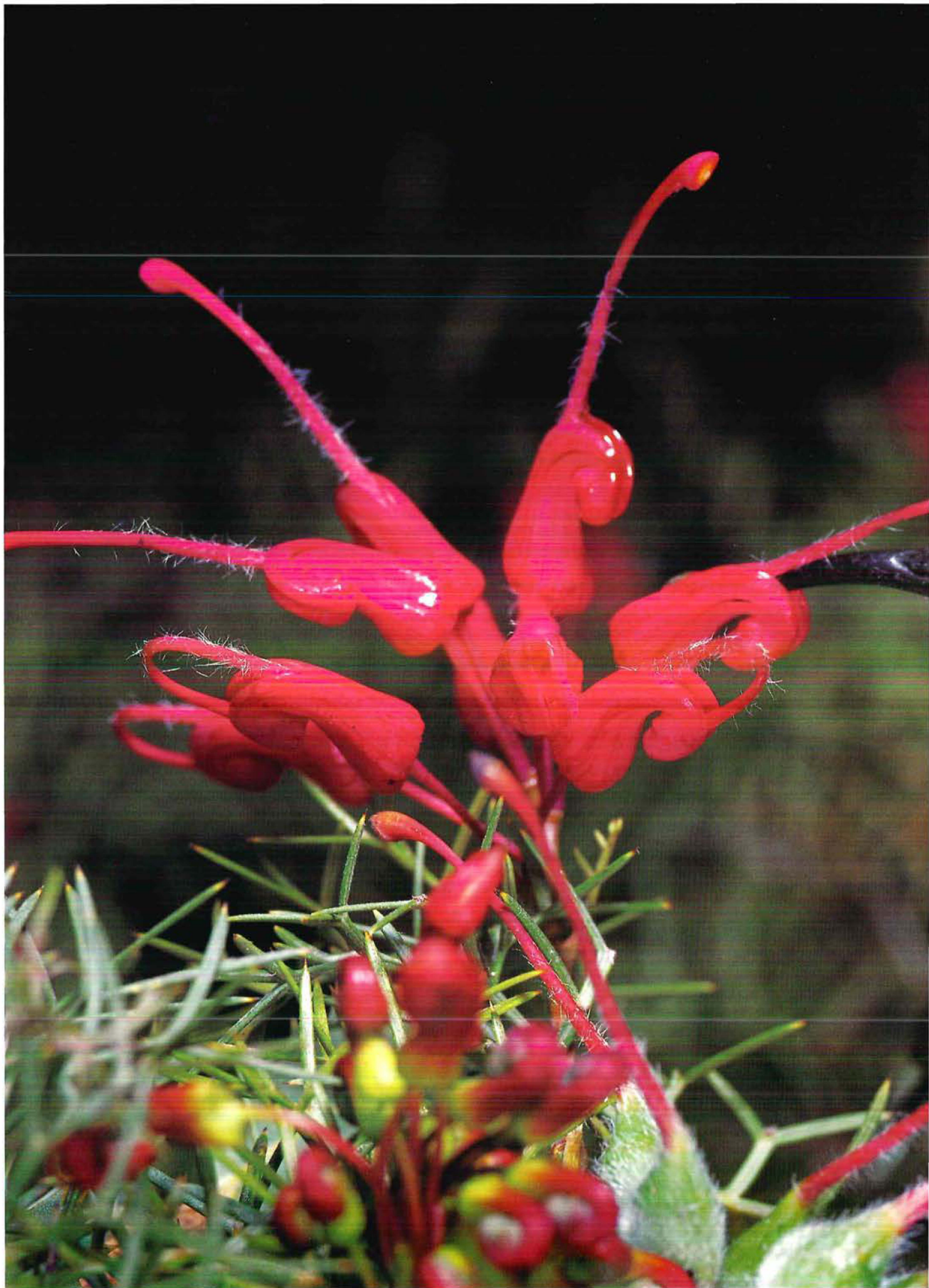
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Birds

IN THE GARDEN

by Allan Burbidge

You don't have to go bush to see native birds; a wide variety live in or visit the urban parks and gardens of Western Australia. But what is it about these places that attract birds to some and not others? Allan Burbidge suggests a few easy ways of making your garden an attractive place for native birds to feed and nest.

Residents of Perth and other Western Australian cities and towns, rarely have to go any further than their back gardens or local parks to spot a wealth of native birds going about their daily business.

Unlike residents of eastern States' cities, where native birds have been largely displaced and outnumbered by introduced birds, such as starlings (*Sturnus vulgaris*), sparrows (*Passer domesticus*), blackbirds (*Turdus merula*) and mynas (*Acridotheres tristis*), we are extremely fortunate in Western Australia to still have a wide variety of native species roaming our urban areas.

Although there are several introduced birds, such as laughing turtledoves (*Streptopelia senegalensis*), native to Africa and India; spotted turtledoves (*Streptopelia chinensis*), from South East Asia and rainbow lorikeets (*Trichoglossus haematodus*) and kookaburras (*Dacelo novaguineae*), from eastern Australia, all of which are common in urban gardens, they are outnumbered by the native birds.

COMMON NATIVES

The native species familiar to people in Perth's urban areas include the singing honeyeater, brown honeyeater, red wattlebird and Port Lincoln ringneck ('twenty-eight' parrot).

The singing honeyeater (*Lichenostomus virescens*) is a common resident in gardens where there are suitable shrubs for nesting. Its cup-shaped nest, which looks somewhat flimsy, can be found suspended from a small fork of a tree or shrub. The nest is made of grasses and lined with wool, fur or down from flowers such as banksias. This is probably the most widespread native bird in Perth gardens, and is also one of the most widespread birds in Australia. The name 'singing' is a bit of a misnomer, as many of its calls are rather



unmusical, although it tends to be at its most melodious during the dawn chorus.

The brown honeyeater (*Lichmera indistincta*) is another common resident that adapts well to gardens. Sometimes it will even nest in plants in hanging baskets, or in ivy on a wall. It builds a small cup-shaped nest, made of fine bits of bark and spiders' webs, that is suspended between small twigs. The bird lays two eggs, sometimes as early as August. As its scientific name suggests, the brown honeyeater is rather modestly plumaged, but it makes its presence known with a loud spirited song, as well as several harsh alarm and warning calls.

The red wattlebird (*Anthochaera carunculata*) is a large, noisy and aggressive honeyeater that often occurs in Perth gardens, especially those with



Above left: Flowering bottlebrushes (*Callistemon* spp.), planted as street trees or in gardens, will attract singing honeyeaters.
Photo - Babs & Bert Wells

Above: The brown honeyeater is easily observed in Perth gardens, becoming quite accustomed to human presence.
Photo - Babs & Bert Wells

trees. It is distinguishable by a small pink-red flap of skin, or wattle, behind the eye at the base of the bird's cheek. Like singing and brown honeyeaters, red wattlebirds can be seen searching under gutters and around verandahs and pergolas for spiders and insects to feed to their young. They also take nectar from a wide range of common garden flowers.

If you live near a patch of bush, you may be lucky enough to have New



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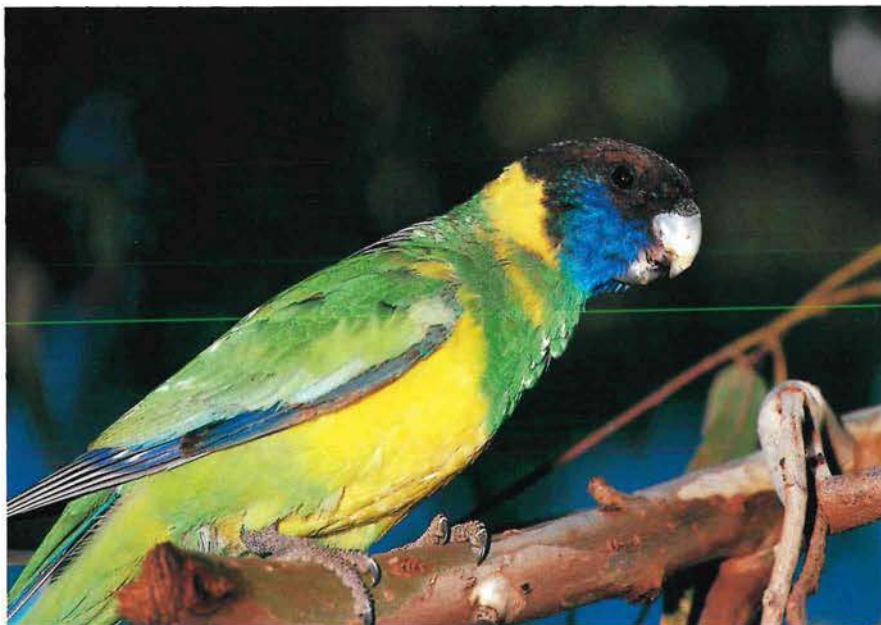
A symbiotic relationship in action.

Western spinebills take nectar from grevilleas and pollinate the plants at the same time.

Photo - M & I Morcombe

Right: Introduced laughing turtledoves are one of the commonest birds in Perth gardens.

Photo - Jiri Lochman



Port Lincoln ringnecks, known locally as 'twenty-eights', will visit most gardens with one or more native trees and will also feed in many exotic trees. Photo - Jiri Lochman

Holland honeyeaters (*Phylidonyris novaehollandiae*), white-cheeked honeyeaters (*Phylidonyris nigra*) or western spinebills (*Acanthorhynchus superciliosus*) visiting your garden. The male western spinebill is a striking little bird. It has a black face with red eyes and white eyebrows, a rich chestnut collar and throat and a black and white breast band.

Port Lincoln ringnecks, or 'twenty-

eight' parrots (*Barnardius zonarius*) are frequent visitors to gardens with trees, where they come to feed on fruits or flowers, or just to perch and chatter. If there is an old eucalypt tree in or near the garden they may stay to breed, laying about five white eggs in a hollow tree limb.

The dapper little silvereve (*Zosterops lateralis*) is generally nomadic, but will often breed in parks or gardens. In spring and summer, colourful rainbow bee-eaters (*Merops ornatus*) are a common sight along many suburban streets. They are usually found perching in trees or on power lines and wheeling and diving to catch bees and other flying insects. Bee-eaters nest in a tunnel that they excavate in the ground. They are migrants, moving to South East Asia and New Guinea

during the winter, arriving back in the South West in late September or early October. Black-faced cuckoo-shrikes (*Coracina novaehollandiae*) - streamlined pearl-grey birds with a clearly defined black forehead and throat - occur in many areas, and are sometimes seen nesting in street trees. Their call is an unusual musical rolling purring or chirring.

Another common visitor to gardens is the Australian raven (*Corvus coronoides*), often known as the 'crow'. Although these birds are common, it is worth spending some time watching them, as they have some complex and intelligent behavioural patterns. In some areas, galahs (*Cacatua roseicapilla*) will also visit gardens. Large flocks of these garrulous birds are spectacular, twisting and turning to show alternately grey and then pink, and giving high screeching calls as they fly over the suburbs.

Australian magpies (*Gymnorhina tibicen*) often occur in relatively open gardens, and sometimes get quite tame in suburban areas. Like willie wagtails (*Rhipidura leucophrys*), they can sometimes even be heard on bright moonlit nights with a familiar flute-like or organ-like carolling. During nesting season, after the chicks have hatched, both male and female magpies often vigorously defend the nests by swooping and diving at potential intruders. Care should be taken not to approach nest sites during this short period.

If you are in a reasonably well-wooded suburb, you may also be lucky enough to hear a boobook owl (*Ninox novaeseelandiae*) calling at night, repeating its well-known falsetto 'boobook' or 'morepork' at intervals.

Gardens near patches of bush, or on the edges of metropolitan areas, will have more native birds than gardens some distance away from such areas. In some gardens in outlying suburbs, 30 or



Far left: Another important pollinator of plants is the strikingly-marked New Holland honeyeater. Photo - Babs & Bert Wells

Left: Spring and summer migrants to southern Australia, rainbow bee-eaters frequent prominent perches, from which they hunt for bees and other flying insects. Photo - Jiri Lochman

more bird species can be seen during the course of a year. But even these suburban gardens will only have a very small number of resident breeding species, relative to those species that visit regularly or occasionally.

WELCOME VISITORS

The colour, movements and song of birds add an extra element to any garden. But in addition, many honeyeaters are also important pollinators of native plants. Bird-pollinated flowers produce relatively large amounts of nectar, which is an important food source for nectar-feeding birds. If you have a grevillea in the garden, you may well have seen honeyeaters sucking repeatedly at the flowers. The advantage for the plant species is that birds, being mobile, are good at transferring pollen between individual plants (albeit unwittingly) and so effecting cross-pollination.

All honeyeaters occurring in our urban gardens will take nectar from flowers, but insects are also a major part of their diet. Most other native birds found in urban areas of Western Australia,

including willie wagtails (*Rhipidura leucophrys*), rufous whistlers (*Pachycephala rufiventris*), pardalotes (*Pardalotus* spp.) and silvereyes, also eat insects and perform the useful function of helping to keep down the numbers of insect pests in our gardens.

CREATING A BIRD-FRIENDLY GARDEN

Different kinds of bird forage in different ways. Magpies or willie wagtails forage on the ground, silvereyes prefer shrubs, pardalotes forage in trees, honeyeaters feed on flowers, and other birds, like sittellas, pardalotes and gerygones, feed on insects that live on rough bark or leaves.

Gardens with a broad range of habitats and foraging sites are likely to attract a larger number of bird species than gardens containing a large expanse of lawn with, perhaps, one or two roses or a couple of conifers.

When it comes to planning and planting a garden to attract birds, it is best to include a variety of potential habitats or foraging areas: some relatively

open areas, some areas with shrubs and some with trees. If space permits, include vegetation of different heights and densities.

The key to attracting native birds to a garden is in the diversity of shrubs and trees present and their placement within the garden. Try looking at your garden from the perspective of a bird. If it consists mainly of lawn, with only one or two shrubs, then it will offer few places for shelter or nesting, and few places in which to look for food. In open places, small birds are vulnerable to predators, but the addition of even one tree will attract more birds. Some birds will just use the tree as a resting point on their way through, but a tree with flowers that provide a good nectar supply, such as a banksia or a eucalypt with large flowers, will attract honeyeaters and other nectar-eating birds. Flowering trees also attract insects, and hence insect-eating birds.

Many people attract nectar-feeding birds by planting some of the numerous species of plant that are bird-pollinated, such as grevilleas and banksias. However, it is just as important to achieve a diversity of foliage heights, leaf shapes and bark textures. If you put the emphasis on these aspects when you plant your garden, you will have the best chance of attracting a range of insect-eating birds and you will find that some plant species that attract nectar-feeding birds are inevitably included. This approach will also provide a greater choice of nest sites for birds (see 'Garden for Wildlife', *LANDSCOPE*, Autumn 1987, and 'Landscaping for Wildlife', *LANDSCOPE*, Autumn 1991).

Ideally, species endemic to the local area should be planted, as native birds are well adapted to these. If you cannot obtain local species to your liking, try to choose species from the general region - many plants from south-western Australia will grow in Perth and will provide excellent habitats for birds.



The striated pardalote, a little bird with a big call that sounds like 'wit-wit', forages for small invertebrates in the leaf canopy. It sometimes nests quite low down in narrow hollows of tree limbs.

Photo - Babs & Bert Wells



Above: *Banksia occidentalis* is native to the south coast of WA, but grows well in Perth gardens. Its attractive flowerheads provide a useful source of nectar for birds.

Photo - M & I Morcombe

Above right: Sociable birds, silvereyes move through gardens in small flocks, mostly feeding on insects, but sometimes also feeding at flowers.

Photo - Babs & Bert Wells

Right: Noisy and aggressive red wattlebirds will try to defend rich nectar sources, such as those provided by the bull banksia, from other birds.

Photo - M & I Morcombe



The bigger the area that can be devoted to bird-attracting plants, the better. Consequently, if you can convince your neighbours to plant for birds and other wildlife, you will achieve even better results. If enough people do this, it will not only contribute to knowledge and appreciation of native birds and plants, it will also help provide corridors for bird movement throughout urban areas.

A TEMPTING TABLE

If you have a garden that is already planted in a way that is attractive to birds, one way to attract even more birds is to provide extra food or water. A bird bath or feeding station will provide a focus for bird activity and opportunities for viewing the birds in your garden. However, if you decide to do this, care should be taken.

Food or water must be in a position

where it is difficult for cats to 'ambush' the birds. Cats are very effective predators of birds, and even putting a bell on a cat will not necessarily prevent it from catching birds. (Multiple bells are more effective.) If you provide food, it is best not to do so continuously in large amounts, for two reasons. The first is that the birds may come to depend on you and may encounter problems if, for some reason, you are unable to continue feeding them, for example, if you go away on holiday. Second, the food being provided may not match the natural diet, and therefore the birds' diets may become unbalanced. For example, in Melbourne it has been found that red wattlebirds may suffer from thiamine deficiency in winter. This is because they rely too much on food from feeders and on nectar from non-local plants that flower in the winter, when wattlebirds would normally

be eating a high proportion of insects. Without sufficient insects in their diet, they do not get enough protein and, in extreme cases, become convulsive and die.

Providing water is not a problem, because native birds can survive well without it. However, when it is available, they will use it for bathing and drinking. Water can be provided in a classic bird bath or in a pond. A pond will have the added advantage of attracting frogs and other interesting creatures (see 'Frogs in the Garden', *LANDSCOPE*, Winter 1993). A pond is more likely to be used by small birds, such as honeyeaters, if there is some vegetation overhanging one edge to provide perches and an access or escape route. If you have a large pond, you may have ducks visiting occasionally or, if the pond contains fish, a heron may stop by to look for a meal.

ARTIFICIAL HOMES

Another way to make a garden more attractive to birds is by providing nest boxes. This has been done for hundreds of years in Europe, but little is known about the use of nest boxes by birds in Australia. This is a great opportunity to learn something new about Australian birds. The birds themselves are not fussy about construction standards, so any old pieces of wood could be used. What is more important is the size of the box and the size of the entrance hole. Pardalotes use quite small hollows, but parrots require a bigger entrance hole and chamber. However, making the hole too large may provide easy access for neighbourhood cats, with disastrous consequences for the nesting birds.

Attracting birds to your garden is a marvellous way of experiencing nature, literally at your back door, with the added advantage of bringing the sounds of bird song into your home. If we can get birds to nest in our gardens, we, and especially our children, will have the opportunity for even greater appreciation of the birds and their family life, and also help make suburbia a greener and better place.



Above: The galah has expanded in range following clearing. The population in Perth is a mixture of local birds and escaped cage birds.
Photo - Jiri Lochman

Below left: The rich song of Australian magpies is a welcome contrast to the sounds of traffic in urban areas.
Photo - Jiri Lochman

Below right: The kookaburra, introduced from eastern Australia, preys on small lizards, snakes and large invertebrates.
Photo - G. Saueracker/Lochman Transparencies

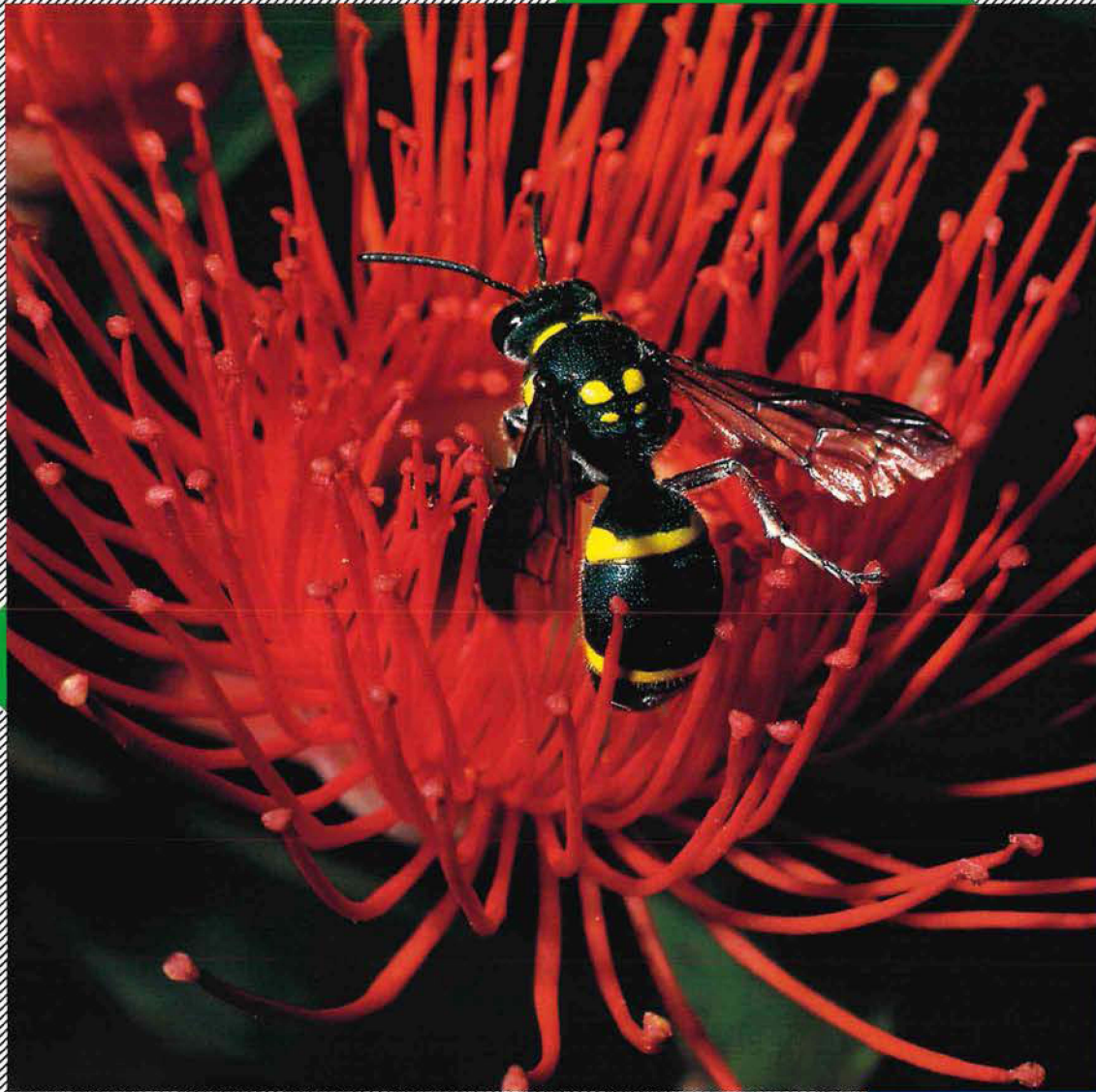


A TASTE OF HONEY

Nectar-feeding birds (honeyeaters and silvereyes) will come to a feeder containing a dilute solution of honey. A concentration of about 10-20 per cent (made by mixing approximately one teaspoon of honey with two tablespoons of water) will match the concentration of nectar in bird-pollinated plants. Do not use sugar, as it contains only sucrose, and none of the vitamins and minerals that are present in trace quantities in nectar and honey. Make sure to change the solution regularly so that it does not ferment or go mouldy.

Allan Burbidge is a Senior Research Scientist with CALM's Science and Information Division, where he is involved with survey work and the conservation of threatened birds. He can be contacted on (09) 405 5100.

THE 'REAL' BEES OF WESTERN AUSTRALIA



BY JOHN ALCOCK

Mention the word 'bee' to an Australian, in fact to almost anyone the world around, and that person will probably think about an unhappy encounter that he or she has had with a honey bee. Yet this introduced species is only one of some 3 000 named species of bee that call Australia home.

Domesticated honey bees (*Apis mellifera*) were introduced to Australia by Europeans. They quickly produced colonies that escaped into the wild, where they multiplied with a vengeance and spread across the continent. Although they produce that delightfully tasty and sticky substance, honey, there is concern that feral honey bees do considerable ecological damage, by occupying tree cavities that parrots would otherwise use as nest sites, and by consuming vast quantities of nectar that would otherwise sustain many Australian birds, mammals and insects.

In contrast, native bees are well integrated into their ecological communities as a result of a long evolutionary history here. Furthermore, the native bees are delightfully diverse in both appearance and behaviour, each species having its own way of making a living.

Consider the banksia bee (*Hyaleus alcyoneus*), a glossy blue-black insect about as long as your thumbnail. Unlike the social honey bee, which forms colonies where a single queen rules over sterile workers, the banksia bee is a solitary species. Females nest by themselves without the benefit of worker

assistants. Each nesting female collects pollen, which she uses to form brood balls in her nest in a hollow twig. Each completed packet of pollen receives an egg laid by the nesting female. The egg becomes a larva that consumes the food its mother provided; the larva in due course becomes a pupa, which in turn metamorphoses into an adult, long after its mother's demise.

Most bees around the world lead a solitary lifestyle when it comes to provisioning nests, although there are a few native Australian bees that form social groups with a sterile worker caste. Among the solitary bees, species differ behaviourally in a host of ways. For example, some nest in hollow twigs, others use termite tunnels or similar pre-existing burrows, a few gnaw homes into solid wood and many excavate tunnels into the ground. In addition, solitary bees vary with respect to the flowers visited by mothers building brood balls.

BEE SMORGASBORD

The huge variety of Western Australia's flowering plants provides a breathtaking smorgasbord for the many native bees of the State, most of which

specialise to some extent on a small part of the available nectar and pollen sources. For example, female banksia bees prefer to nibble pollen from the inflorescences of the bull banksia (*Banksia grandis*) or the showy banksia (*B. speciosa*), which is often found in national parks along the south coast, such as Fitzgerald River and Cape Le Grand. The banksia bee swallows the pollen and stores it for regurgitation back at the nest. Other native bees carry pollen on their hairy hind legs, whereas some pack pollen on the underside of their abdomen. Other species forego pollen-collecting and nest-building altogether. Instead, they parasitise the hard-working females of certain other species, slipping into an established nest and laying their eggs on brood provisions intended for the nest builder's offspring.

No matter what their occupation, the native bees are completely inoffensive in dealing with people. Most are smaller than the honey bee and could not do much damage even if they wanted to.

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A female of the solitary bee *Hyleoides zonalis* gathering nectar from the flower of the red-flowering gum (*Eucalyptus ficifolia*).

Photo - John Alcock

Left: A common honey bee (*Apis mellifera*) feeding from the flower of a pigface plant.

Photo - Jiri Lochman

Below: A territorial male banksia bee (*Hyaleus alcyoneus*) guarding his showy banksia (*Banksia speciosa*) inflorescence.

Photo - John Alcock





Above: The bull banksia (*Banksia grandis*) is a favourite nectar source for banksia bees.
Photo - Jiri Lochman

Right: Male Dawson's burrowing bees (*Amegilla dawsoni*) fighting over a female.
Photo - Babs & Bert Wells



Any person who has been stung by a banksia bee or any other native species probably deserved it, as they probably tried to capture a female for some reason and she resented it.

Only female bees can sting, because only they possess a stinger, which is a modified ovipositor (the egg-laying device). In contrast, male bees lack a stinger, as well as lacking any drive to collect food for their offspring. Even so, their behaviour is every bit as intriguing and diverse as that of the females. The focus of male behaviour is the location of mates, a task to which the typical male Australian native bee devotes much of each day of his adult life.

TO DEFEND OR PATROL?

Because female bees are attracted to certain flowers, male bees are often found at the appropriate pollen or nectar source. If you visit Walpole-Nornalup National Park in January, you may see females of *Hyleoides zonalis*, a small black and yellow bee, sipping nectar from the beautiful red-flowering gum (*Eucalyptus ficifolia*). If you are alert, you will also see males of this species cruising steadily from one red flower to another, following a patrol route that keeps them going around in circles. The males are not there to drink nectar or admire the

flowers, but to inspect any female that happens to show up. If she is receptive, the male pounces and mating occurs.

Hyleoides zonalis males make no attempt to defend the flowers they inspect, but the males of some species are ferociously aggressive (but not towards humans). A spectacular example is provided by Dawson's burrowing bee (*Amegilla dawsoni*). Some males of this species search for females that have just become adults and have gnawed their way up to the surface of the ground (their mothers having tunnelled out underground nests in which they placed their brood balls). Having discovered an emerging female, a male may have to fight violently to gain access to her, while other males attempt to displace him from his partner-to-be. Mobs of males may form a ball around a female, wrestling and tumbling over the ground in an effort to take her away to copulate.

There are other Australian species whose mate-searching males may employ more than one tactic to encounter females, exhibiting behavioural flexibility and complexity that give the lie to the reputation that insects have for being automatons. The banksia bee provides an instructive example. During summer, some males of this species engage in

small but violent dramas played out on the stage of banksia inflorescences.

Any visitor to Cape Le Grand National Park in February or March can verify this point by locating a showy banksia with a considerable number of flowering spikes. Inspection of the spikes will reveal that some are being used as perches by yellow-faced, blue-black bees about a centimetre long. People can easily approach the bees, so intently do they cling to their flower spikes. The perched males are not harvesting nectar or pollen but are guarding their flower spikes against other males while they wait for receptive females to fly to them. When a resident male spots an approaching intruder, he wheels around to confront the other bee, whirring his wings as the other individual darts in, then leaping off his perch as the incoming bee becomes an outgoing one. Should the intruder have the temerity to land on the perch, a battle royal is likely to result, with the two males tumbling about on the flower spike in a wrestling match without Marquess of Queensbury rules. The bees bite at each other's wings, and thump their opponent with their abdomen, which has two spines on its underside, just to add emphasis to the thumping. Soon one male is on his way, and the other adopts the alert, head-down,

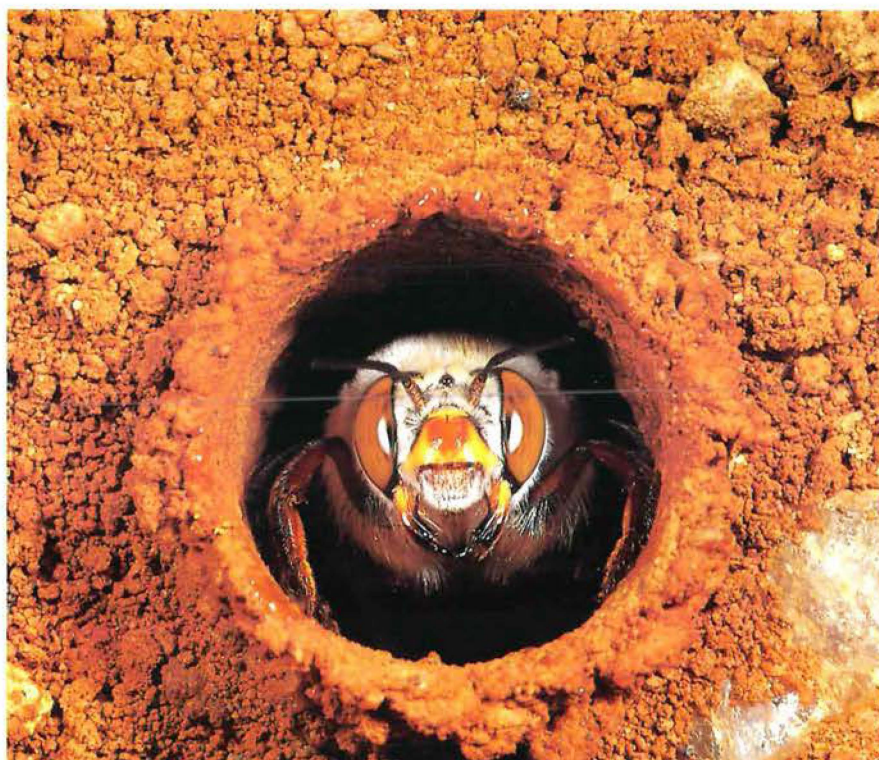
territory-defending pose, ready to respond at once to a new challenge.

MARKING MALES

In my studies of banksia bees, done in collaboration with Terry Houston of the Western Australian Museum, I have found that making sense of their lives is helped immeasurably by marking some males, so that they can be recognised as individuals. To this end, I have captured several dozen male banksia bees and marked them with dots of liquid paper applied to the thorax or abdomen.

Once this was done, and remember that handling male bees does not require courage, as male bees cannot sting, I released the marked males, which invariably made a beeline back to their perch. If they found the spike occupied by a newcomer who had taken advantage of their temporary absence, a wrestling match usually ensued, with the original resident usually regaining his territory. Thereafter, by surveying a population of marked individuals on some banksias, I learned that some males returned to the same territory for five or six hours a day over a period of as much as a couple of weeks. Moreover, once I got to know 'yellow three dots', 'white two dots' and 'blue X', I quickly realised they had 'personalities', in the sense that they did not all behave in an identical manner. Besides the determinedly territorial individuals, some did not defend their perches, but instead patrolled a whole battery of inflorescences, using one flower spike or another as an occasional resting site only.

I have also learned that territorial males are larger than patrollers. In this bee species, and for many other creatures, body size determines fighting potential, with smaller males being disadvantaged when it comes to physical combat. As a result, in the banksia bee, small males have evolved the capacity to avoid their bigger, tougher rivals, which they do by patrolling a set of flower spikes rather than by attempting (unsuccessfully) to defend a territory. But if one removes the large territory defenders from a banksia shrub, some of the smaller males will quickly claim the vacant perches, defending them against still smaller rivals. Amazingly, the bee is able to judge the nature of the competition in reaching a 'decision' about whether to defend a



mating perch or to peacefully patrol a set of less attractive flower spikes in the attempt to encounter willing females that happen to be there.

Thus, the lives of banksia bees are anything but simple or dreary. And remember that this is just one of hundreds of bee species native to Western Australia, no two of which behave in precisely the same manner. The native bees may not have the economic or physical impact of the introduced honey bee, but they remind us that there are worlds within worlds in nature. Knowing even a little about them enriches a walk in native bushland as the bees invite us to focus down, to consider the smaller living things, and to be surprised and delighted by the stories they have to tell.

Top: A Dawson's burrowing bee at the entrance to its burrow.

Photo - Jiri Lochman

Above: *Lasiglossum* sp., one of a group of bee species whose females may nest together in the same burrow, is seen here feeding on a coastal plant.

Photo - Jiri Lochman

John Alcock is Professor of Zoology at Arizona State University and a regular visitor to Australia on his study leaves.

WONGAN HILLS

AN

'ISLAND'

SANCTUARY

RISING LIKE AN
ISLAND FROM THE
VAST SANDPLAINS OF
THE WESTERN
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WHEATBELT, THE
WONGAN HILLS
PROVIDE A SANCTUARY
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AND AROUND THE
HILLS.

BY SUZANNE CURRY



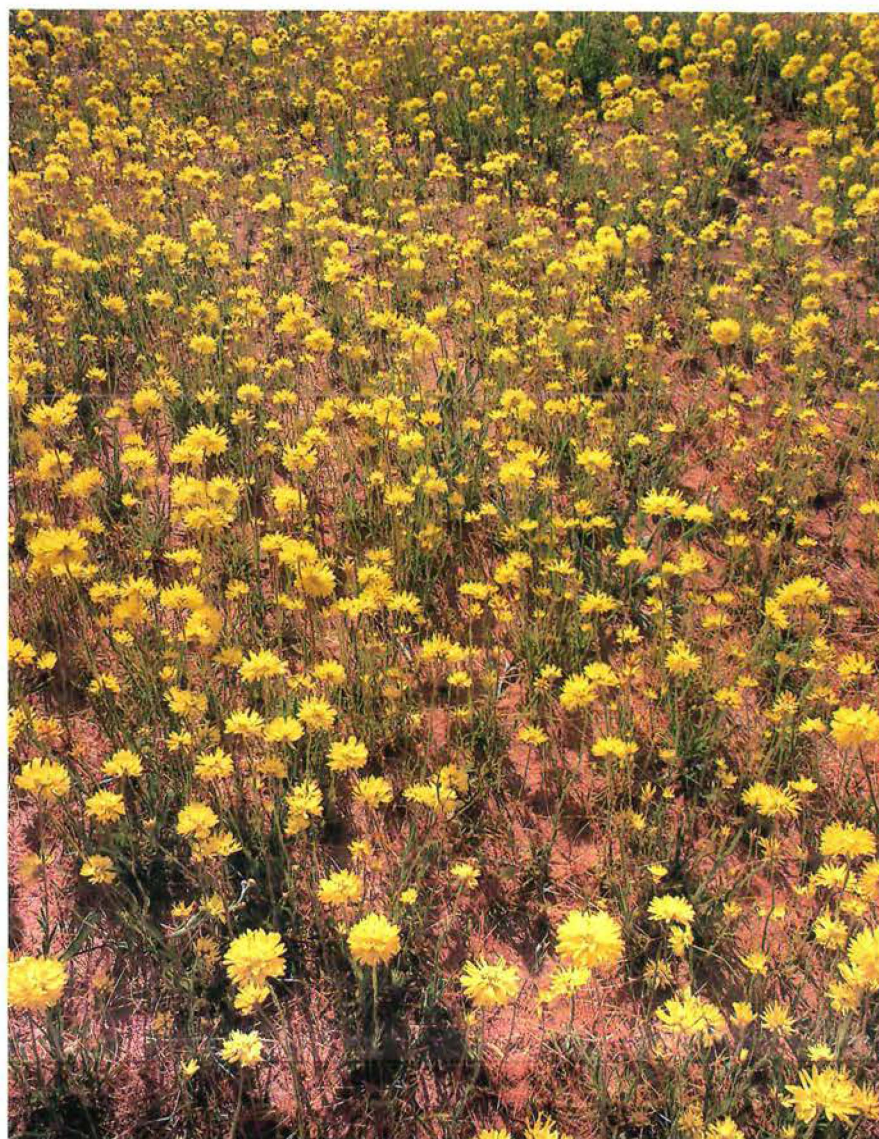
The sandplains of Western Australia's vast Wheatbelt once supported low woodlands and shrublands, which have now largely given way to farmland. The town of Wongan Hills, 194 kilometres north-east of Perth, forms the centre of a rich wheat and sheep farming district. The Wongan Hills themselves were never cleared, and today represent one of the most significant areas of natural vegetation remaining in the northern Wheatbelt, providing a window to the region's natural history.

The Hills are composed of hard metamorphic rocks that protrude from the surrounding plain (the highest point being Mt Matilda at 434 metres). These have been eroded away to form striking flat-topped mesas, which are thickly encrusted with laterite (ironstone gravel). The mesas are dissected by numerous deep gullies surrounded by well-developed breakaways. The plateau top of the mesas is mainly covered by lateritic gravel and shallow soil, whereas alluvial debris predominates on the gully floors. Rich red soils flank the Hills.

EARLY EXPLORATION

The Swan River Colony was established in 1829, and within a year the limited river flats were occupied by colonists. If the Colony was to continue to expand there was an urgent need to find suitable agricultural land, and exploration of the areas surrounding the Colony became a vital issue for Lieutenant-Governor James Stirling. The Wongan Hills, which were known as *wangan katta* by the Aborigines, were first discovered by Europeans only seven years after the founding of the Swan River Colony. In November 1836, a party led by Surveyor-General John Septimus Roe, George Fletcher Moore (Secretary of the Agricultural Society of Western Australia) and surveyor George Smythe explored and named the Wongan Hills.

The scientific importance of the Wongan Hills was first recognised in 1842, when two of the outstanding naturalists in the fledgling colony explored the area. James Drummond the botanist and John Gilbert, a natural history collector employed by the famous English ornithologist John Gould, made careful observations of the natural history of the Hills and made many collections of plants and animals previously unknown



to science. Remarkably, many of these species can still be found there more than 150 years later, a tribute to the natural resilience of the bush and a confirmation of the importance of the Hills as a biological sanctuary.

Vast tracts of native bush in the sandplains were opened up to agricultural clearing, to become part of the prosperous Wheatbelt. But this tide of agricultural expansion swept around the Wongan Hills. They escaped clearing, primarily because of their rough terrain, and survived as an 'island' sanctuary.

A WEALTH OF SPECIES

Recent surveys of the Hills have listed more than 400 plant species. There are more than 60 species of the family Myrtaceae alone, including more than 25 species of eucalypts. Many of the Myrtaceae produce striking displays of flowers. Between September and November, the starflower bushes (*Calytrix depressa*) are covered with

Pompom head (*Cephalopterum drummondii*) is one of the colourful spring annuals found in the hills.

Photo - Marie Lochman

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The agile varied sitella (*Daphoenositta chrysoptera*) is a trunk-feeding bird which can be seen in the hills in family groups numbering up to ten.

Photo - Babs & Bert Wells

pretty yellow flowers. The broom honey-myrtle (*Melaleuca uncinata*) often forms dense thickets on the gully floors, and is easily recognised by the hooked tips of the cylindrical leaves and by the pale yellow flower-heads.

There are about 50 species of daisy (Asteraceae) growing in the Hills. Most of them are colourful spring annuals such as the pompom head (*Cephalopterum drummondii*), pink sunray (*Rhodanthe manglesii*) and golden waitzia (*Waitzia nitida*). Among the most beautiful of the plants to be found in the Hills is the tiny blue fairy



Top: The Wongan Hills rise like an island from the vast sandplains of the surrounding wheatbelt.
Photo - Marie Lochman

Above: Feather flowers (*Verticordia* spp.) provide another bright splash of colour in spring.
Photo - Jiri Lochman

orchid (*Cyanicula deformis*), which grows to only 15 centimetres tall.

The Hills are extraordinarily rich in wattles (*Acacia* species), and shelter both the common jam wattle (*Acacia acuminata*) and the rare sandpaper wattle (*Acacia denticulosa*). This very unusual species has thick rough heavily veined leaves, and remarkable yellow caterpillar-like flower-spikes that can grow up to eight centimetres long. Many of the wattles in the Hills are not found in any other nature reserve in the Wheatbelt.

The Wongan rhagodia (*Rhagodia acicularis*), belonging to the family

Chenopodiaceae, is rare and mainly restricted to the Hills. This small compact shrub has many spiny branchlets covered in small rounded hairs, which give it a rough appearance. It is found in red soil on the gravelly laterite slopes, and flowers from October to May. The appropriately named *Eriostemon wonganensis*, known as the Wongan eriostemon, is another rare plant known only from the Hills. Belonging to the family Rutaceae, this erect, many-branched shrub grows to about one metre tall. It has pink-striped white flowers and warty leaves. Another rare plant described from the Hills is *Microcorys eremophiloides*, so-named because the flowers resemble those of the poverty-bush genus, *Eremophila*. The attractive deep pink to red flowers grow up to four centimetres long, and are probably pollinated by birds.

Many of the rare species found in the Hills are normally associated with breakaways and other erosional features. They have also been found colonising

disturbed ground adjacent to roads or walking tracks, and walkers should take extra care where they put their feet when walking in nature reserves in the Hills, to avoid trampling rare plants.

The significance of the flora of the Hills lies not so much in the number of species to be found per square kilometre, but in the remarkable combination of plant species that grow there.

COMMUNITY LIVING

There are many different types of plant community to be found within the Hills. Dense shrubby prickly-leaved *Dryandra* species such as the Wongan dryandra (*Dryandra comosa*) predominate in some areas, usually on summits and upper slopes. Tough mats of the herbaceous pincushions (*Borya* species), accompanied by attractive feather flowers (*Verticordia* species), are found on rocky pavements fringing the lower slopes of the Hills.

Mallees are an integral part of the vegetation and form the basis of many of these communities. Mallees are woody plants of the genus *Eucalyptus*, and generally take the form of erect many-stemmed shrubs or trees. They vary in shape, but commonly have a spherical or vertically flattened canopy raised well above the ground. The leaves are usually borne near the ends of the branches and the stems arise from a lignotuber (mallee 'root') or swelling at the base of the plant. These mallees include redwood (*Eucalyptus transcontinentalis*), Drummond's gum (*E. drummondii*), sand mallee (*E. eremophila*) and red-flowered mallee (*E. erythronema*).

As well as being the basis for many plant communities, mallees provide a habitat for an array of animals. Trunk-feeding birds such as the varied sittella (*Daphoenositta chrysoptera*) forage on their trunks. These agile birds are seen in family groups of up to 10, typically working down the trunks, probing crevices and levering flakes of bark away to feed on small animals. The race of varied sittella found in the Wongan Hills is characterised by a glossy black crown and pure white underparts.

Australia's smallest bird, the weebill (*Smicromis brevirostris*), feeds on tiny insects on the leaves of eucalypts. These diminutive yellowish green birds are only about eight centimetres long, but they

have a robust voice for their size and are usually heard before being seen. Weebills are widespread, being found in a wide variety of habitats in all mainland States of Australia. They can be seen in the Wongan Hills, fluttering in and around the foliage of the mallees, producing a sharp clear 'weebill' sound.

Animals find shelter underneath the bark that is regularly shed from mallees. Long streamers of bark fall to the ground, where they provide a haven for lizards and geckos, such as the clawless gecko (*Crenadactylus ocellatus*). This tiny dark grey-brown gecko lives in the leaf litter, feeding on tiny insects such as termites. It is unusual in being the only one of its kind without claws, and unlike most other geckos, it rarely ventures into the open. Butler's skink (*Morethia butleri*), named after Harry Butler the renowned Western Australian naturalist, is one of the small lizards associated with the mallee. It is olive-brown in colour and is heard during the day as it rustles through the leaf litter in search of small insects.

The young shoots of mallees produce a substance that attracts many insects,

particularly ants. The flowers of many mallee species offer a rich supply of nectar and pollen, and honeyeaters are very active around the flowers, including the attractive white-eared honeyeater (*Lichenostomus leucotis*).

A HILLTOP REFUGE

There are now only a few types of mammal in the Hills, bats being the most common. One of the smaller bats, Gould's wattled bat (*Chalinolobus gouldii*), lives in tree hollows there. The white-striped mastiff bat (*Tadarida australis*) is the largest of the mastiff bats and mainly feeds high above the tree canopy. It is so-called because its wrinkled lips and square muzzle resemble those of a mastiff dog, but its fierce appearance belies a very gentle nature. Other mammals found in the Hills include the echidna (*Tachyglossus aculeatus*), which is widespread. Evidence of its diggings is most common around breakaways. The euro (*Macropus robustus*) occurs in small groups throughout the Hills. The ashy grey mouse (*Pseudomys albocinereus*), which was

once common throughout the Wheatbelt, is now confined to a few widely scattered reserves, and occurs in a few sandy places within the Hills. Predation by feral cats and foxes has led to widespread decimation of our vertebrate fauna (see 'Masterly Marauders', *LANDSCOPE*, Summer 1992-93) and the mammals that still survive in the Wongan Hills probably represent only a part of the original fauna.

Birds are plentiful in the Hills. Some 90 different species have been recorded there, including cuckoos, owls, honeyeaters and wrens. The renowned malleefowl (*Leipoa ocellata*) was first recorded there by Septimus Roe in 1836. John Gilbert made detailed descriptions of the birds and of their nest mounds in 1842. These big-footed birds grow to about 60 centimetres, but are well camouflaged and are capable of moving quite stealthily through the bush. They lay the foundations for their extraordinary incubation mounds by digging a shallow hole in the ground, which is then filled with pebbles, soil, dry leaves, twigs and bark. These are left to be dampened by the winter rains before



Left: Mallees (*Eucalyptus* spp.) form an integral part of the vegetation of the hills and provide a home for Australia's smallest bird, the weebill (*Smicromnis brevirostris*).
Photo - Babs & Bert Wells

Below: Evidence of the diggings of echidnas (*Tachyglossus aculeatus*) are most common around the breakaways of the hills.
Photo - M & I Morcombe



being covered with soil. As the plant material starts to decompose it generates heat, and the male works the mound daily until the temperature stabilises at about 33 degrees Celsius. When the incubation mound is ready, the female lays up to 30 eggs over a period of many days. The eggs are then buried deep within the mound. The male continues to manage the mound, controlling the incubation temperature. These rounded mounds are often re-used again and again, growing in size over the years. The oldest mounds can be as large as four metres in diameter and one metre tall, with the foundations probably extending 75 centimetres below the ground. Because there are relatively few malleefowl left in the Hills, their mounds are not commonly seen.

Pairs of western yellow robins (*Eopsaltria australis*) are often found in the gullies and wooded thickets. These yellow-breasted robins are a rare species in the Wheatbelt because of loss of their habitat. Their cup-shaped nests are made of bark bound by spiders' web and are lined with leaves. The nests are well camouflaged, but can sometimes be seen in the forks of saplings and trees. Other species that are declining in numbers, but that can still be found in the Hills, are the beautiful blue-breasted fairy-wren (*Malurus pulcherrimus*) and the southern scrub-robin (*Drymodes brunneopygius*).

Because of their position near the overlap between the South West and the arid zone, the Hills provide a haven for a diverse array of bird species. They are extremely important as a refuge for resident, migrant and nomadic birds, as indicated by the fact that most of the species recorded by early ornithologists are still found there. Similarly, the Hills support an assemblage of reptiles that are not found elsewhere in the northern Wheatbelt.

More than 40 species of spiders have been recorded in the Hills. The Wongan Hills wishbone spider (*Kwonkan wonganensis*) is an interesting trapdoor spider that builds a mound over its burrow, usually composed of pebbles and sometimes of eucalyptus nuts. The crater-like burrow entrance, which is lined with silk, can be found in the centre of the mound. These mounds are quite substantial structures, and can be 10



Top: The fierce appearance of the white-striped mastiff bat (*Tadarida australis*) belies a very gentle nature. Photo - Babs & Bert Wells

Above: The beautiful blue-breasted fairy wren (*Malurus pulcherrimus*), though declining in numbers, can still be found in the hills. Photo - M & I Morcombe

centimetres wide and four centimetres high. During heavy rain, the mound acts like a levee in preventing flooding of the burrow.

CONSERVATION IMPORTANCE

The Wongan Hills shelter a unique assemblage of plants and animals, and their conservation significance has long been appreciated. The first comprehensive natural history of the Hills, coordinated by Department of Conservation and Land Management (CALM) Principal Research Scientist

Kevin Kenneally and published in 1977 by the Western Australian Naturalists' Club, stands as an invaluable benchmark for further studies in the area. The Department recognises the immense value of the Hills and continues to fund survey work in the area. Local volunteers from the Toodyay Naturalists Club have assisted CALM in surveys for Declared Rare Flora species, and have increased the Department's understanding of the unique flora and fauna of the Hills. The area has been monitored using colour aerial photography. This photography shows boundaries between plant communities, indicates land-use regimes in the surrounding area and is used for the construction of survey maps. In addition, the Western Australian Herbarium houses a collection of 2 500 plant specimens collected in and around the Hills.

A factor of vital importance in the preservation of the flora of the Wongan Hills area is the threat posed by dieback disease. Fortunately, the area is currently

free of the *Phytophthora* fungus that causes the disease, but if fungal spores were accidentally introduced many of the native plants growing in the area, particularly those on the sandplains surrounding the Hills, could be lost. It is vital that sensitive areas such as this should remain free from contamination.

There are a few simple precautions that can help to restrict the spread of dieback fungus.

The disease is spread in Western Australia mainly in infected soil carried on the wheels and underbodies of vehicles. By avoiding walking or driving in bushland areas under wet conditions, when there is a greater risk of picking up contaminated soil on boots or vehicles, and by keeping vehicles clean of mud, wet soil or vegetation, you can help to prevent the spread of this devastating disease.

Although only part of the Hills is reserved for flora and fauna conservation, CALM, in co-operation with local landowners, other government authorities, the local community and voluntary organisations, is working to ensure that the whole of this unique area will be protected for present and future generations.



Suzanne Curry is a CALM Technical Officer in the Science and Information Division. She spends much of her spare time researching and writing on the natural history of WA and can be contacted on (09) 334 0492.

The assistance of John Dell of the WA Museum, Barbara York Main of the University of Western Australia, C. & A. de Rebeira, Mike Fitzgerald CALM District Manager Merredin District and CALM Principal Research Scientist Kevin Kenneally is gratefully acknowledged.

An excellent reference on the Wongan Hills is *The Natural History of the Wongan Hills*, published in 1977 by the Western Australian Naturalists' Club.



Top: Mallee eucalypts are common throughout the hills.
Photo - Kevin Kenneally

Above: Emerging flowers of the sand mallee (*Eucalyptus eremophila*).
Photo - Jiri Lochman

Left: Gimlets (*Eucalyptus salubris*), with their polished and fluted trunks, dominate much of the heavy soils in the hills.
Photo - Kevin Kenneally



ENDANGERED!



MERRALL'S TRIGGERPLANT

Merrall's triggerplant was first collected in 1888 from near Lake Brown north-east of Toodyay, by Edwin Merrall, a gold prospector. The plant material was sent to the famous Victorian botanist Ferdinand von Mueller, who described it as *Candollea merrallii* in October 1888. It was transferred to the genus *Stylidium* in 1896.

For more than a century, the collecting locality and identity of the plant was to remain an enigma. Thought to have been destroyed by clearing for farmlands, it was presumed to be extinct and gazetted as such in 1991.

The original collection is in the Herbarium of the Royal Botanic Gardens in Melbourne. It consists of two fragments, one with a rosette of leaves conveying the false impression that the plant was related to the group known as creeping triggerplants.

In 1976, Basil and Mary Smith of Wongan Hills sent the Western Australian Herbarium part of an

inflorescence of a triggerplant collected in the state's eastern Wheatbelt. This specimen remained among the many unidentified plants in the Herbarium until 1991, when Allen Lowrie examined it and suspected it might be the long lost *S. merrallii*.

In 1992, Dr Syd James, of the University of Western Australia's Botany Department, collected non-flowering material of an unknown triggerplant from a granite rock. Examination of this material by Allen Lowrie confirmed it was identical to the material collected by the Smith's.

On the basis of the Smith and James collections, extensive fieldwork was conducted in 1992 and 1993 in the eastern Wheatbelt by Allen Lowrie, Daphne Edinger and Kevin Kenneally. Populations of what were believed to be *S. merrallii* were located and collected. The rediscovery was confirmed by matching the original Merrall material from Melbourne against the new collections.

Merrall's triggerplant is a perennial herb, arising from a rootstock and producing a basal rosette of leaves and long, spreading, flowering shoots. It flowers continuously throughout summer. In late January, it produces adventitious rosettes of leaves along the flowering shoots, which take root on touching the ground.

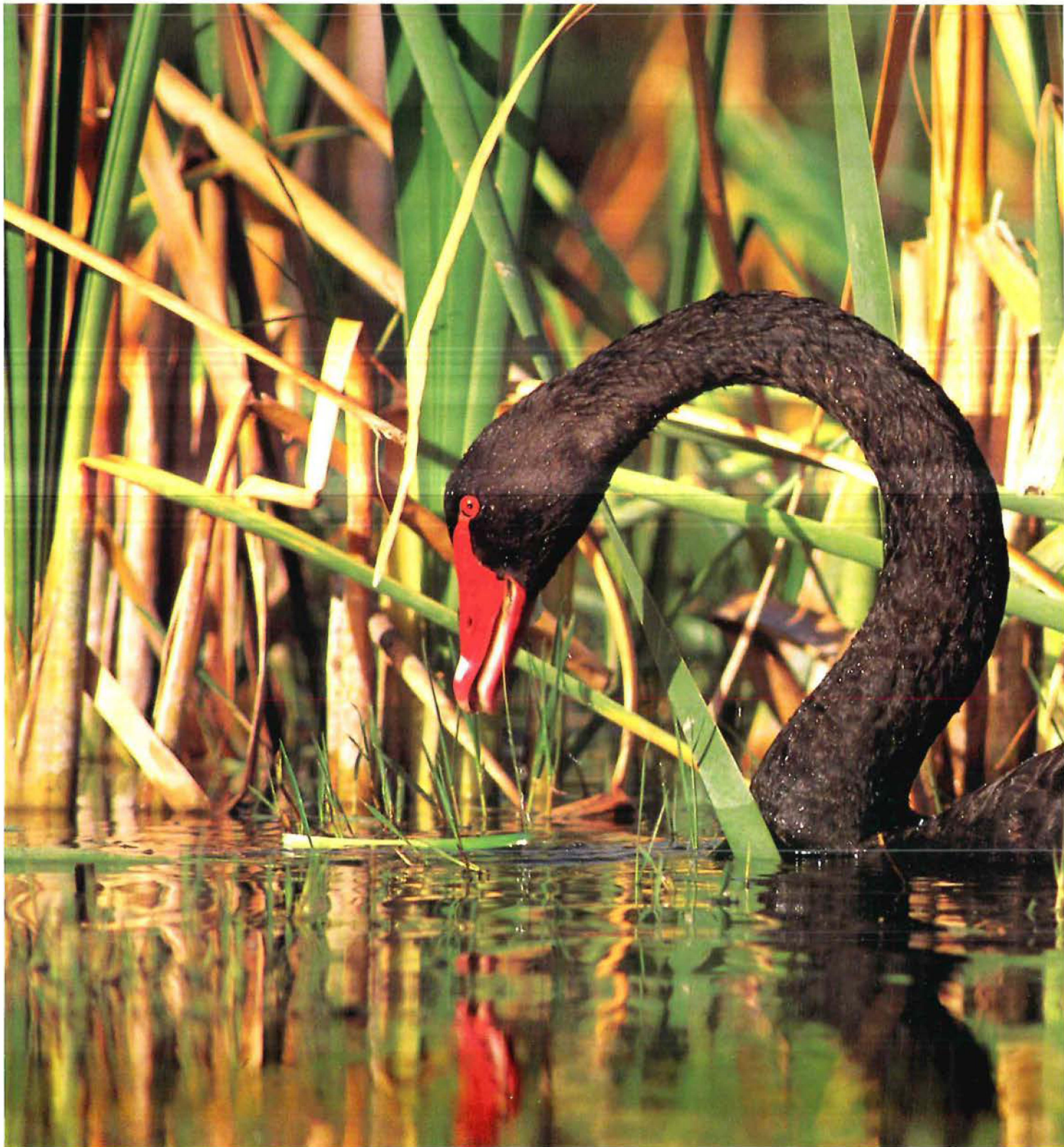
Merrall's triggerplant is endemic to Western Australia and is restricted to the aprons of granite rocks in the eastern Wheatbelt. Although the plant is protected within the Yanneymooning Hill and Walyahmoning Rock Nature Reserves, further surveys will need to be conducted to establish the extent of the species on other granite rocks in the eastern Wheatbelt.

Genetic studies suggest Merrall's triggerplant may be one of the most primitive triggerplants.

**Kevin Kenneally
and Allen Lowrie**

YANCHER

THE REBIRTH OF A NATIONAL PARK



A curious contradiction of extensive recreation developments, heritage buildings, stunning limestone caves, pristine wetlands and banksia woodlands has made Yanchep National Park one of Perth's most treasured parks for nearly a century. Now, a new management and development plan has given the Park a new lease of life, which will see it continue to be a major recreation area well into the next century. **By Rod Annear and David Gough**



Reserved in 1905 for 'the protection and preservation of caves and flora and for a health and recreation pleasure resort', Yanchep National Park reflects the changes in attitude and approach to the management of natural areas over the years. The tended garden beds, golf course, extensive shaded and manicured lawns, grand Tudor-style buildings and wide range of exotic trees found in the recreation area reflect an attitude which prevailed before World War II. Today, they leave us with a wonderful legacy on which to build a new future for the park, and one which reflects modern interest in wildlife and nature conservation as well as recreation in our national parks.

Historically, Yanchep and its wetlands were important to Aboriginal people as a source of food and fresh water during the summer months they spent on the coastal plain. Aboriginal groups from as far north as Moore River and south to the Swan River would sometimes meet to share the abundance of food the area had to offer. One of these foods is the bulrush (*Typha domingensis*), whose Aboriginal name, *yanjet*, is the word from which the name Yanchep was later derived.

Visitors from the Swan River Colony began to come to Yanchep shortly after the first settler in the area, Henry White, arrived at the turn of the century. These first visitors came to explore the caves, which had been noted by explorers to the area as early as 1838. Henry became the honorary caretaker and guide, and would meet visitors at an old stone hut named Caves House, which was built near the lake. The building had earlier been used by cattlemen who summered their cattle on the coast from as early as the 1880s.

Henry would meet these adventurers

Previous page

The black swan, once hunted on Loch McNess by Aborigines, is now a protected species and the State's bird emblem.

Photo - Jiri Lochman

Above right: Gloucester Lodge once provided exclusive accommodation and meals. It is now a museum of local history.

Photo - CALM

Right: Ex-Perth trams were converted to provide accommodation overlooking Boomerang Gorge.

Photo - CALM

and guide them through the caves using a magnesium flare; crawling along muddy streams to reach the best and most spectacular chambers. By 1905, most of the major caves in the park had been discovered.

Although the area was popular, poor roads made travelling there difficult for all but the most adventurous. Between 1905 and 1930, access was improved, but only limited development took place as management shifted between the Caves Board, Immigration Tourist and General Information Department, the State Hotels Department and finally, in 1931, the State Gardens Board.

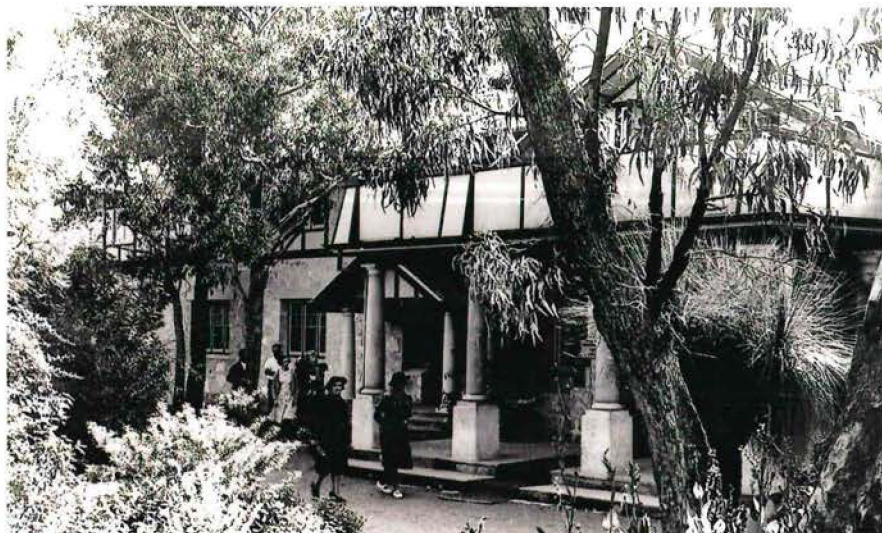
THE BOOM YEARS

In 1931 a grant of £11 660 was made by philanthropist Sir Charles McNess to alleviate the distress of the depression. Over the following 10 years, under the guidance of Gardens Board Head L. E. Shapcott, the park that we know today began to take shape. Roads and walking

tracks were laid down, the main buildings were constructed, areas were cleared for picnicking and sports ovals, and paths, lighting and stairways were installed in several caves, including Cabaret Cave, which was converted to a ballroom.

By 1936 the park boasted four levels of accommodation: McNess Hostel, which incorporated parts of the original Caves House; the Lodge; the Yanchep Inn and eight ex-Perth trams, which were refitted and set up overlooking Boomerang Gorge. Perth's 'silvertails' would flock to the park on weekends for rest, relaxation and, of course, to dance the nights away at Cabaret Cave. A high point of these years was the visit by the Duke of Gloucester in 1934, which culminated in a gala dinner dance in Cabaret Cave and the changing of name of the Lodge to Gloucester Lodge.

Development continued until war broke out in 1939. In 1942 the park was taken over by the RAAF who established a radar station there. Yanchep Inn



became an out-station of the Shenton Park Rehabilitation Hospital and McNess House was used to accommodate nurses.

The park remained popular through the 1940s and '50s and '60s, and a bus service was established, departing regularly from the tourist bureau in Perth. This brought visitors to see the park's attractions, which by then included launch tours, rowing boats, a golf course, extensive bird aviaries and the State's only captive koala colony.

Although it had been managed by the National Parks Board from 1956, it was not until 1969 that the area was given national park status. People still flocked to the park throughout the 1970s and '80s, but by then the facilities and infrastructure had begun to look tired. When a park management plan was written in 1989, it was recognised that much work would be needed to upgrade the park and provide for the needs of visitors during the 1990s and beyond.

Public attitude and use of the park were shifting too. Where once most visitors came primarily for a picnic, a survey in 1992 revealed that the park's natural features, its geology, fauna and flora, were the main attractions.

THE GEOLOGY

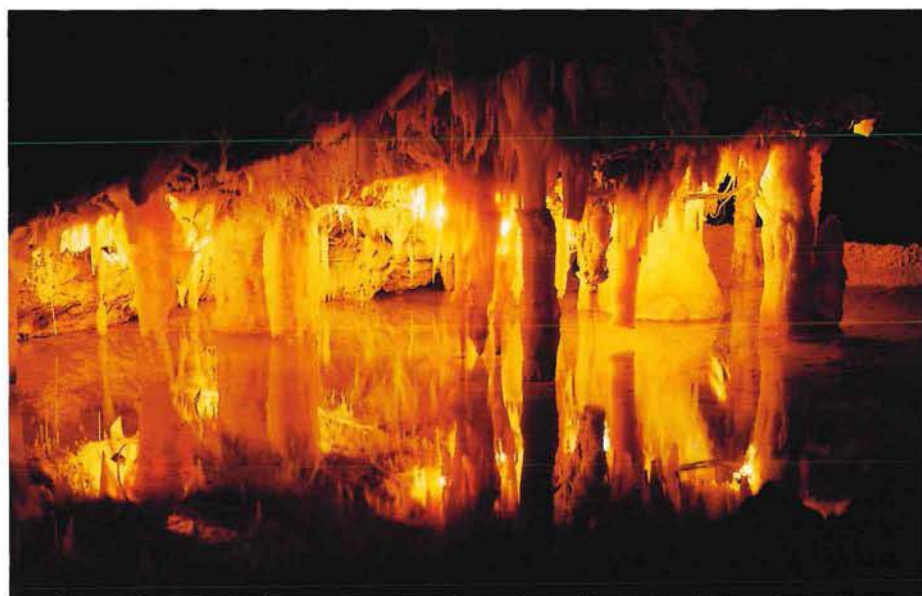
Yanchep National Park lies east to west across the Bassendean, Spearwood and Quindalup dune systems, all of which are less than one million years old. The present day geomorphology and vegetation patterns reflect these three systems.

It is in the Spearwood system that the extensive labyrinth of limestone caves, for which the park is famous, has been formed. There are currently more than 300 recorded caves in the park and

Top left: The name Yanchep was derived from the Aboriginal word for the bulrush (*Typha domingensis*). The roots of these plants were harvested by Aboriginal people who inhabited the area. Photo - John & Val Butler/Lochman Transparencies

Top right: Just like humans, kangaroos are attracted to the lush watered lawns of the park. Photo - Jiri Lochman

Above right: Crystal Cave's subterranean delights have been a popular attraction for decades. Photo - CALM



there could be as many as 1 000. Within the caves the slow movement of water through the limestone and soil has redeposited calcium carbonate to form the stunning cave decorations or speleothems that are synonymous with limestone caves. Few organisms can survive in limestone caves. However, studies by The University of Western Australia's Department of Zoology have led to the discovery of a unique underground ecosystem that survives, with no light and little food, on the root mats of tuart trees in the shallow underground cave streams. As many as 36 species have been discovered so far, many of which are new to science.

Fossil deposits in the caves give us an insight into the fauna of Yanchep's past. Bones of tammar and brush wallabies, dalgtye, quokka, chuditch, Tasmanian devil, thylacine (or Tasmanian tiger) and koala have been found. Evidence has also been found of long-extinct Pleistocene mammals, such as the enormous two-and-a-half-metre kangaroo *Sthenurus*.

Today, the park is still a refuge for a range of faunas that, elsewhere on the Swan Coastal Plain, have had their habitats and numbers significantly diminished due to the clearing of wetlands and woodlands.

MAMMALS

Twenty-one mammal species have been recorded in the park, of which six are introduced. Some native species have not been sighted in the park for many years, possibly because of predation by introduced foxes and/or cats, and are now considered locally rare or extinct. Among these is the chuditch (*Dasyurus geoffroii*), which has not been sighted since 1972, and the quenda or southern brown bandicoot (*Isooden obesulus*).

Other mammals are relatively common. The honey possum (*Tarsipes rostratus*) is found in the banksia woodlands and low heathlands in the park, where it feasts on the huge variety of flowering trees and shrubs. Honey possums rely solely on nectar and pollen for their food and need to be able to

access flowering plants all year round. Western grey kangaroos are prolific. They are frequently found in the developed recreation areas of the park, where they can be seen grazing on the lawns, and at the golf course, where golfers often need to dodge them on the greens.

Southern bush rats (*Rattus fuscipes*) are also common, especially around the wetlands. Another wetland inhabitant is the water rat (*Hydromys chrysogaster*), which feeds on the gilgies and marron in the lakes. Bats, particularly the lesser long eared bat (*Nyctophilus geoffroyi*), can be seen and heard stalking their prey of insects around the park. Unfortunately, introduced animals, such as rabbits, foxes and cats, are common in the park and probably account for the low numbers or absence of some of the medium-sized native mammals.

REPTILES

The area supports a variety of reptiles. Venomous tiger snakes (*Notechis scutatus occidentalis*) can be found around the wetlands, where they feast on a variety of frogs. Other venomous snakes, such as the dugite (*Pseudonaja affinis affinis*) and bardick (*Brachyaspis curta*), are also common and visitors need to be alert when walking in the park, especially in spring and summer. If you are lucky, you may see the rare and patchwork-camouflaged carpet python (*Morelia spilota imbricata*), which is non-venomous.



The long-necked tortoise (*Chelodina oblonga*) can be found in the wetlands on the edge of Loch McNess, where they are often seen just below the surface scavenging for crumbs missed by the ducks and coots. They are abundant near the boat ramp. The wetlands also contain a huge number of frogs, such as the moaning frog (*Heleioporus eyrei*), which lives in deep burrows from where it makes its long low moaning call. In the heathlands, especially after rain showers, you can find the curious turtle frog (*Myobatrachus gouldii*).

BIRDS

Birds are plentiful in Yanchep National Park. Forty-nine species of wetland birds and 92 species of land birds are recorded there. Around the wetlands black ducks, wood ducks, black swans, mountain ducks, pelicans, coots, cormorants and darters are common. At the edge of the lake you may see the shy musk duck (*Biziura lobata*), which at

Yanchep is unusually forward. In the picnic areas surrounding the Loch McNess wetland you will find grazing maned ducks (*Chenonetta jubata*) and the awkward looking, but beautifully coloured purple swamp hen (*Porphyrio porphyrio*). Some elusive, but equally interesting birds to watch for are the buff-banded rail (*Rallus philippensis*), blue-billed duck (*Oxyura australis*) and rainbow bee-eater (*Merops ornatus*).

One bird synonymous with the park is Carnaby's cockatoo (*Calyptorhynchus latirostris*), which flocks in large numbers especially during the summer. These birds feed in the pine plantations to the east and north of the park. They come into the park for water and to roost at night in the large tuart trees surrounding the wetlands. At some times of the year their raucous calls can be deafening.

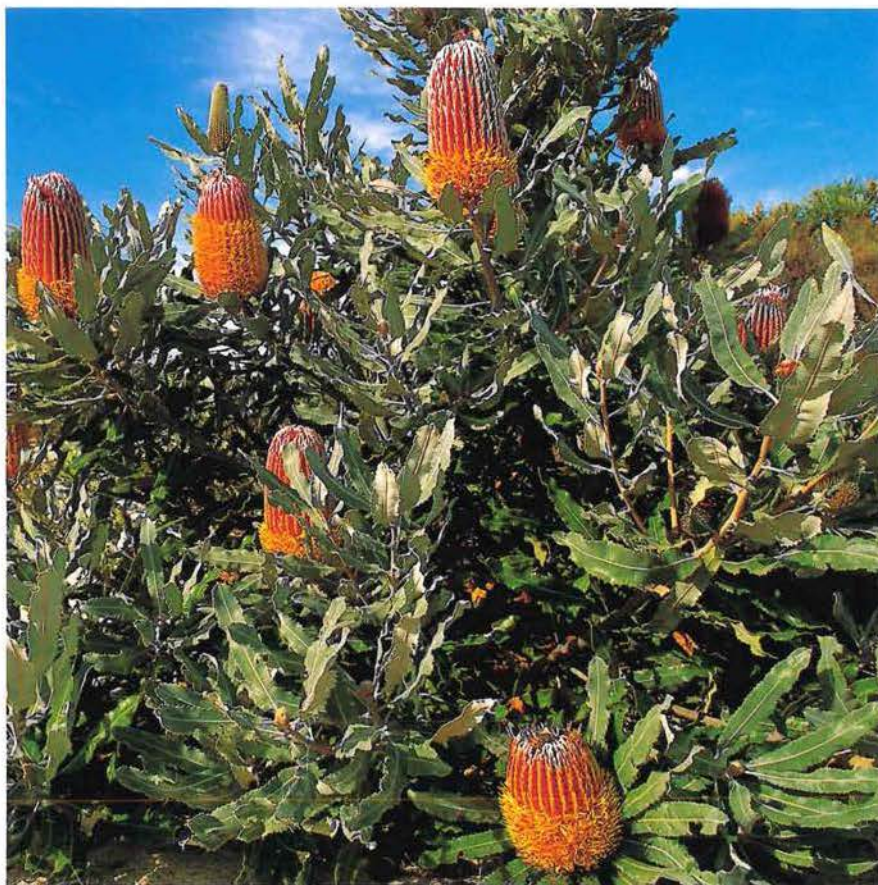
Birds of prey are also common. The collared sparrow hawk (*Accipiter cirrhocephalus*) nests close to the lake. Patrolling overhead you can often find the marsh harrier (*Circus aeruginosus*), little eagle (*Hieraaetus morphnoides*) and brown falcon (*Falco berigora*).

FISH AND CRUSTACEANS

There are three fish species recorded from Loch McNess: the native nightfish

Above: The call of the moaning frog (*Heleioporus eyrei*) is unmistakable.
Photo - Jiri Lochman

Left: Dugites are common in wetter parts of the park, especially during warmer months.
Photo - Jiri Lochman



(*Bostockia porosa*) and two introduced species, the mosquito fish (*Gambusia affinis*) and golden carp (*Carassius auratus*). The latter was originally introduced to provide sport fishing for visitors to the park.

Many crustaceans, including gilgies and marron, occur and freshwater mussels are common, particularly at the boat ramp.

TREES AND WILDFLOWERS

The flora of Yanchep National Park is typical of large areas of the coastal plain north of Perth. The principal trees are tuart (*Eucalyptus gomphocephala*), jarrah (*E. marginata*) and marri (*E. calophylla*), which together with a characteristic set of shrubs and smaller trees, including coast honey-myrtle (*Melaleuca acerosa*), occupy a large part of the western portion of the park.

There are also extensive heathlands in the northern and eastern sections, that are composed largely of banksia woodland with scattered stands of sheoak (*Allocasuarina* spp.), prickly bark (*E. tottiana*), blackboys (*Xanthorrhoea* spp.), grasstree (*Kingia australis*), and zamia (*Macrozamia riedlei*). Bull banksia (*Banksia grandis*) is common near the swamps, whereas firewood banksia (*B. menziesii*) and candle banksia (*B.*

attenuata) occur widely elsewhere.

These woodland and heathland areas also support shrubs and ground covers of yellow flowered native buttercups (*Hibbertia hypericoides*), prickly Moses (*Acacia pulchella*) and other wattles. Trails of native wisteria (*Hardenbergia comptoniana*) and old man's beard (*Clematis microphylla*) twine among the yellow-flowered wattles, providing a colourful display each spring. The purple hoveas (*Hovea* spp.), smooth heliotrope (*Heliotropium curassavicum*), lilac hibiscus (*Alyogyne huegelii*) and red trailing coral vine (*Kennedia coccinea*) are other springtime favourites.

The large red and green kangaroo paw (*Anigosanthos manglesii*), the floral emblem of Western Australia, grows in profusion in the park, often with the smaller catspaw (*A. humilis*). The creamy yellow-flowered parrot bush (*Dryandra sessilis*), one sided bottlebrush (*Collothamnus quadrifidus*) and red

peapod-shaped flowers of the templetonia or cockies' tongues (*Templetonia retusa*) form dense thickets on the coastal dunes and limestone ridges, and provide nectar for flower-seeking birds.

The lakes and swamps, which stretch in a chain from the north to the south of the park, support their own suite of vegetation. Freshwater paperbarks (*Melaleuca raphiophylla*) are found in low-lying swampy areas, along the lake's edge or in the water itself. Bulrushes and sedges are also common in these areas.

There are many areas of the park, particularly in the southern section, that still contain relatively undisturbed examples of most of the vegetation types found on the coastal plain near Perth, and this is one of the factors that makes Yanchep National Park an important natural asset and a popular destination for visitors.

But the park has always been a special place to visit and the changes taking place now will continue make it popular for a new generation of visitors without disturbing the natural values it has to offer.

THE FUTURE

Work has been under way since 1990 to revitalise Yanchep National Park. A master plan, which separates vehicles and walkers and makes the lakefront area a pedestrian only zone, was prepared for the main recreation area. The plan also provides for new walktrails, picnic



Above: Firewood banksia (*Banksia menziesii*) flowers prolifically during early spring.
Photo - Jiri Lochman

Right: Parrot bush (*Dryandra sessilis*) is a favoured food of many birds and the honey possum.
Photo - Jiri Lochman

and barbecue areas, rest areas and courtyards, an upgraded koala exhibit and new car and bus parking areas. The planners studied historic photos of the park and have based some of their plans on the original 1930s design.

The renovation of McNess House, the park's new Visitor Centre, recaptures the charm and style of the 1930s era. Here, visitors can find out about the park's special features, get information about what to see and do and how to get around, or watch an audio-visual presentation about the park. The first floor is used as a classroom for school and adult education programs.

CALM has linked with the private sector to achieve many of the changes

needed to meet modern visitors' needs at Yanchep National Park. A lease was recently signed for a private company to operate the Yanchep Inn, caves, rowing boats, and golf course, and to maintain the picnic areas. Under this agreement, Yanchep Inn will be renovated and extended to include more accommodation, a winter lounge and upstairs function centre. New tea rooms, which will overlook the lake, are due to be opened in early 1994.

As well as the physical changes to the park, more subtle changes have taken place. Relieved of many of the routine maintenance tasks of the past, the National Park Rangers have been able to turn their attention to providing activities

and information. Visitors to the park can now join a wide range of activities, including bush tucker trails, adventure caving, instruction in survival bushcrafts, bird watching and much more.

Yanchep National Park remains unique for the range of recreation opportunities it offers and its conservation values. The park contains vast areas of banksia woodland, with patches of tuart forest and attractive heathlands, both of which are declining in the face of the urban sprawl elsewhere near Perth. In all, seven vegetation communities have been recognised within the park and these provide important habitats for a wide range of animals. The draining, reclaiming and clearing of most of Perth's wetlands has left us with little of the vast system of lakes and swamps that were once widespread on the Swan Coastal Plain. Loch McNess is one of the most pristine wetland remaining north of the Swan River. As a window into the groundwater table of the Gnangara mound, it reflects the health of this vital resource.


The park development plans recognise the importance of the natural values of the area and will help ensure that future generations will be able to enjoy the beauty and diversity of plants and animals that were once so common through the entire coastal plain. The rebirth of Yanchep National Park is an exciting time and in many ways reflects the changes in community attitudes and needs.



Above left: Originally introduced in 1938, captive koalas continue to be a popular attraction in the park.
Photo - Jiri Lochman

Left: McNess House, once a guest house, has been renovated to become the Park Visitor Centre.
Photo - Rod Annear

Rod Annear is Visitor Services Officer at Yanchep National Park and can be contacted on (09) 561 1004. David Gough is Editor of *LANDSCOPE* and can be contacted on (09) 389 8644.



FASCINATING *Phascogales*

BY SUSAN RHIND

If you go down to the woods today, you are very unlikely to come across a phascogale.

These engaging creatures are among the most elusive of our native marsupials, but a researcher from Murdoch University is uncovering some intriguing facts about their unorthodox lifestyle.

Most Australians have never heard of a phascogale, let alone seen one. While in the bush, a man recalled spotting what he took to be an enormous black hairy caterpillar on a fence post. It was only when a small furry face appeared that he realised it was a very large tail attached to a small mammal. The brush-tailed phascogale of the South West (*Phascogale tapoatafa tapoatafa*) is a member of the marsupial group of animals known as the dasyurids. Its squirrel-like appearance and tree-dwelling habit have earned it the nickname 'native squirrel', but unlike squirrels, all the dasyurids are carnivorous. The scientific name is a combination of the scientific term 'phascogale', meaning pouched weasel, and the Aboriginal name *tapoa tafa*. In Western Australia, the animal is known by its Aboriginal name (wambenger), and in eastern Australia it is known as a tuan.

Phascogale tapoatafa is not a household name, not just because it does not exactly roll off the tongue, but because its owner is extremely elusive. There are several reasons for this. It occurs sparsely throughout the forests of Australia, and the fact that it is arboreal (tree-living) as well as nocturnal means that you have to be very lucky to spot one. Although the animals are small (females weigh only 100-160 g, males 140-280 g), they require large ranges and the females appear to be territorial. Each female seems to require a territory of 20-60 hectares. Although information on males is insufficient, their territories are even larger. At least one male in Victoria is known to have travelled a distance of 17 km in the breeding season.

Another reason why phascogales are rarely seen is the large annual drop in their population. In common with their nearest relative, the red-tailed phascogale (*Phascogale calura*), and a number of

the smaller dasyurids (*Antechinus* species), the males adopt the somewhat extreme strategy of dying off each year at the end of the winter mating season. During the breeding season, large amounts of hormones flood the males' bodies. As well as preparing them for mating, the hormones have side effects: they cause bleeding, a tendency for gastric ulceration and suppress the immune system. This form of built-in obsolescence means that males die from gastric haemorrhage or stress-related illnesses after the mating season. In addition, in order to encounter as many females as possible, the males must cover considerable distances. In doing so, they spend less time than usual up in the trees eating, and more time moving on the ground, where they are vulnerable to predators. It is likely that many fall victim to the introduced fox and cat.

Phascogales are rarely caught during routine mammal surveys, partly because they are cautious about entering traps and partly because they are extremely good escape artists. Given this talent for escapology, their nocturnal and arboreal habits, the low density of the animals and the large annual changes in population, it is hardly surprising that phascogales are rarely seen. Those who have had an encounter with this extraordinary creature regard it as a unique experience. The animal is about 40 cm long, silver-grey with a cream belly, and has a magnificent black bottle-brush tail. When in action, it can be electric in its movement and remarkably agile, scampering upside down with ease.

A northern subspecies of brush-tailed phascogale is recognised (*Phascogale tapoatafa pirata*), but few of these have



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The phascogale easily clings upside down on trunk bark.

Photo - Jiri Lochman

Left: Phascogales climb with lightning speed, scaling the tallest tree in seconds.

Photo - Babs and Bert Wells

Far right: Jarrah and other trees provide the phascogale with bark, which the animal shreds. It then uses the strips to line its nest.

Photo - Jiri Lochman



been captured. Those that have been found in the Kimberley region of Western Australia, the Northern Territory and northern Queensland are smaller than their southern relatives, have slightly different dentition and are subtly different in colour.

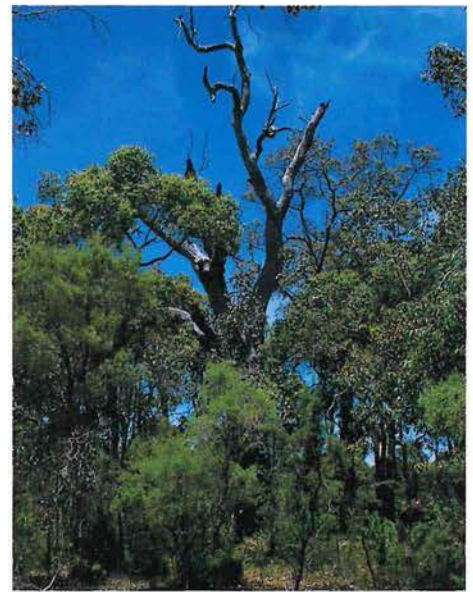
After the winter mating season, the males die, leaving the females to rear the young. After a 30-day pregnancy, up to eight young are born, find their way to the pouch and attach themselves to the nipples. Seven weeks after birth, the young are deposited in a tree hollow by the mother, who returns to feed them in between her nightly foraging expeditions. The young begin to emerge from the hollow at about three-and-a-half months and start dispersing in early summer at five months of age. The young males disperse earlier than the females, and travel further before settling into an area, which may be kilometres away from the maternal nest.

After leaving the family nest, phascogales lead a solitary life. Although



there are accounts of animals sharing a nest, this seems very rare. All phascogales are short-lived, but unlike the males that die after one year, it seems that about half of the females survive their first year and have a second litter of young in their second year.

The phascogale is one of the most arboreal of the dasyurids. It gleans insects from trees, and depends on trees for hollows in which to nest. The clearing of forests for farmland has reduced its range throughout Australia, and in New South Wales and Victoria its range has declined by 40 per cent. The last confirmed sighting of a phascogale in South Australia was in 1967 and they may be extinct in that State. In Western Australia, the brush-tailed phascogale is considered extinct in the Wheatbelt. Recent fossils



found near Balladonia and at Coalseam Reserve near Geraldton suggest that phascogales might have been far more widespread in Western Australia at the time of European occupation than they are now. It is estimated that their range has contracted by about 30 per cent in Western Australia, and they are now confined to the jarrah and karri forests of the South West.

NESTS AND HOLLOWES

If we are to ensure the conservation of the species, detailed information on the biology and habitat requirements of phascogales is needed. In 1992, Murdoch University began a four-year research project to investigate these factors. Phascogales were known to use artificial nest boxes at the Perup Forest Ecology

Above left: Nest boxes being made from second-hand pine at CALM's Manjimup workshop.
Photo - Murdoch University

Above centre: The author identifying insect parts in phascogale scats.
Photo - Murdoch University

Above right: Habitat trees are located by searching out radio-collared phascogales during the day when they are asleep.
Photo - Murdoch University





Phascogales in Western Australia are now found only in the jarrah and Karri forests of the south-west.

Photo - Jiri Lochman

Centre near Manjimup, run by the Department of Conservation and Land Management (CALM), so this location became the starting point for the research. The nest boxes had originally been placed in trees to attract hollow-nesting birds, but phascogales obviously found them attractive too.

In order to catch animals in the numbers required for research, several study sites were established, more nest boxes were put in place and a trapping program was begun. Given the phascogales' talent for escape, traps were modified to include a lock mechanism designed by Todd Soderquist, who has been studying phascogales in Victoria for several years.

When animals are caught or retrieved from nest boxes, they are sexed, weighed, measured, individually marked with an ear tattoo and released. Some individuals

are fitted with radio-collars before being released, and their movements followed. During the day, the phascogales nest in tree hollows and can be radio-tracked to these trees. Detailed information is taken on the location and characteristics of the trees that bear hollows suitable for phascogales. As the hollows cannot be assessed directly, the number of times that an animal uses the same hollow is taken as a measure of the quality of that hollow. Preliminary results show that all hollows are not equal. Young adults appear to use several hollows within their range (some only once), before settling down to use fewer, 'better quality' hollows. Typically, a 'quality' hollow is used for 3-5 days before the animal moves residence, but there are, of course, exceptions. One male was known to use the same hollow for at least 30 days in a row. The hollows that are used repeatedly

are usually in much larger trees than those that are used only once, and the trees are typically mature or dead.

The nests that phascogales make in nest boxes are lined predominantly with shredded jarrah bark, although paperbark and feathers are added when available. The nests that females make in which to raise their young are extremely fine; they put considerable effort into shredding bark and collecting fur, feathers and wool. Ellis Troughton noted in his classic work *Furred Animals of Australia* (1941): 'On one occasion the disappearance of a pound-note caused a distinctly strained feeling in a timber-cutters' camp, until it was discovered in a brush-tail's nest when a nearby tree was felled'.

In addition to radio-tracking animals during the day, night-time radio-tracking is undertaken to record behavioural data. Unlike most Australian marsupials, phascogales are very tolerant of being quietly followed and watched under spotlight. With care, the animals can be approached as they forage and will continue to behave normally. If an animal is annoyed, it will either sit still and glare at the intruder or tap its feet loudly.

Phascogales are primarily arboreal insectivores. They explore the tree bark, examining all the crevices and bulldozing the bark off with their noses in search of the insects underneath. Sometimes they are meticulous in their searching and will cover even the tiniest twig on every tree limb, whereas at other times the search is cursory. The number of trees that are covered in a foraging expedition can vary enormously. In addition to tree insects, animals have been observed eating the brilliant red flesh of zamia nuts, and licking marri sap. There are accounts of phascogales creating havoc in chicken yards by killing chickens, but this is probably a rare event. They are undoubtedly opportunistic when it comes to food, eating whatever can be caught and subdued, but tree insects are clearly their staple diet.

Phascogales move from tree to tree, either by jumping short distances of up to two metres between the canopies, or by coming down the trunk and quickly bouncing along the ground to the next tree. The amount of time they spend on the ground varies considerably between individuals, and males certainly spend much more time on the ground during the mating season than they would normally. In general, an animal will spend only a few seconds on the ground between trees, but one night, I was watching a male who wandered around on the ground for at least half an hour, and on two occasions bounded over and circled my feet. This type of curiosity is not uncommon.

From radio-tracking information, data on activity is also being gathered.

Phascogales emerge after dusk, forage for a couple of hours, return to the nest to rest, then re-emerge to hunt for several hours before returning to a nest at dawn. The amount of time spent resting depends on night-length: on long winter nights they appear to sleep for 3-5 hours. Many nocturnal species are less active on moonlight nights, perhaps to avoid predators, but phascogales do not seem unduly deterred by moonlight, and appear to continue their foraging regardless.

CONSERVATION

Predation of phascogales is difficult to determine in a study, unless radio-collared animals are killed. Of five such animals killed fairly recently, four deaths were attributed to a cat and one to a fox



or dog. About 60 per cent of the phascogale specimens in the WA Museum were handed in following cat kills, and there are numerous anecdotes of phascogales being brought home by the family cat. Clearly cat predation is a serious problem (see 'Masterly Marauders' in *LANDSCOPE*, Summer 1992-93), but there are other, less obvious predators. Phascogale remains have been found in tiger quoll faeces in eastern Australia, and it is quite possible that our own quoll, the chuditch, preys on phascogales. In order to determine this, the faeces of chuditch (which also occasionally enter the phascogale traps) are collected for analysis. Other known predators of phascogales in eastern Australia include the powerful owl and the goanna. The feral motorcar also claims phascogale lives: 35 per cent of WA Museum specimens were killed on the roads. Deaths caused by both cars

Above: Unlike the solitary brush-tailed phascogale, the red-tailed phascogale shown here is a social animal. It is more at home in areas of allocasuarina (shown here) and wandoo rather than jarrah.
Photo - Jiri Lochman

Left: Radio-tracking collared animals provides an insight into their behaviour. The radio collar weighs only 4 g, and the whip aerial bends easily as the animal moves in and out of hollows.
Photo - Jiri Lochman



INFORMATION WANTED ON PHASCOGALES

The author would appreciate any information on sightings of animals around Perth, north and east of Perth, and any region east of the Albany Highway. The most important information is: exact location, date, description of the animal and its activity, surroundings, contact name and address.

Details should be mailed to Susan Rhind, School of Biological and Environmental Sciences, Murdoch University, South Street, Murdoch WA 6150.

and predators are greatest during the period of dispersal of the young in summer and during the mating period (May-July). Almost twice as many males are killed as females, which is largely a reflection of their greater ground movement.

The range of the brush-tailed phascogale has contracted throughout Australia. These animals need large territories, which cannot be provided by small, isolated reserves, and are strictly dependent on forest which contains mature trees with hollows. Proper conservation is therefore of great importance. As large-scale agricultural clearing has now all but ceased in the South West forests, timber cutting and predation by feral animals are the remaining potential threats to phascogale populations. Much work is being done to find controls for feral animals, and logging practices continue to be modified. Some measures are already in place, such as leaving habitat trees and strips of mature vegetation in areas where jarrah is harvested; the effectiveness of these will be monitored at least during the present research. Furthermore, large areas of mature forest have been set

aside as parks and reserves, where timber cutting and mining are not scheduled.

With so much of the Wheatbelt devoted to farming, the forests of the South West are now the one habitat of the phascogale in Western Australia. It has been suggested in the eastern States, however, that phascogale populations may be particularly affected by some methods of logging. Similar information is needed for Western Australian conditions; the findings would help in devising harvesting practices that maximise phascogale conservation. For that reason, CALM is very supportive of the current research into the impact of logging on the phascogale. In co-operation with CALM, study sites have been established in an area designated for timber cutting in 1995. Detailed information will be gathered before, during and after logging to determine its impact and the measures to be adopted to minimise it.

Phascogale populations have already declined throughout Australia. More information on their habitat requirements is needed if we are to prevent future losses of this delightful creature.

Susan Rhind is a postgraduate student at the School of Biological and Environmental Sciences at Murdoch University in Western Australia. She can be contacted on (09) 360 2468.

This project has been helped immensely by numerous volunteers, the advice and support of Todd Soderquist at Monash University, the WA Museum, major financial assistance from *Australian Geographic* and the Australian Federation of University Women, and the practical support and co-operation of the Department of Conservation and Land Management.

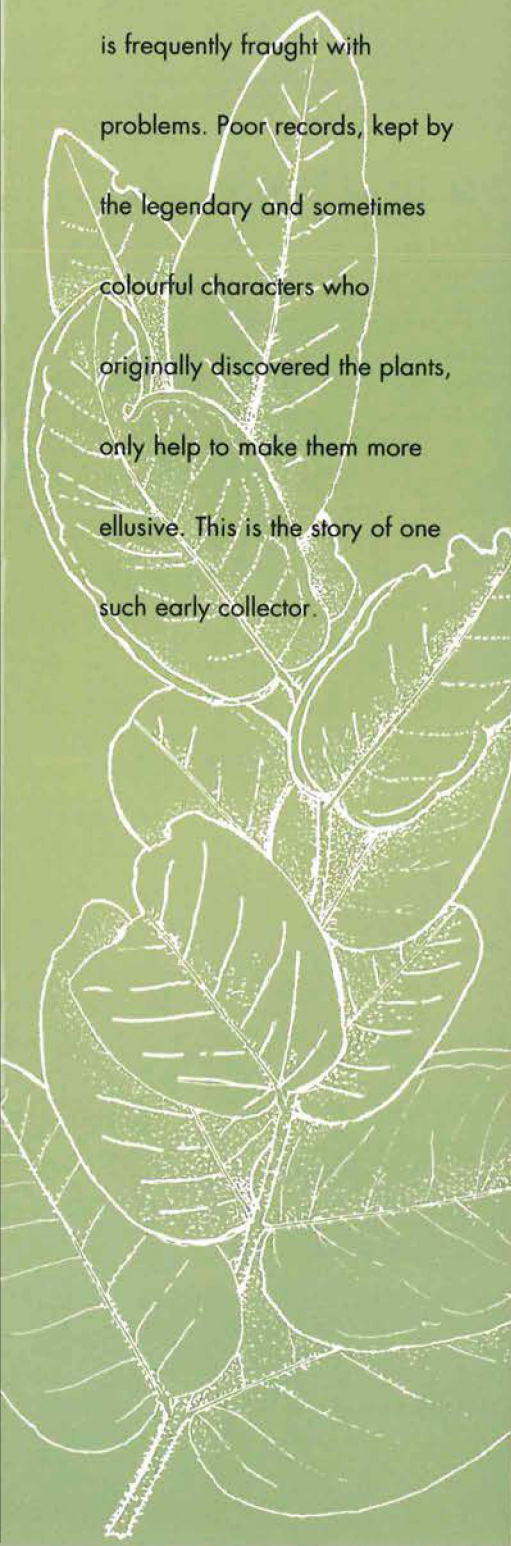
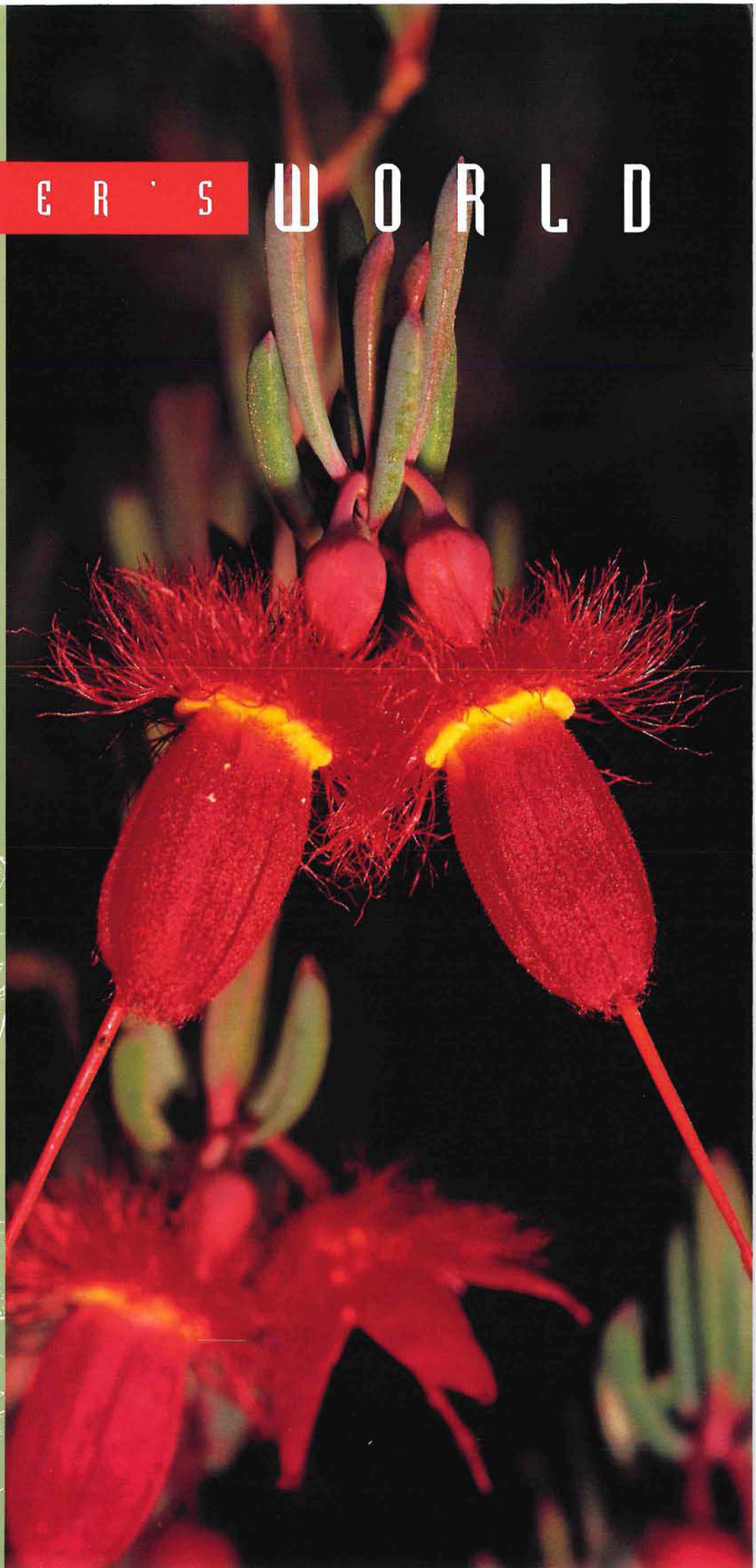
Phascogales frequently nest in the hollows of dead and decaying trees.
Photo - Babs and Bert Wells



GARDENERS' WORLD

by Rob Buehrig and
Kate Hooper

The quest to relocate some of Western Australia's rare plants is frequently fraught with problems. Poor records, kept by the legendary and sometimes colourful characters who originally discovered the plants, only help to make them more elusive. This is the story of one such early collector.



Western Australia has an array of plants that rivals those of the species-rich tropical regions of the world. It is estimated that there are about 9 000 species in the area from Shark Bay to Israelite Bay alone.

Pioneering botanists such as James Drummond, Ludwig Preiss and Charles Gardner contributed much to our knowledge of the flora of Western Australia, but the State covers such a vast area and encompasses such a rich variety of plants that much botanical exploration remains to be done. It may come as a shock to some to realise that some of the estimated 12 000 plant species thought to grow in Western Australia have only been collected and documented once or twice, some as long ago as the 1840s, and have never been rediscovered since. Having a plant specimen without knowing where to find the plant is somewhat academic, we are continually looking for ways to retrace the steps of the early collectors.

Charles Gardner was one of the most influential figures in the rich history of botanical study in Western Australia, and also one of its great personalities. As Government Botanist, Gardner is credited with having collected 10 000 to 12 000 plant specimens, and he named a large number of the plant species in WA.

A DEVOTION TO PLANTS

Gardner was an enigmatic figure, remembered by many Western Australian botanists for his idiosyncrasies as well as his prodigious knowledge of plants. Plants were his life. His fascination with them led him to roam the entire State over a period of 50 years, collecting, naming and characterising its plants. He described eight new genera and some 200 new species.

Charles Austin Gardner was born in England in 1896, into a Lancastrian farming family. He developed an interest in botany at an early age, starting his first herbarium (collection of dried plant specimens) when he was about 11 years old. When Charles was 13, the Gardners sold their farm and emigrated to Western Australia, arriving in Albany in November 1909. They settled on a property near Yorkrakine in the central Wheatbelt, where the abundant wildflowers must have spurred young Charles' burgeoning interest in plants.



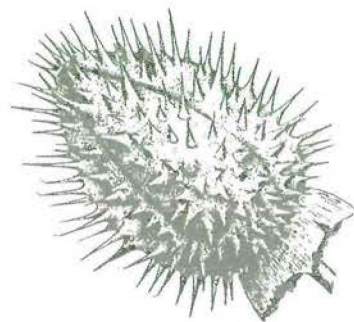
Throughout his teens and early twenties, while working as a bank clerk, Charles Gardner extended his knowledge of the local flora; collecting and identifying plants around Yorkrakine, and lovingly producing drawings of them. He made a name for himself among amateur botanists and, most importantly, impressed D.A. Herbert, then Economic Botanist and Plant Pathologist with the Department of Agriculture. As a result he was appointed Forests Department Collector in 1920, an opportunity that turned his obsession with plants into a career.

As luck would have it, one of his earliest commissions was to accompany an expedition sent by the Surveyor-General's office to survey the northern Kimberley in 1921. It must have been overwhelming to enter a region hardly touched by settlers; indeed, the expedition came into contact with Aborigines who had never seen Europeans before. Gardner must have been overawed by the plants he encountered, many of which had never been described and were unlike any he had seen before. The collections he made on that expedition launched his professional career: he described 20 new species and added a new family to the known flora of Western Australia.

In 1924 Gardner transferred to the Department of Agriculture, and in 1929 at the age of 33 he was appointed Government Botanist and Curator of the WA Herbarium, a post he held until the age of 65.

Gardner had a photographic memory, and an astonishing ability to identify local plants on the spot. He could even identify exotic plants that he had never seen before, simply by remembering their descriptions. His intimate knowledge of soils, aspects, climate and flowering times gave him the ability to examine a set of specimens and say exactly where they had been collected. When collectors brought plant specimens to the Herbarium, he took delight in saying something like, 'Don't tell me, let me examine them. You have been to Wongan Hills, Dalwallinu and Moora'. And he was invariably right.

With the help of his friend Father William Gimenez of the Benedictine Monastery at New Norcia, he became



Previous page
Rapier feather flower (*Verticordia mitchelliana*).

Photo - Jiri Lochman
Illustrations by Charles Gardner

Above: Phalanx grevillea (*Grevillea candelabroides*) is just one of many striking species documented by Gardner.

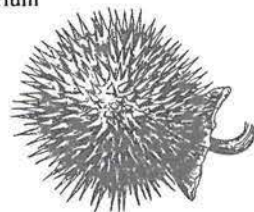
Photo - Charles Gardner



Left: *Verticordia etheliana* was named in 1941 after the wife of Dr W.E. Blackall, an eminent amateur botanist who produced illustrated keys to the flora of south-western Australia.
Photo - M&I Morcombe

Below left: Charles Gardner.
Photo - WA Herbarium

Below right: This 'plant with no name' was collected by Gardner, but he gave no details of the species or its location.
Photo - WA Herbarium



fluent in Latin, the language of botany. He often wrote his collecting notebooks and labels in Latin, a habit that has made the task of unravelling his notes rather more difficult!

Gardner's collecting trips were prolific. He documented many of the State's most striking species, such as the phalanx grevillea (*Grevillea candelabroides*) and the rapier featherflower (*Verticordiamitchelliana*), which has a pendulous woolly flower with a sharp rapier-like protruberance. Gardner would collect and press enormous numbers of plants, his besetting sin being that he was often so eager to move on to the next plant that he would neglect to label the specimens. His collecting notebooks were often

written up much later, and despite his prodigious memory, errors must have occurred.

Of course, even when he knew exactly where he had found a plant, it was not always easy to provide a specific location. Modern botanists record plant locations using geopositioning systems, giving latitude and longitude, but in Gardner's day such precise methods were not available.

He would probably have taken the train to somewhere like Dalwallinu, then hired a horse and cart, or later a motor car, from a local farmer and rambled around the area. A specimen labelled 'Dalwallinu' might have been found anywhere within a 30-40 kilometre radius of the town.

SHARING THE KNOWLEDGE

There is an intriguing plant specimen in the WA Herbarium, mounted on one of Gardner's herbarium sheets, which is otherwise left blank.

The 'plant with no name' is a fascinating-looking plant, probably a new genus, perhaps related to the feather flowers (verticordias) or to the darwinias. Could he not remember where he had found it? Or was he so keen to keep the finding to himself that he did not record details of its locality? Botanists at the Herbarium have since tried, without success, to find out from where it came. The secret of this mysterious plant may have died with Gardner.

The 'plant with no name' reveals another facet of Gardner's character: he





was often reluctant to share his knowledge with other scientists. With his vast knowledge of plants and their relationships, his great ambition was to write a complete *Flora* of Western Australia. But, like many a gifted perfectionist, he was reluctant to share the huge task of classifying the plants he had discovered.

Charles Gardner made an outstanding contribution to the study of the State's flora. However, the irony is that instead of being a catalyst for research into the plants he loved, he may have hampered research by his determination to encompass the whole of the local botany himself. He could have used the skills of the many informed amateur plant collectors in the State, but instead he tended to freeze them out. The tragedy is that although he made copious notes, he never completed the comprehensive *Flora* of WA that he was so uniquely positioned to write. The first volume of this *magnum opus* (*Flora of Western Australia Vol.1 No.1, Gramineae*, published in 1952) was the only part he completed. Many of his observations were never published, and have been lost.

Paradoxically, in some respects he was generous in sharing his knowledge of plants. His *Wildflowers of Western Australia*, first published in 1959, is now in its eighteenth edition, and is still considered an inspired work on the subject. He was a gifted speaker, with the ability to inform and enthuse his audience, and was much in demand. In his day his lectures on wildflowers packed Perth's Town Hall. He gave numerous

radio talks and acted as a botanical guide. He also lectured on systematic botany at the University of Western Australia for nearly 40 years.

Charles Gardner never married; his great love in life was plants. Even after his retirement he continued to collect and record plants, but ill-health overtook him before he could complete his ambitious systematic *Flora*. He died in 1970.

CONSERVING THE LEGACY

Charles Gardner's legacy lies in the many plant specimens he collected, and in some of our nature reserves and national parks. He had a strong commitment to conservation, and the vision to realise that on a world scale, some areas of the State were extraordinarily rich in plant species. He used his gift for expression to extol their virtues and to urge the government to set aside large reserves such as Cape Arid and Fitzgerald River, which now protect many rare and endangered species.

Although national parks and reserves have a vital role in conserving our flora, they do not contain all our rare species. Unfortunately, our knowledge of some rare and endangered plants is sketchy. For some specimens in the Herbarium, it is not known whether the species still grows at the site at which it was originally collected, let alone elsewhere.

The Department of Conservation and Land Management (CALM) has initiated a series of Wildlife Management Programs, to provide information on the appearance, distribution, habitat and conservation status of the wildlife and



Above left: A specimen of (*Melaleuca arenaria*), recently rediscovered by Rob Buehrig more than 70 years after Gardner first discovered it.
Photo - CALM

Above: *Eucalyptus jucunda*, one of the many plants described by Gardner.
Photo - Steve Hopper

Declared Rare (and Priority) Flora in particular Districts and Regions. This information will allow the Department more effectively to conserve and manage our rich flora and fauna.

When the original collector's notes on a plant species provide information on location, soil type, landform, aspect and association with other plants, it is possible to design the survey so as to increase the chance of rediscovering the plant.

Normally, a survey of the plant life of an area begins with a search of the Herbarium records, to produce a list of all the plants known to have been collected in that area previously and their locations.

This may not prove as simple as it sounds: part of the difficulty in rediscovering rare species lies in the lack of information given by some collectors. Charles Gardner was by no means the only botanist to provide imprecise information on the locations of plant specimens; the nineteenth

century collector James Drummond was notoriously vague about locations. One of Drummond's most infamous specimens is simply labelled 'New Holland', and another 'Swan River Colony'. For this reason, tracking down rare plants can involve some detective work.

RETRACING THE STEPS

In the case of rare plants for which there is little information, we can sometimes do little more than familiarise ourselves with the specimens available and hope eventually to find the plants during the course of other survey work. On other occasions there are clues that give direction to the search.

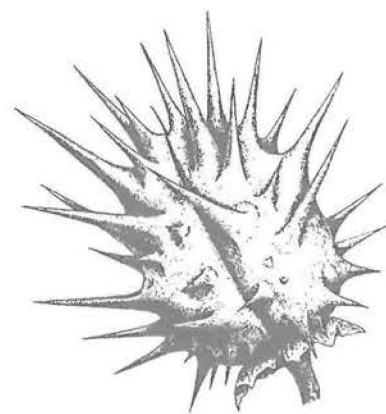
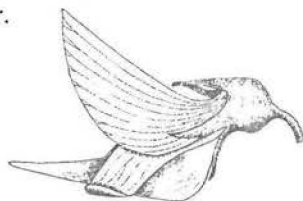
Even though Gardner's locations are often imprecise, he prided himself on correctly describing the plant's habitat. His soil descriptions were very accurate. As soils often faithfully reflect the underlying bedrock, one key to unlocking Gardner's locations, and to rediscovering some of our rare and endangered plants, could be geology.

By making educated guesses as to the rock-type preferences of particular species, one can use geology to inform the search for them. The reverse technique, using vegetation to map

minerals, is not new. For example, particular plants are known to favour copper-rich soils, and prospectors will take their occurrence as an indication of the nature of the bedrock. Here, we use geology to prospect for the plants.

A benefit of this method is that, by noting the rock types found in reserves and parks, it is possible to forecast which rare species one might expect to find there. In looking for a book on a crowded bookshelf, it helps to have a mental image of the cover. In the same way, if one surveys an area with a rough idea of what rare plants one might expect to find there, one is more likely to pick them out. In this way, new populations of endangered species may be found (see 'From Buckshot to Breakaways', *LANDSCOPE*, Spring 1993).

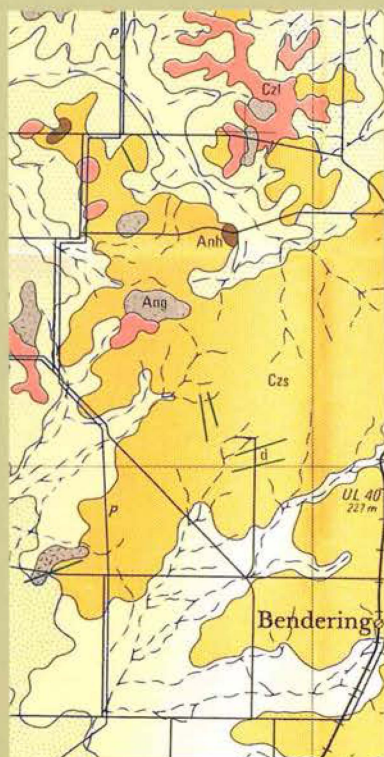
This approach is simple, cheap and has great potential for locating rare and endangered plants. It may save time in the field by focusing our search. It may also resolve some of the mystery surrounding a great botanist, Charles Gardner.



Rob Buehrig is a CALM Senior Technical Officer at the Dwellingup Research Station. He is currently working on a Wildlife Management Program for the Narrogin District. He can be contacted on (09) 538 1145.

Kate Hooper is a contributing editor to *LANDSCOPE* and can be contacted on (09) 384 5711.

The assistance of Acting Director of the WA Herbarium Neville Marchant, who provided much of the biographical detail on Charles Gardner, is gratefully acknowledged.



GEOLOGY AS A TOOL

How does one go about using geology to find rare and endangered plants? The first step is to pinpoint all of the original sites of collection, as closely as possible, on geology maps. If a plant species has been collected more than once, we can look for geological features that are common to the different locations. In this way, it is often possible to define a species in terms of the geological formations that it favours.

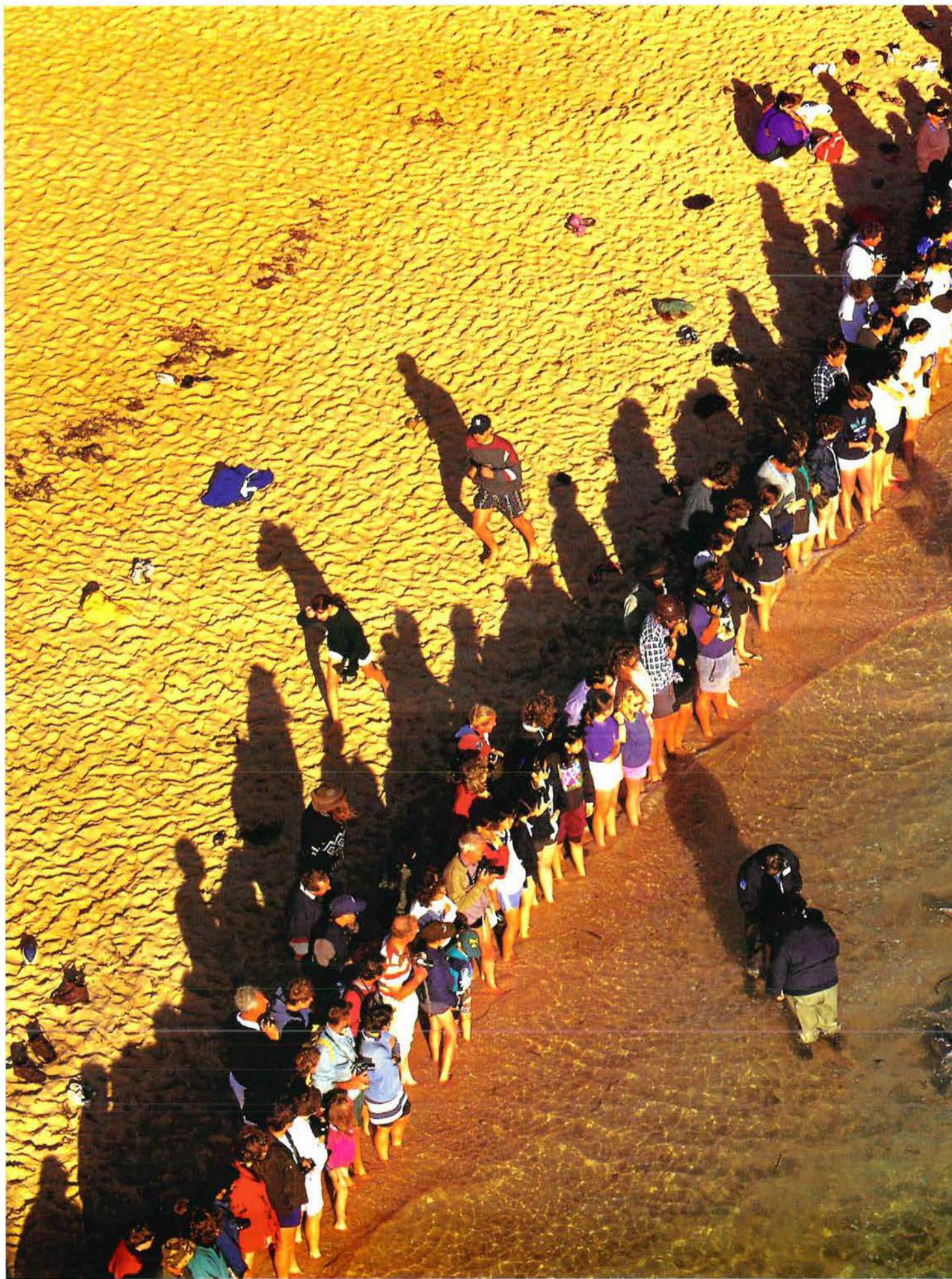
Of course, in some instances the collector gives helpful clues. The species *Melaleuca arenaria* had been collected only once, in 1922, near Bending by Charles Gardner. It had never been found since, and was described as: 'Presumed extinct and unknown in cultivation. There seems little hope that this species will be rediscovered'. But Gardner described the habitat of *Melaleuca arenaria* as '...yellow sandy gravelly soil...'. He also named the plant *arenaria* meaning 'pertaining to, or growing in, sand'. Interestingly, the geological map of the Bending area includes a formation described in the key

as 'Reworked Cainozoic sandplain: yellow and white sand containing locally abundant limonite pebbles'. This formation may be the basis of the soil that Gardner described, and it is something to work on. Looking at the geological map around the place that I estimate Gardner must have collected *M. arenaria*, I found this type of sand formation in a large nature reserve nearby. Thus, without stepping from the office, a strategy was laid.

In the case of this plant, the strategy paid off. The next time field work took me near that nature reserve I was able to follow up the hunch. As I stepped from the car I was surrounded by *Melaleuca arenaria*, growing in abundance more than 70 years after Gardner first discovered it.

Rob Buehrig

The geological survey map of Corrigin used to help find the *Melaleuca arenaria*. Map - Courtesy of the Geological Survey of Western Australia





TRAVEL COMPANIONS

the Visitor,
the Tour Operator
and the Manager

by Gil Field and Kate Hooper

Co-operation between CALM and professional tour operators is making our national parks and reserves more accessible and helping visitors to appreciate their environmental and cultural values, while preserving the unique landscapes and ecosystems they come to see.

With its huge tracts of wilderness and its many natural wonders, Western Australia has much to offer the tourist seeking a unique natural experience (see 'Our Natural Advantage', *LANDSCOPE*, Winter 1993).

Nature-based tourism is on the move in Western Australia. For example, in 1992 more than 250 000 people visited the stunning Kimberley region in the north-west of WA. About 126 000 visits were made to Kimberley national parks and, not surprisingly, parks such as Geikie Gorge near Fitzroy Crossing and Mirima (Hidden Valley) at Kununurra, which are accessible all year round by conventional vehicle, were the most heavily visited. The more remote parks that require an 'off-road' vehicle for access, such as Purnululu and Wolfe Creek Crater, had far fewer visitors.

One of the main reasons people visit the Kimberley area is to experience the remoteness of its rugged landscapes, and currently the majority of tourists travel there independently. This is reflected in the fact that more than 70 per cent of visitors to the Kimberley are from Western Australia, and only about four per cent are from overseas. There are many arguments for introducing more visitors from Australia and overseas to the wonders of our State, but how can we do this while preserving the unique qualities of the landscapes that they have come to see?

The Department of Conservation and Land Management (CALM) is responsible for the protection and management of conservation reserves and wildlife in Western Australia. One of the challenges that the Department faces is to open up

areas of natural beauty for the enjoyment of as many people as possible, while ensuring that visitors have no detrimental impact on the environment and wildlife.

GETTING OUTDOORS

By encouraging nature-based recreation and tourism, CALM aims to meet the need for healthy outdoor pursuits that are sensitive to the natural environment. 'Nature tourism' experiences can also be used as opportunities to develop people's awareness and appreciation of natural and cultural values. If such understanding contributes to the development of 'environmentally friendly' lifestyles and support for wildlife conservation, it is an investment in a better future for all of us.

CALM's book *Perth Outdoors* is a guide to the natural areas in and around Perth, and provides a menu of places to go and things to do, and a perspective on the natural environment of the Perth region. The Department's 'Perth Outdoors' initiative aims to help people

Above: The deeply eroded sandstone ranges of Mirima National Park near Kununurra in the East Kimberley.
Photo - Bill Bachman

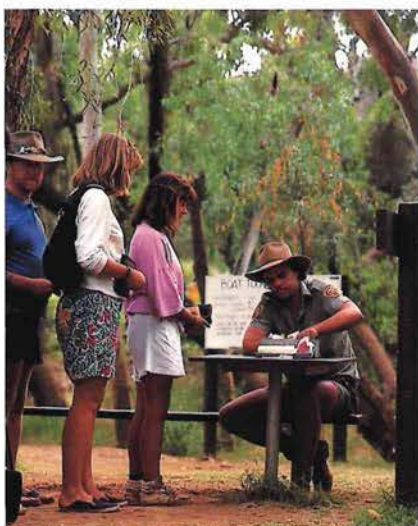
Previous page
Main: Visitors interacting with the dolphins of Monkey Mia under supervision of local rangers.
Photo - Jiri Lochman
Inset: Lennard River Gorge, off the Gibb River Road 200 km east of Derby, epitomises 'the Kimberley experience' of rugged remoteness.
Photo - Bill Bachman

Below: Wolfe Creek crater is the world's second largest meteorite crater and is accessible for visitors with off-road vehicles.
Photo - Bill Bachman

get outdoors and enjoy nature, and has seen the re-development of Yanchep National Park and the development of facilities in The Hills Forest and in Shoalwater Islands Marine Park.

Yanchep National Park has been one of Perth's most popular recreation areas for more than 60 years. The original Park buildings, dating from the 1930s,





Above: Visitors to Geikie Gorge can purchase tickets for two very different boat tours.

Photo - Marie Lochman



Above right: New boardwalks at Penguin Island, in the Shoalwater Island marine Park, provide ease of access while minimising visitor impact.

Photo - Terry Goodlich

Right: Little penguins (*Eudyptula minor*) now have a more secure home on Penguin Island.

Photo - Terry Goodlich



have recently been given a facelift. The near-derelict McNess House has been converted into a visitor centre, a 1930s-style teahouse is being constructed, and the old Yanchep Inn is being developed into a resort (see 'Yanchep - The Birth and Rebirth of a Park', in this issue of *LANDSCOPE*).

The Hills Forest area covers more than 20 000 hectares of the Darling Range east of Perth, and includes State forest, several national parks and nature reserves. The area offers a wealth of different outdoor experiences, from quiet woodland walks to canoeing, fishing and camping. The Hills Forest Activities Centre is the focus for the very successful 'Go Bush!' program of activities, which presents some great opportunities to get out and enjoy the bush. The Centre now includes three buildings transported from Gnangara Forest to be used as an administrative centre, a resource centre and a forest museum. In addition, there is a courtyard seating area and a forest amphitheatre, where gatherings of up to

180 people can enjoy performances celebrating our relationship with the forest.

At Shoalwater Islands Marine Park, visitors can take a gentle cruise around the waters and islands of Shoalwater Bay, viewing sea lions, dolphins and seabirds, and stopping off at Penguin Island to see the little (fairy) penguins (*Eudyptula minor*). Visitors can now purchase their ferry tickets from the new Visitor Centre and Teahouse at Mersey Point. On Penguin Island, newly constructed boardwalks provide ease of access, while minimising impact on the Island's vegetation, so preserving the penguins' breeding habitat. A penguin-viewing area that will seat more than a hundred people is currently being designed, and should be completed in 1994.

Significant improvements have been made to many conservation reserves managed by CALM recently. Developments that advance tourism are progressing throughout Western Australia, making key areas of our natural

environment better known, more accessible and more able to accommodate larger numbers of visitors without compromising conservation values. In fact, such professionally designed development programs have actually succeeded in increasing in visitor numbers as well as enhancing conservation values, as evidenced at Penguin Island, where the tourism developments have increased the penguin breeding habitat.

PARTNERS WITH THE PEOPLE

As well as improving facilities, CALM thoroughly supports the forging of links with the tourism industry. In the 1980s, conservation managers recognised that nature tourism and conservation had more similarities than differences in intent, leading to a range of partnerships between the tourism industry and CALM. The blend of the Department's expertise in natural resource management and interpretation, with the tour operators'



Left: In the Cape Range National Park, visitors can explore Yardie Creek by boat with a licensed tour operator.

Photo - Marie Lochman

Below: Walking tours, led by the Panyjima people, provide an Aboriginal perspective of Karijini National Park.

Photo - Alan Padgett

expertise in marketing, promotion and catering for the transport and accommodation needs of visitors has already proved extremely productive. Partnerships that bring together these complimentary roles can significantly enrich visitors' experiences and contribute to the development of nature tourism in Western Australia.

In recognition of the increased

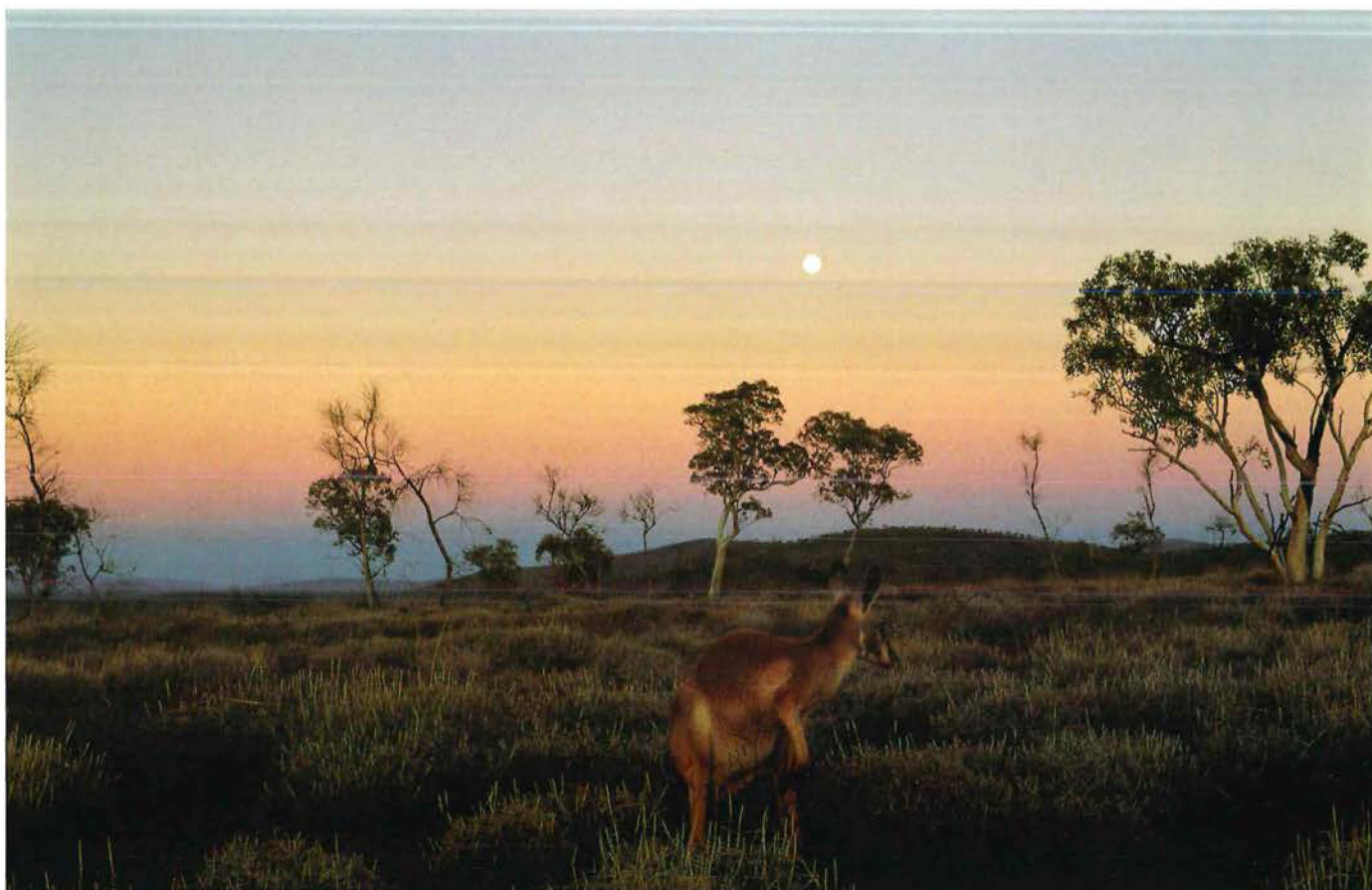
demand for nature-based tour packages, CALM issues permits to selected commercial operators to operate on CALM-managed lands and waters. The tour operators are required to protect the conservation values of the area. They are provided with information to help them to minimise impact on the environment, while maximising visitor enjoyment and understanding of the

natural and cultural values of the area visited. More than 80 such tour operators are now registered in Western Australia.

In some instances, where the effect on wildlife needs to be limited, or where visitor numbers restrict the economic viability of a tour, it makes most sense to grant exclusive use of an area to a single operator. The launch boat tour operation in Yardie Creek in Cape Range National Park, which offers visitors a glimpse of the shy black-footed rock-wallabies (*Petrogale lateralis*) living there, is an example of an exclusive licence granted after a public call for expressions of interest.

An innovative lease and licence agreement covering the developed recreational land and buildings within Yanchep National Park has been one of the factors in the revitalisation of the Park. As well as investing in new facilities at the Park, the successful tenderer has taken responsibility for the day-to-day running of the picnic areas, golf course and cave tours.

This leaves CALM staff free to concentrate on wildlife management and visitor communication programs. The lively Interpretive Activities Program now





offered during each school holiday period, has proved extremely popular with visitors of all ages, and is testament to the success of this lease arrangement. Everyone is a winner in this partnership - CALM, the lease-holders, the visitors and the wildlife.

In some places, co-operative arrangements between CALM and the local Shire have proved extremely fruitful. The famous Monkey Mia Reserve, which annually gives thousands of visitors the opportunity to interact with dolphins, is jointly vested in the Shire of Shark Bay and CALM. The arrangement combines the local knowledge and skills of the Shire and its staff, with CALM expertise in land, marine reserve, wildlife and visitor management.

With funding from the Australian Nature Conservation Agency (ANCA), CALM has employed Sam Lovell, an Aboriginal tour operator with years of Kimberley experience, to assist the Darl Ngunaya Aboriginal Corporation in launching a nature-based tourism venture at Geikie Gorge National Park in the Kimberley (see 'Bush Telegraph', *LANDSCOPE*, Spring 1993). Bunuba Aboriginal Cultural Tours explore Geikie Gorge by boat and on foot, allowing visitors to share the rich cultural heritage of the Bunuba people. This partnership is enriching visitors' understanding of the cultural values of the Park, while providing opportunities for the local Aboriginal community to generate income and provide employment for their people.

Visitors are increasingly keen to understand Aboriginal culture and its relation to the natural environment, and

CALM has recently conducted two 'cultural interpretation' workshops for Aborigines. Such initiatives aim to develop the participants' skills as activity leaders in the tourism industry, and help them to pass on their intimate knowledge of the landscape and wildlife. Some participants have since found employment in CALM's activity programs at Yanchep National Park and The Hills Forest. Others have used the workshop to refine the cultural tourism programs in which they were previously involved.

DEVELOPING RELATIONSHIPS

CALM is keen to develop even stronger working relationships with potential partners in the tourism industry. Two workshops held far apart demonstrate the benefits to be reaped from such partnerships.

Perup Forest, 50 kilometres from Manjimup in the South West of WA, is a very special place, as it supports viable populations of at least six threatened mammal species: numbat, chuditch, woylie, tammar wallaby, western ringtail possum and southern brown bandicoot. At CALM's Perup Forest Ecology Centre, local tour operators gathered together with professionals in nature-based tourism, communication, environmental and wildlife management and local history. The aim of the workshop was to show the operators how to give their clients memorable experiences, while developing an understanding of how nature functions, how the locals interact with nature, and how CALM manages the land to accommodate these pressures. The participants shared an experience

Above left: The Pinnacles Desert, in Nambung National Park, is WA's most popular park destination for Perth-based tour groups.

Photo - Brian L. Downs/Lochman Transparencies

Above right: A hovercraft tour explores the shallow seagrass meadows between Carnarvon and Monkey Mia without fear of injury to grazing dugongs or inquisitive dolphins.

Photo - Bill Bachman

they would value and remember. They also had the opportunity to gain new knowledge and skills. They came away with a better understanding of how CALM operates and of the complexities of land management in the Southern Forest Region. In return, CALM learnt much about the needs and aspirations of the operators, and many new friendships were forged.

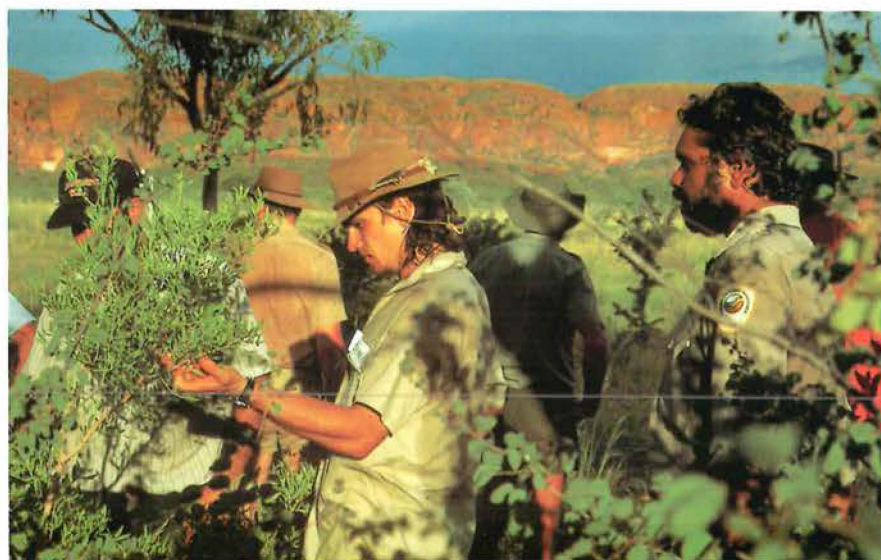
At the other end of the State, at Purnululu National Park (more commonly known as The Bungle Bungles) in the East Kimberley, a workshop for tour operators was held prior to the dry season influx of tourists.

Purnululu National Park protects the remarkable 350-million-year-old sandstone beehive-like formations of the Bungle Bungle massif, a considerably older limestone ridge of great significance to local Aboriginal groups, the Osmand Range, and the surrounding savanna woodlands. The Park offers a truly remote wilderness experience. Visitors can explore the deep red gorges of the Bungle Bungle massif, where there are patches

of remnant rainforest. The northern nailtail wallaby (*Onychogalea unguifera*) and euro (*Macropus robustus*) live around the massif, and there are more than 130 bird species in the Park, including rainbowbee-eaters (*Merops ornatus*) and flocks of bright green budgerigars (*Melopsittacus undulatus*).

To reach the spectacular Bungle Bungle by road, visitors have to negotiate 50 kilometres of very rough track. Because of its inaccessibility, only 8 500 people visited Purnululu National Park in 1992, but 30 000 flew over the Park with the six airtour companies that operate there. Tour operators bring 40 per cent of the visitors to Purnululu National Park, and more than half the visitors take the on-site helicopter tour over the Bungle Bungle massif. From the air, the massif is an imposing sight, and this is the best way to gain a perspective of its immense size. Many visitors declare it to be the flight of a lifetime.

The Purnululu National Park is a phenomenon not just for its natural and cultural values, but also as a case study in nature-based tourism. Purnululu is at



the special end of the nature tourism market. A relatively small number of visitors invest a large amount of time, effort and money to have a special experience there. In its management of the Park, CALM aims to reconcile environmental and wildlife conservation with visitor needs and tour operator opportunities.

The Tour Operators Interpretation Workshop at Purnululu was timed to coincide with the setting up of tour operators' base camps within the Park,

and with the park rangers' preparation of the camping areas for the tourist season. During the wet season the grass had grown to more than two metres high, and rangers were busy slashing the camp sites and getting water through to them. Of the three camping areas, two cater for general campers and tour groups, and one is now exclusively set aside for three special lease Fly-Drive operations. These allow visitors to be flown into the Park, met on the ground by the tour operator and taken on a tour in an off-road vehicle.



Left: CALM Ranger Paul Butters led a bush tucker activity during the recent Tour Operators' Workshop at Purnululu National Park.
Photo - Gil Field

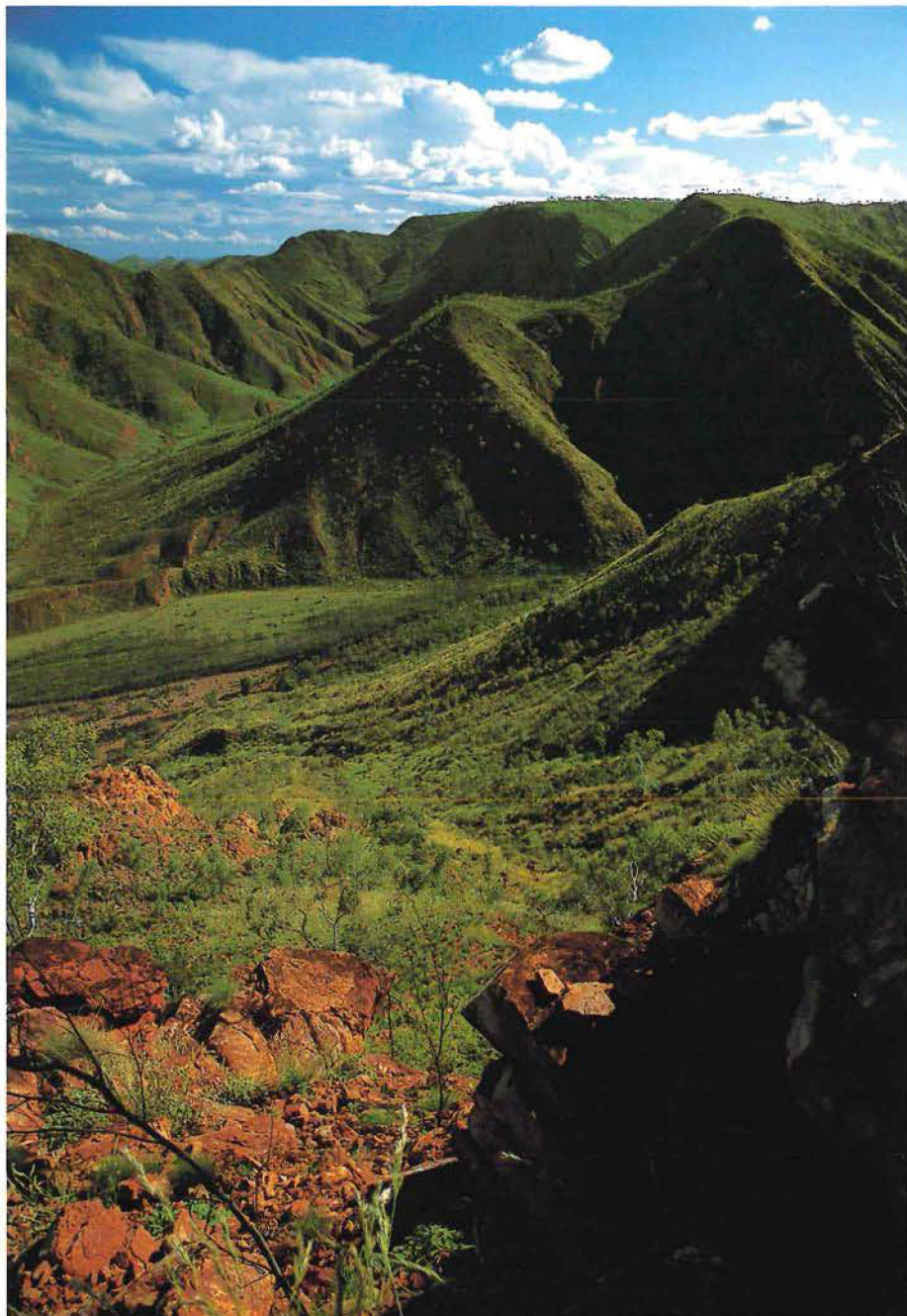
Below left: Caving within Cape Range National Park is permitted for guided access only, to protect the cave formations and wildlife as well as cavers.
Photo - Geoff Taylor/Lochman Transparencies

Right: A less familiar face of the Bungle Bungle Range in Purnululu National Park.
Photo - M&I Morcombe

The workshop was an opportunity to develop further CALM's relationship with the tourism industry and its operators. There were seminar sessions and a range of 'hands-on' activities, designed to demonstrate the different ways in which people learn and communicate. Aboriginal Park Ranger Paul Butters together with Raymond Wallaby, whose people live within the National Park at the Kwarre Aboriginal living area, explained some of the traditional links that the Kija people have with the land. They took the participants on a bushtucker trail through one of the camping areas, identifying various plants, giving their Kija and botanical names and describing their uses. Then it was on to Echidna Chasm at sunset, where the deep narrow gorge resounded to the sounds of a didgeridoo.

To gaze at the Kimberley night sky is a memorable experience, and the operators were given a tour of the 'galactic wilderness', which they could share with their clients. There was an introduction to the wildlife of the Park, and spotlighting and other wildlife observation techniques were explained. It is the geology of the Park that most intrigues visitors to Purnululu, and a visit to 'the lookout' on top of a volcanic extrusion provided a vantage point from which to read the landscape. Finally, rangers explained the steps being taken to rehabilitate the eroded areas resulting from one hundred years of grazing before the area became a national park.

In sharing ideas and experiences through discussions and activities, it was apparent that tour operators can and do make a significant contribution to the interpretation of both the natural and



cultural values of the Park. Better-informed operators and their clients can only mean more support for the Park's management. The shared intent of this partnership, to create memorable experiences for Park visitors that enhance their appreciation of and support for the Park's natural and cultural values, ensures a vibrant future for nature tourism in WA's north-west.

PARTNERS IN NATURE

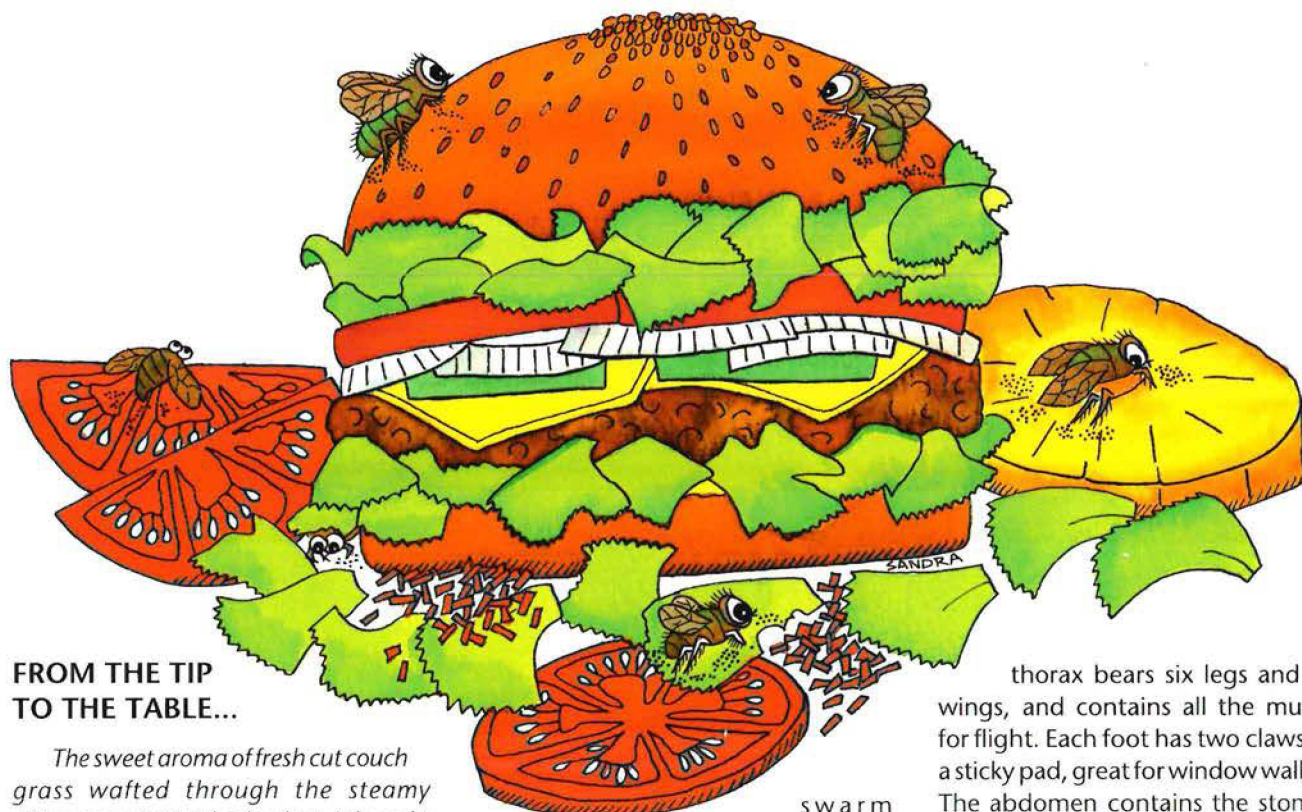
In these economically difficult times both the public and private sectors of the community need to be adaptable, innovative and resourceful. Partnerships in nature tourism are a way of achieving positive outcomes for all. A carefully crafted partnership, whether it be a

permit, licence, lease, co-operative arrangement or a learning exchange, has the potential to benefit visitors, tour operators, conservation managers, the local community and the natural environment.

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URBAN ANTICS!



FROM THE TIP TO THE TABLE...

The sweet aroma of fresh cut couch grass wafted through the steamy afternoon air. Finished at last, I thought and drew a deep breath. . . AAAGH!!!

A small, grey, ugly, scaly, spiky and known-to-be-filthy, germ-bag of a fly went right down my throat. My eyes watered and my stomach rolled. Yuk!!! I was so upset, I didn't know whether to spit or buy a new hat.

Flies, like some other insects and spiders, are not my favourite creatures, but like it or not, we're stuck with more than 100 000 species worldwide and up to 8 000 in WA. The Diptera, or true flies, are one of the largest orders of insects with a few having no wings, but all the others having a single pair of wings. Most other winged insects have two pairs.

In our west coast urban neck-of-the-woods, we are bewitched, bothered or bewildered by about nine varieties of fly each summer; when their breeding and activity are at a peak. The little pest that prefers to live inside our homes and run across our dinner plates is the common house fly. The other two frequent intruders are the 'brown bomber' blowfly and the greenbottle blowfly.

Outside the sanctity of our homes, we are fair game for bush flies. These are the persistent little grey devils that

swarm around your eyes, nose and mouth, and are responsible for vigorous arm waving, hysterical clapping and the occasional self abusive smack on the nose. Worst of all are the blighters that stab with their mouth parts and suck blood. These are the sand flies, stable fly and the mosquitoes and march flies.

Other, lesser-known flies, found around the garden and worthy of observation, are the fruit flies and hover flies. While the fruit fly does not cause us any direct pain, it sure knows how to ruin a good peach. Hover flies, on the other hand, are beautifully coloured (bright orange, white and yellow) and they hover, apparently motionless, in front of flowers and foliage looking for nectar.

Most flies are similar in their activities, habits and anatomy. Like all adult insects, their bodies are made up of three parts - the head, the thorax and the abdomen. On the head are the eyes. Between them are the antennae, which are sensitive to touch, smell and, in some species, sound. The mouth is either a tubelike pump for spewing out solvents and retrieving liquids, or a sharp proboscis part, for stabbing flesh and sucking blood. The

thorax bears six legs and two wings, and contains all the muscles for flight. Each foot has two claws and a sticky pad, great for window walking. The abdomen contains the stomach and reproductive organs.

Because they and their larvae (maggots) eat smelly, rotten material like dung, dead animals and general refuse, we must assume that they carry deadly germs. But, like all the creatures on Earth, even flies have some good points. They pollinate plants, prey on a wide range of other pest insects, devour animal carcasses and provide me with the fattest little wrigglers that ever graced a good fishing hook!

JOHN HUNTER

DID YOU KNOW?

- The mydas fly of South America is the largest fly in the world. It measures 7.6 cm in length and the same from one wing tip to the other. Midges are the smallest flies at only 1.3 mm length.
- A fly has compound eyes, each having about 4 000 hexagonal (six-sided) lenses that point in different directions and work independently.
- A house fly's wings beat around 200 times a second and it travels at an average speed of 7.2 km/h. Midges' wings beat about 1 000 times a second.

YOUR PERFECT WALKING PARTNER



Family Walks in Perth Outdoors is the first book of its kind in Western Australia.

It is designed to encourage you and your family to venture out into Perth's wonderful natural environment, to learn something about the plants and animals that live there and to enjoy yourself at the same time.



The 52 walks (one for every week of the year) range in length from a few hundred metres to about 18 kilometres, so you can choose the walks to suit your family. Almost all the walks have picnic facilities nearby and most can be completed within a couple of hours.

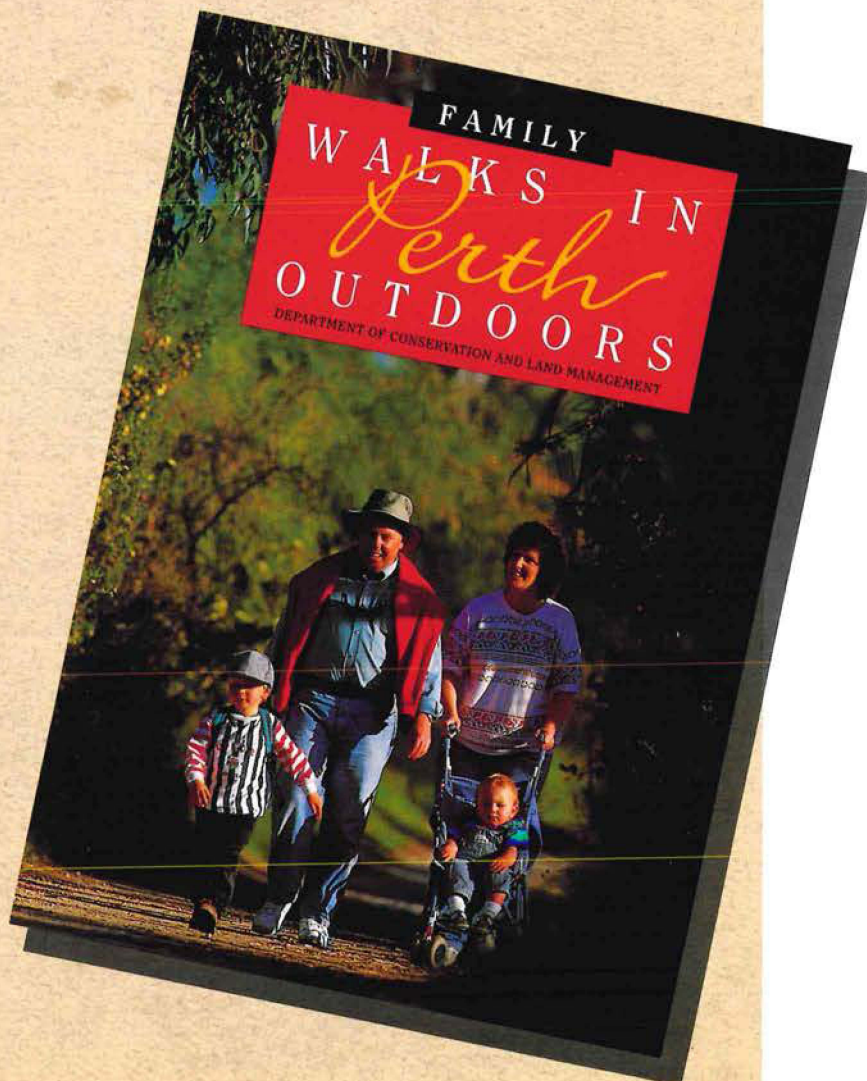


Family Walks in Perth Outdoors contains mud maps and descriptions of every walk and is punctuated with frequent fascinating features on the plants and animals of Perth Outdoors; all of which are designed to make your walk even more enjoyable.

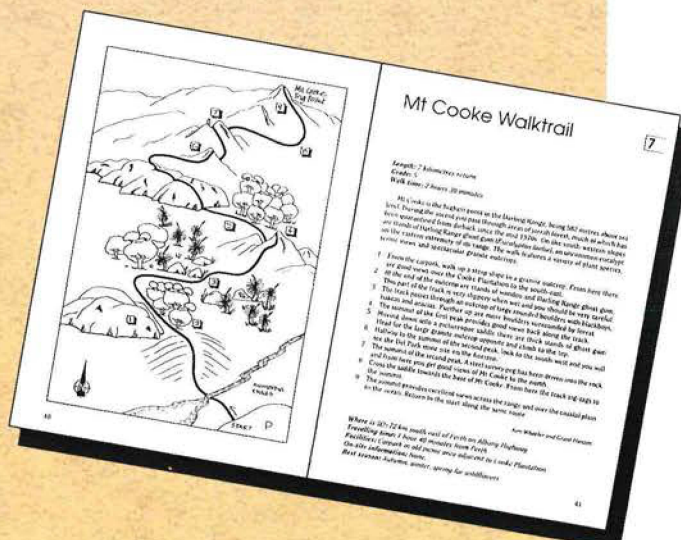


Take this book walking with you and explore the wonder that is Perth Outdoors.

Family Walks in Perth Outdoors costs just \$14.95 and is available from CALM Offices, booksellers and good newsagents throughout Perth and its surrounding areas.



Department of Conservation and Land Management





The 300 million-year-old sandstone outcrops near Didbagirring lookout in the HiddenValley National Park, East Kimberley.

Photo - Bill Bachman



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