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



NATURE'S MEDICINE

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HARVEST FROM THE SANKO

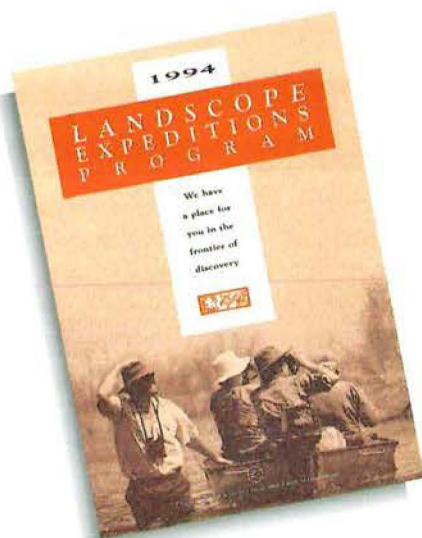
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FIRE, WIND and WATER

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LANDSCOPE is WA's premier conservation and wildlife quarterly magazine — a 56-page award-winner in glorious colour. *LANDSCOPE* Expeditions are operated jointly with the Extension Service of The University of Western Australia.



Hand in hand with nature. This brushtail possum is just one of the animals studied during fauna surveys of the Batalling Forest. See page 16.



Lush vegetation and a welcoming smile greet you as you arrive at Mt Hart Homestead, the 'Oasis in the Leopolds'. See page 48.

LANDSCOPE

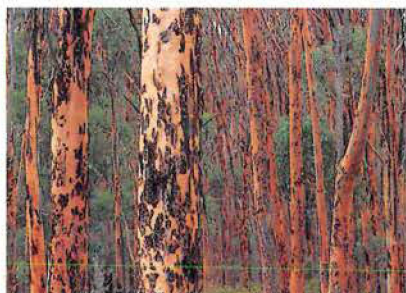
VOLUME NINE NO. 4 WINTER ISSUE 1994



'Fire, Wind and Water', on page 42, tells of recent research into the rehabilitation of exploration tracks in the Rudall River area of the Little Sandy Desert.



Deep beneath the Southern Ocean lies the wreck of the Sanko Harvest. This rotting hull is now an artificial reef attracting marine life and divers alike. See page 23.



Plantations of brown mallet in the early 1900's began a chain of events that resulted in the 'Woodland Wonderland' of Dryandra. See page 28.

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COVER

Woylies prefer clumped, relatively open vegetation with sandy soils that are easy to dig. They are found, among other places, at Batalling Forest and the Dryandra Woodland. See stories on pages 16 and 28.

The illustration is by Philippa Nikulinsky.



Managing Editor: Ron Kawailiak
Editor: David Gough
Contributing Editors: Verna Costello, Nigel Higgs, Kate Hooper, Carolyn Thomson
Scientific and technical advice: Andrew Burbidge, Roger Underwood
Design and production: Maria Duthie, Stacey Strickland
Finished art: Gooitzen van der Meer
Illustration: Gooitzen van der Meer
Cartography: Promaco Geodraft
Marketing: Estelle de San Miguel ☎ (09) 389 8644 Fax: 389 8296
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Published by Dr S Shea, Executive Director
Department of Conservation and Land Management,
50 Hayman Road, Como, Western Australia 6152.

THE ETHICS OF CONSERVATION

Anybody who reads Dick Perry's account of his journey to Mount Lesueur with Charles Gardner ('On Drummond's Trail' in Bush Telegraph) can't help but relive the excitement these two great Western Australian conservationists felt more than 50 years ago. I must confess, however, to some negative thoughts as I read Dick's account. How can any of us in this generation match the continuing contributions of Dick Perry, who turns 92 this year, to the priceless plant and animal life of this State?

Dick Perry, of course, has also made a major economic contribution to forestry in this State, as one of the pioneers of the Pinus pinaster tree breeding program (see 'In Search of the Perfect Pine', LANDSCOPE, Autumn 1992). This species, which grows superbly on the sandy soils of the sandplains north of Perth that Dick describes in his article, is providing major feedstock for large wood fibre processing facilities, which are creating significant wealth and jobs.

It is ironic that the region he and Charles Gardner explored north of Perth also supports the species of Conospermum which has yielded the highly prospective anti-AIDS compound Conocurvone. If these practical pioneer conservationists knew that the unique and diverse flora they described also had the potential to produce life-saving drugs and generate huge wealth, there is a good chance there would be far more areas of native vegetation reserved than there are today.

That is one of the propositions put forward by Jim Armstrong and Kate Hooper in 'Nature's Medicine'. The article is also a fascinating and exciting description of the discovery and development of what could be one of the most significant pharmaceutical compounds ever derived from natural plants. It is surprising, however, that, despite the achievements they describe, amendments to the Conservation and Land Management Act (which reasserted the right of Western Australians to control the utilisation of native plants growing on public land) were opposed by some people who believed it was not in keeping with the conservation ethic.

But the opposite is true. The legislation enables CALM to enter into agreements with Australian pharmaceutical companies to ensure that the department can sustainably manage plants and animals with economic value. Already, co-operative developments between CALM and the Australian Medical Research and Development Corporation regarding Conocurvone have resulted in substantial payments to CALM's conservation and land management effort. This money is to be directed to all Western Australian biota under CALM's care, whether economic or not.



The publisher

WHAT, NO MAPS?

After my visit to your beautiful State in 1992, my friends in Perth gave me a subscription to your magazine and I have since renewed the subscription for 1994. I compliment you on a great publication. I often pass it on to other Queenslanders.

I just wish that you would use more maps. A map inside the back cover would be terrific. So would a small map with the relevant area marked for your particular articles.

There were no maps in the Summer [1993-94] issue and I find this very frustrating. I'm sure even your WA readers don't know every bit of such a large State.

I hope to make many more visits to WA. You have so much to offer.

J V MAXWELL (MRS)
MOOROOKA QLD 4105

Small 'location maps' are usually included in stories specific to a particular area or place in the State. We occasionally produce more detailed maps of national parks or when a particular geological or topographical point needs illustrating. For example, in the last issue [Autumn 1994] we had detailed maps of Nambung National Park and the geomorphic zones of the Perth region; the latter was to illustrate the soil types preferred by particular species of reptile. However, with space at a premium, we are sometimes unable to use as many maps as we would like. - ED

TO BURN, OR NOT TO BURN

I was disappointed to read the notes from your publisher, Dr Shea, in the Summer 1993-94 issue.

Dr Shea asserts that CALM workers have a sense of

satisfaction when managing an Autumn burn because of their contact with nature. I can hardly believe that someone could be happy to burn a beautiful piece of forest, let alone walk through it afterwards, counting the destroyed animals, young trees and habitats. Where is the satisfaction in watching a diverse ecosystem slowly change to a monoculture as frequent burns interrupt the natural composting process and rampant grasses take hold.

In view of the current debate over the controlled burning policies of CALM, Dr Shea should be more circumspect in his personal views. A publication like LANDSCOPE should not be used to push one side of the question. Conserving forests requires a policy of minimal intervention where natural ecosystems exist, not regular man-made conflagrations to satisfy some popular belief.

GORDON PAYNE
SUBIACO WA 6008

Every article that is written in LANDSCOPE inevitably reflects, to some degree, the personal views of the author. But to the best of our ability, the views that are expressed in LANDSCOPE reflect the most up-to-date scientific understanding of natural ecosystems. Mr Payne has the right to express his views on prescribed burning. It is our responsibility to ensure that the community is aware there is no scientific evidence to support them. (See the article 'Fighting Fire with Fire' in the Autumn 1994 issue of LANDSCOPE.) - Dr Syd Shea

We are always pleased to receive letters about articles that appear in LANDSCOPE. Letters should be addressed to the Editor, LANDSCOPE magazine at the address on page 3.

SOMETHING OLD, SOMETHING NEW...



A new species of frog has been found in a peaty swamp in a remote part of the south-west of WA. The discovery was made by Edith Cowan University lecturer, Pierre Horwitz, in January.

"The frog is distinctively coloured, with a mottled blue and white belly. Its legs, hands, chest and throat are a striking orange colour and its back is covered with knobby brown skin. It is about 35 millimetres long," Department of Conservation and Land Management researcher Grant Wardell-Johnson said.

"The frog is like no other in Australia and is clearly a new genus. The species therefore has immense scientific interest," Dale Roberts, a frog researcher at The University of Western Australia, said.

"It appears to be related to several genera and is therefore very old - perhaps more than

30 million years!"

The species is currently known from only two sites within the proposed Mount Roe National Park, recommended in CALM's new Forest Management Plan.

"CALM will ensure its habitat is given special management protection," Grant said.

"It will be important to protect the vegetation surrounding the swamps from dieback (*Phytophthora cinnamomi*), to ensure water tables stay at current levels, and to keep the peat that forms the frogs' habitat fire-free."

Grant, Pierre and Dale are currently describing the animal. Subsequent research will investigate where it fits into the picture of frog evolution in Australia.

Studies on the distribution and conservation status of the species will also be carried out.

Scientists can then recommend whether it should be added to the schedule of threatened fauna.

This discovery shows that we still have much to learn about the State's wildlife. It is surprising that, despite more than 40 years of intensive study, a new frog species has been found in a region in which most people thought the vertebrate fauna was well known.

Who knows what other vulnerable or restricted species may await discovery in the fascinating peat swamps of the South West?

This striking new frog species is so new that it doesn't yet have a scientific name, but it has already attracted a great deal of scientific interest. Scientists from CALM, Edith Cowan University and the University of WA will scour surrounding swamps to find out its exact distribution.

Photos - Grant Wardell-Johnson

BELTING WEST CAPE HOWE

Park managers have come up with a novel method to overcome degradation at West Cape Howe, one of the State's most spectacular coastal national parks.

Because of unmanaged access in the past, four-wheel-drive tracks snaked through the sandhills of the South Coast park, forming an unsightly network of spaghetti strands.

Department of Conservation and Land Management Ranger Richard Pemberton designed a system of track rehabilitation and stabilisation, using a combination of old rubber conveyor belting from Alcoa of Australia and concreting.

"We got in touch with the mine manager of Alcoa to see whether disused conveyor belting could be used for a trial

on the Lake William Road. It worked and we have now used three kilometres of belt to stabilise one-and-a-half kilometres of hill sites. It is much cheaper than palleting and re-uses the rubber. The idea is to keep traffic off the ground and stop vehicles digging into the sandhills," he said.

Belting is held in place with 50 cm pegs that cost about a dollar each to manufacture. Cockburn Cement also donated 32 tonnes of second grade cement that was used to compact with sand to stabilise tracks on level sections.

Richard said 70 per cent of old tracks in the park had now been rehabilitated, with funds from the Australian Nature Conservation Agency. The funding enabled CALM to employ two local Nyoongar



men, Mal Roberts and Ron Coyne, who were involved throughout the project. Help was also received from the West Cape Howe Association, Albany Angling Club, Albany Scouts, Greenskills, local school groups and other volunteers.

Richard said he had written a report on the belting and concreting system and it had potential to be used across the South Coast and throughout WA for rehabilitation projects.

Belting on the degraded tracks at West Cape Howe
Photo - Richard Pemberton

He said CALM was planning to use belting in the Fitzgerald River National Park next year. Belting allowed access to the coast without the problems of water and wind erosion and the spread of dieback disease. It also allowed the rehabilitation of disused tracks, which improves the park's landscape.

BIRDS OF A FEATHER

Two chicks found in a sand quarry being excavated at Kangaroo Hills Timber Reserve near Coolgardie were taken under the wing of a local wildlife carer.

CALM regional ecologist Andy Chapman confidently identified them as rainbow bee-eaters, because of the shape of their beaks and the fact that they came from a burrow.

The chicks were duly installed in a hospital box kept at 25°C and fed mealworms and a specially prepared insectivore mix every three to four hours by wildlife carer Pam Chapman.

They thrived on this diet, grew very fast and developed demanding and aggressive table manners, frequently "biting the hand that fed them" in their frenzy to eat. They called for their food with a repetitive, high-pitched grinding call. But as they grew, the disproportionate size of

their head and beaks puzzled Andy, who began to doubt his identification.

As the plumage developed it became clear they were anything but rainbow bee-eaters; the turquoise wings, red rumps, enormous square heads and formidable beaks indicated beyond a doubt that they were red-backed kingfishers.

After about four weeks the chicks began to show an interest in flight and were transferred to an outside aviary where they practised perching and began to feed themselves on a range of insects.

After being nurtured for seven weeks, the kingfishers were vigorously flying up and down their aviary and it was becoming difficult to satisfy their voracious appetites. On the day of their release they sat huddled together on a nearby TV aerial before exploring their immediate vicinity and feed

on insects off the ground.

For the next five days they were repeatedly seen together in the mornings, disappearing later in the day. On the sixth day they did not return from their afternoon foray and it is assumed they had successfully returned to the wild.

The red-backed kingfisher is a spring-summer visitor to the Eastern Goldfields. At Coolgardie they are at the edge

of their range. The closely related sacred kingfisher occurs in the south-west of WA and both species occur in the north-west and north of the State. Their presence also adds to the biological knowledge of Kangaroo Hills Timber Reserve.

These two red-backed kingfishers were hand-raised by Kalgoorlie wildlife carer Pam Chapman.
Photo - Andy Chapman



NEW HERBARIUM

Specimens from towering tingle trees, the bizarre pitcher plant, a new species of eucalypt and rare orchids are among 2 000 plants in a herbarium officially opened at Manjimup recently.

The regional herbarium, at the Manjimup office of the Department of Conservation and Land Management, is affiliated with the Western Australian Herbarium, where all specimens are duplicated.

"This is a fantastic community resource. It is not just for CALM officers - officers from other government departments and community members can all use it to identify specimens and learn more about the region's unique flora," Acting Head of the WA Herbarium Neville Marchant said.

The Manjimup regional herbarium features flora from the southern forest region, which is renowned for its high rainfall species.

The herbarium aims to provide an identification and information resource for a botanically defined region from Cape Naturaliste almost to Albany. There are about 2 500 flowering plant species in this area, including some that grow nowhere else.

They include Gondwanan species, such as the rare tingle tailflower (*Anthocercis* sp.) from Walpole, first collected in 1965 and rediscovered recently. CALM scientists found the tailflower when putting study plots in the tingle forest. There are only 30 to 40 plants growing in only one location and so far no seeds have been found.

Collections made for the herbarium have already turned up new species. The rare Jackson's sun orchid (*Thelymitra jacksonii*) was discovered in 1988 by Walpole



Above: This rare plant species, the fringed leaf lily, is among 2000 plant specimens in the Manjimup regional herbarium.

Right: Jackson's sun orchid was discovered in 1988 by Walpole resident Bill Jackson and is known from only one swamp. Photos - Grant Wardell-Johnson

resident Bill Jackson. This species has striking gold and brown flowers and is found only in one swamp near Walpole.

A completely new eucalypt, first collected in 1987, has recently been identified. The new tree, which grows near the Sabina River, is known only from five plants.

A new species of fringed leaf lily (*Chamaexeros* sp.) from near Walpole, which botanists waited for years to see in flower, is currently being named.



ON DRUMMOND'S TRAIL

In the late 1940s, Government Botanist Charles Gardner and forester Dick Perry went looking for a plant previously collected by the famous botanist James Drummond in the 1840s. Dick describes how their mission led them to Mount Lesueur, now one of the most famous botanical reserves in the country.

In the decade after World War II, as part of my work as a forester with the WA Forests Department, I was deeply involved in the establishment of *Pinus pinaster* plantations on the coastal plain south and north of Perth. During this time I became very familiar with the whole region between Busselton and Yanchep. Before long the vast stretch of country beyond Yanchep and extending up to Dongara began to arouse my curiosity.

Another person with a special interest in this area was my great friend Charles Gardner. He was the Forests Department's botanical collector and had set up a wonderful herbarium, later transferred to the Department of Agriculture. The collection became the basis for the present Western Australian Herbarium.

Charlie had been able to make several quick journeys into the heathlands and sandplains north of Hill River

during the War, with the help of the Army, but felt frustrated because the area was a botanical wonderland, and he could never get to spend enough time there.

He had a second reason for his interest. James Drummond had travelled through the same area 100 years earlier, using stock routes for access, and he had made a comprehensive plant collection of the region. Unfortunately there were many blanks in Drummond's diaries and the exact locations of particular collections were not always accurately noted. One of Charlie's special interests was reconstructing Drummond's work by retracing of his expeditions using Drummond's diaries, letters and plant collections to guide him. He became expert at tracking Drummond by following the plants he had collected. There were also many species collected by Drummond which had never been seen since, and Charlie was keen to fill in all the gaps.

Charlie Gardner had largely finished this work by about 1950, but a number of plants still eluded him. One of these was the elusive *Urocarpus phebalioides* (now known as *Asterolasia drummondii*), which Drummond had collected on the eastern slopes of Mount Lesueur. Charlie had made two



previous attempts to get into the area to search for the plant, but without success. Talking this over one day, we realised we shared a common interest in the area. So we decided to pool our resources and spend a whole fortnight, exploring and collecting in the Mount

Lesueur region.

I had an ex-army 2 x 4 'Blitz' wagon I had bought from Army Disposals for just this sort of expedition, and plenty of camping gear. In late August, 1949, having arranged for a fortnight's leave, we were on our way.

We decided to make our base at Cockleshell Gully, the Grigson family property, as it was central to the area we planned to explore. In all this vast area, literally hundreds of square miles, from Dandaragan in the south to Dongara in the north and bounded on the west by the coast and the east by the Midland Railway line, there were only two permanently occupied properties at that time: the Grigsons at Cockleshell and



Top: Dick Perry's ex-army 'Blitz' wagon was an excellent vehicle for traversing the Mt Lesueur wilderness in the 1940s and 1950s.

Above: Collecting plant specimens in the Mount Lesueur area.

Left: Members of the 1951 expedition to Mt Lesueur in search of the elusive *Asterolasia drummondii*. Charles Gardner is on the far right.

Photos - Dick Perry

ON DRUMMOND'S TRAIL

the Kings on the east side of Lake Logue further north. The map we carried was of little use - there was practically nothing on it! Over a century of agricultural development had by-passed this area almost completely. And once I became familiar with it, the reasons were obvious: the soils were sandy and infertile, with outcropping limestone caprock all along the coast, and massive ironstone and gravel hills inland. And yet it was a botanical treasure trove, and I consider it a tragedy that this area was eventually thrown open, and then largely cleared and developed into farms when new agricultural technology became available in the 1950s.

It took us three days to traverse the track from the tiny settlement at Dandaragan through to Cockleshell Gully. There were numerous sandy

stretches where we had to let the tyres down to get through and every creek crossing or ford had been washed out in winter and had to be repaired as we came to it before we could cross. We stopped often to make botanical collections - the plains were ablaze from horizon to horizon with spring wildflowers.

Very few visitors made it to Cockleshell Gully in those days. The Grigsons were delighted to see us and made us very welcome. They were especially pleased when we delivered their mail. They hadn't been to town to collect it for over a year and there was a wheatsack-full of it.

The next day, with Frank Grigson and his young sons Noel and John as willing field assistants, we set off in the Blitz for Mount Lesueur, several miles to the east, to search for Charlie's "lost" *Asterolasia*.

Our hunt began on the eastern slope of the mountain, as this was where Drummond's notes suggested he had made the collection, but we found nothing. So we decided to search each gully from its source up on the mountain right down to its confluence with the main creek in the valley below.

The first gully we followed drew a blank, so we worked our way up to the summit and began down a second. Well into it we hit the jackpot! All of a sudden we walked into a patch of white flowering plants, and Charlie began dancing about with excitement. It was the *Asterolasia* we had been seeking. At that moment we realised that we were standing on the very spot where Drummond had stood, and where he had made his collection of this same species, 100 years before. It was a

thrilling moment.

The patch covered less than an acre, and we confirmed over the next few days that it was the only one, when we systematically searched all the other gullies in the area and failed to locate a single further *Asterolasia drummondii* plant.

The remainder of our expedition took us north to investigate the underground river from Green Lake to the ocean, then to Lake Logue and on to the Arrowsmith River and then east to the main highway and 'civilisation' at Three Springs.

Forty years or so later, I remember almost every detail of the trip and, looking back, I consider myself to have been very fortunate to have seen this fascinating region of WA when it was still in its pristine state.

BY DICK PERRY

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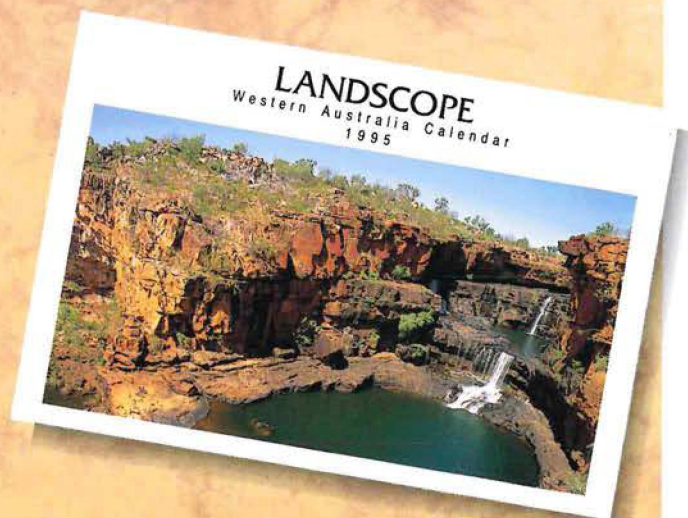
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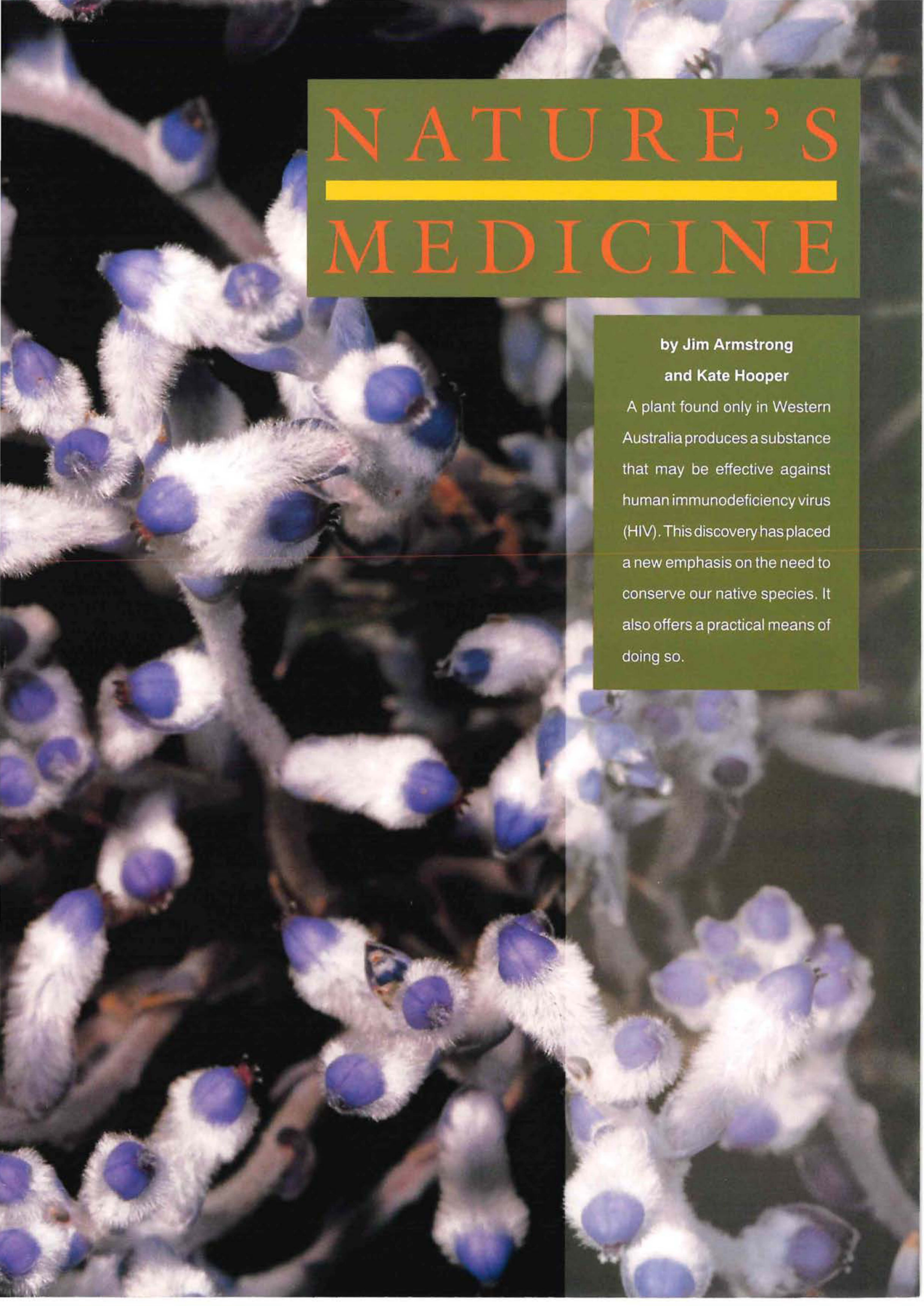


A CALM publication



Department of Conservation
and Land Management





NATURE'S MEDICINE

by Jim Armstrong
and Kate Hooper

A plant found only in Western Australia produces a substance that may be effective against human immunodeficiency virus (HIV). This discovery has placed a new emphasis on the need to conserve our native species. It also offers a practical means of doing so.

Biodiversity has become the buzzword of the nineties in conservation circles. The term means the variety of life on earth, and embraces all the world's plants, animals, fungi and micro-organisms. The genetic information they contain represents a priceless resource, but it is one we are squandering.

The fact that the growth in human population is leading to the rapid loss of wild communities is only too well documented; but it is not generally appreciated that every extinction of a species is a lost opportunity. Despite the best efforts of conservationists, the majority of people remain unconvinced of the value in genetic variety. One way of turning the tide of public opinion is to demonstrate the commercial value of the biota; we need to realise the 'bio-wealth' in our biodiversity.

The Department of Conservation and Land Management (CALM) has long recognised the importance of funding its conservation work by promoting initiatives such as nature-based tourism. But one recent initiative has made headlines because it could place a tangible value on all our biological resources, not just those with aesthetic appeal.

REMEDIES FROM NATURE

Remedies derived from plants have been central to traditional medicine for centuries. But it is only in the past 25 years or so that mainstream science has begun to recognise their value.

During the 1960s, the National Institutes of Health in the United States became interested in deriving potentially

useful drugs from plants. They were particularly keen to find new drugs for the treatment of cancer, and the work was based at the prestigious National Cancer Institute (NCI). They established a huge collecting program, employing a network of professional plant collectors worldwide. These collectors worked in collaboration with national agencies. For example, the Institute's contracted collector in Western Australia was issued with a licence to collect plants for scientific purposes, and the WA Herbarium assisted by processing about 1 200 plant specimens for the program.

By 1981, the NCI had accumulated many thousands of plant specimens from around the world. Extracts made from these specimens were tested in the laboratory for their ability to inhibit the growth of cancerous cells. In the late 1980s, when a new threat to health, AIDS, was emerging, scientists once again sought help from nature. They turned to the bank of plant samples held in cold storage at the NCI.

Using human cells infected with human immunodeficiency virus (HIV), they tested the extracts for their ability to inactivate the virus. By 1989, at least four extracts were shown to have some effectiveness. One of these was made from a plant collected in Western Australia. This extract was particularly exciting because, even at low concentrations, it was very effective at inactivating HIV and, crucially for a potential drug, without apparent ill-effects on the cells.

The extract was made from a species of smokebush (genus *Conospermum*),

a plant common on the sand heaths of the south-west. The smokebush belongs to the same family as the banksias and grevilleas - the Proteaceae. The genus is found mainly in Western Australia. The active component isolated from *Conospermum* was named Conocurvone.

REALISING OUR BIO-ASSETS

When news of the potential biological activity of the smokebush extract was published in 1993, there was great excitement in Western Australia. Pharmaceuticals are big business. This is especially true where a disease like AIDS is involved, which has reached epidemic proportions and is still spreading rapidly.

In the past, Australia has allowed unhindered access to its biological resources. For example, Israel is now selling eucalypt leaves as 'fillers' to the cut-flower trade and making exports to the European market worth 70 million dollars per year. New Zealanders are marketing an Australian waratah (*Telopea speciosissima*) as the 'kiwi rose', with great success.

CALM wished to ensure that Western Australia would receive the maximum benefit from the use of its own biological resources. This meant more than simply receiving royalties on production of any drug from the smokebush plant. Not content with this traditional role of resource provider, CALM was determined that the development and production of any potential drug should be based and co-ordinated in Western Australia.

With the benefit of hindsight, it seems obvious that Western Australia should



Previous page

A species of *Conospermum* (smokebush). The anti-HIV compound Conocurvone has been extracted from species in this genus.

Photo - Jiri Lochman

Left: Scarlet banksia (*Banksia coccinea*), a highly successful Western Australian species cultivated for the wildflower trade.

Photo - Eva Boogard, Lochman
Transparencies

Opposite page: Smokebush in full flower. It is easy to see why its common name is appropriate.

Photo - Marie Lochman



have kept a far tighter rein on the export of its plant resources for scientific purposes. We should have recognised the potential commercial value of our biodiversity. But in the past we were prompted by the prevailing scientific ethos of the day: namely that scientific research is undertaken for the benefit of all, and the results should be shared openly among the community.

Although these are laudable sentiments, the scientific community has been forced to adapt to the economic realities of life in the late twentieth century. Scientific research costs money, and as the research dollar becomes scarcer, there is increasing pressure on research institutes to find ways of generating revenue.

With the aim of ensuring that the research and development work was based in Western Australia, CALM entered negotiations with an Australian company, AMRAD. In addition, CALM brought together a consortium of talented scientists to investigate the smokebush substance. These included ecologists, geographers, botanists, chemists, pharmacologists and immunologists.

In a landmark agreement signed in December 1993, AMRAD agreed to fund the basic research into Conocurvone, which would be undertaken by the CALM consortium of scientists in collaboration

with the National Cancer Institute. In March 1994, after being put out to tender, an exclusive production and marketing licence was awarded to AMRAD. The agreement with AMRAD has already provided CALM with more than a million dollars to help conservation research.

Drawing up the agreement required changes to the CALM Act. These changes have given the State sovereignty over our flora, ensuring for the first time that Western Australians will benefit from its commercial use. They also allow CALM to grant exclusive rights to one

commercial company, necessary because of the huge costs of developing a potential drug. For example, the basic research into the drug Taxol, which is derived from the Pacific yew tree (*Taxus brevifolia*) and is effective against ovarian cancer, cost the NCI an estimated \$70 million. Once they had demonstrated its efficacy, they sold the development licence to a pharmaceutical company. It cost that company a further \$200 million to develop the compound into a marketable drug.

With such large sums of money

TESTING PLANT EXTRACTS

The plant material is ground into powder, and each sample is coded and placed in cold storage. When needed, samples are dissolved in various solutions to make extracts.

To test for activity against human immunodeficiency virus (HIV), the extracts are added to tissue-culture plates containing cells infected with HIV and uninfected 'control' cells.

Cells infected with HIV would normally die. If one of the plant extracts allows infected cells to survive, the extract may contain a biologically active compound that is effective against the virus. Of course, to be useful, it should also have no toxic effects on the 'control' cells.

An indicator dye is used, which develops colour in the presence of living cells. The 'bio-assay' plates are scanned by computer to detect colour changes.

Once a useful plant extract has been detected, the extract is chemically 'fractionated' - or divided into its separate constituents. The bio-assay is used repeatedly throughout this process until the fraction containing the biologically active compound is identified.

When the pure, active compound has been obtained, chemical characterisation techniques are used to establish the chemical structure of the compound.

involved, a pharmaceutical company must be confident of the potential of a prospective drug. Conocurvone is considered viable for pre-clinical development because it seems to be exceptionally potent against HIV, yet with a low toxicity to human cells. The mode of action of Conocurvone is not yet known, but it seems to act in a different way from currently used drugs such as AZT. Therefore, it is an excellent candidate for use in conjunction with other drugs.

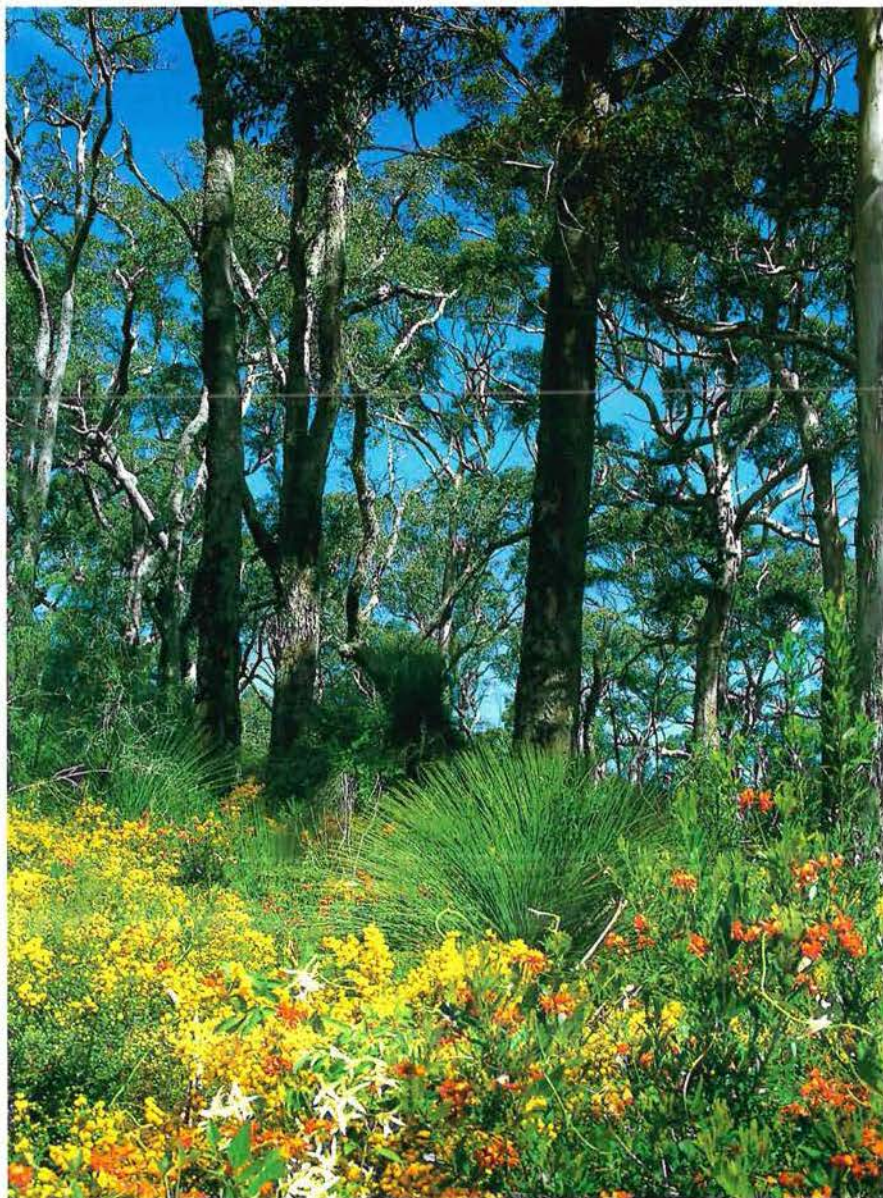
CHANGING ATTITUDES

What place does a conservation agency have in taking advantage of our natural biological assets? Cynics might say that such activities are about wealth-generation, not conservation, but it is more and more difficult to achieve the latter without the former. Nowadays, a vital part of conservation work lies in changing attitudes to our environment. If we are to protect the goose that lays the golden eggs, the community must see some golden eggs.

Western Australia has one of the richest floras in the world. It is estimated that there are 12 000 species of flowering plant in Western Australia, about half of the total number in Australia. But we also have more than our fair share of threatened species; 42 per cent of Australia's rare or threatened flora occurs in Western Australia.

Although dieback disease is now the major threat to our flora and fauna, the biggest problem in the past has been the clearing of land for agriculture and grazing by introduced animals. This is reflected in the fact that three quarters of the State's threatened plant species occur in the area now known as the Wheatbelt. Many of the plant and animal species that were once found throughout the area are now either extinct or are confined to small isolated nature reserves and to road reserves. The thin strips of native vegetation bordering roads are the last bastions of biodiversity in the Wheatbelt. But they are outside the conservation estate, and are under immense pressure from weed invasion, fertiliser drift and road widening.

Historically, land was only considered valuable once it had been cleared. Areas set aside as national parks or reserves were those that were of little use for agriculture. For example, the remarkable



Stirling Ranges were too inaccessible to clear. They now represent one of our most valuable areas of natural diversity and are home to many species that are found nowhere else. The Stirling Range National Park contains about 1 500 plant species, more than the entire flora of Great Britain.

The exception to this rule is the forests of the south-west. Unlike land originally cleared for agriculture, State forest, which has been carefully managed for the past century, retains an almost complete set of native vertebrate and vascular plant species. But the forests were initially left standing because it was difficult to plough the stony soils and clear the many trees; by the 1860s the export value of jarrah timber had also become known.

Conservation is often driven by practicalities and economics rather than ideals. It is a cold, hard fact that activities which return little or no revenue to the

State are at a disadvantage when government funds are allocated. National parks and reserves, for instance, have attracted little funding. Although there is no question of their value in cultural, aesthetic and recreational terms, they make little money for the State; the revenue raised from entry and camping fees in national parks does not even cover their management costs. Nature reserves do not generate any revenue, but cannot be simply 'left to nature'; they must be managed to minimise damage by fire, exotic weed invasion and feral animals. In addition, money must be found for documenting the characteristics, distribution and abundance of species if we are to conserve them effectively. Yet the economic reality is that conservation is often in need of more funding than government spending priorities permit.

Noble ideals such as the 'inalienable rights of species to exist' and the



Opposite page: Western Australia is endowed with a wealth of floral diversity, as shown in this mass display of wildflowers within a woodland in the South West. Any one species may at some time yield a potential new medicine such as Conocurvone.

Photo - Brian Downs, Lochman Transparencies

Top left: Kwongan (heath) in the Stirling National Park, location of some of the greatest biodiversity in Western Australia.

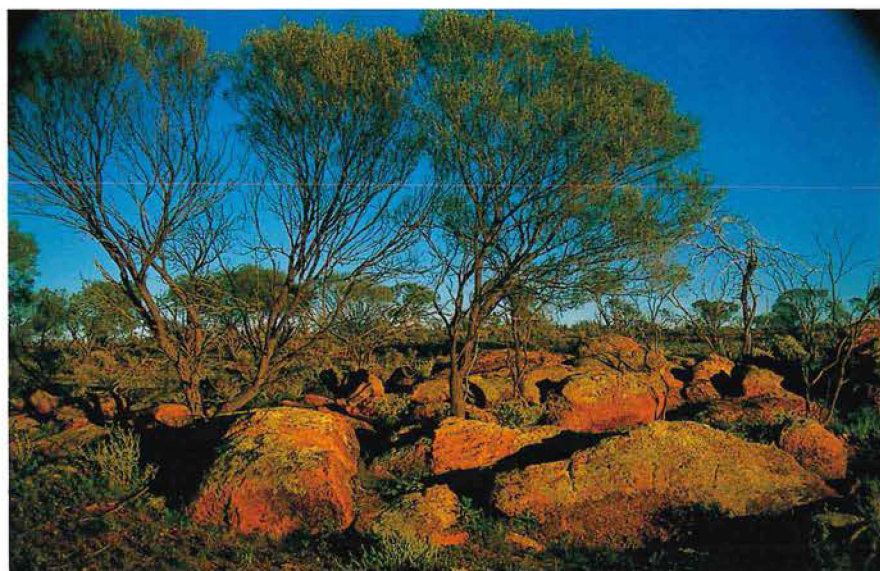
Photo - Kim Howe

Top: Fruits of the quandong (*Santalum acuminatum*), useful as a source of bush tucker. The commercial sandalwood tree belongs to the same genus.

Photo - Babs and Bert Wells

Left: Remnant vegetation in the Wheatbelt. More than 90 per cent of the native vegetation of this region has been cleared for farming.

Photo - Barbara Porter



'preservation of natural heritage' are of no use, either to species or to heritage, if there is neither the public will nor the money to support them. One way of protecting our native species is by realising their 'bio-wealth' and demonstrating the commercial value of the biota to the community. We cannot afford to allow species and plant communities to become extinct.

FUTURE OF BIOPROSPECTING

Conocurvone is still in the very early stages of development. It may turn out not to be a viable drug, but we have now established a firm platform to evaluate systematically the pharmaceutical potential of the Western Australian flora.

Australian plants are unique and full of potential. Plant populations have evolved here in virtual isolation over millions of years, and have developed a

vast array of chemical defences against herbivores, predators and pathogens. Western Australia is well placed to take advantage of this approach to conservation because it contains more species than other States, a high proportion occurring nowhere else. It is hoped that we can attract further commercial interest in funding the documentation, discrimination and conservation of our biota through the collecting and testing of plant specimens.

Turning our flora to economic gain must not prejudice one of CALM's prime aims: conservation. Harvesting of resources has to be managed professionally to ensure that dieback disease is not spread, the landscape is not degraded and the plant populations are sustained.

The Conocurvone story is a model for the innovative and sustainable use of our biological resources. Genetic assets could

take their place alongside minerals as a wealth-generating resource for the State - and, unlike minerals or hydrocarbons, biological organisms are renewable if they are managed sustainably.

If Conocurvone progresses to become a commercial drug, the State could receive royalties by the year 2002 of \$100 million per annum. Imagine the potential value of just five pharmaceutically useful compounds derived from Western Australian plants. While you think about that, CALM scientists are working in partnership with scientists from tertiary institutions and other government agencies to discover more such compounds.

Jim Armstrong is CALM's Director of Science and Information and can be contacted on (09) 442 0300. Kate Hooper is a contributing editor to *LANDSCOPE* and can be contacted on (09) 384 5711.

B

O U N T I F U L



B

A T A L L I N G

by Gordon Friend, Keith Morris
and Carolyn Thomson

The Batalling jarrah forest, east of Collie, has become a 'hotspot' for native mammals such as woylies, chuditch, brushtail possums, mardos and phascogales. As a result, the area has become a focal point for scientific research, a mammal conservation course and a new *LANDSCOPE* Expedition.



As the early morning sun filters through the jarrah forest, the rattling of a wire-cage trap heralds the first animal to be tagged, measured and released. It is a routine that is repeated each time researchers from the Department of Conservation and Land Management (CALM) set their traps among the tall trees of the Batalling, Hillman and Nundedine forest blocks. These forests are on the eastern edge of the forest belt, 35 km east-north-east of Collie. There is an abundance of fauna here now, with some species approaching numbers that were present during the countless years before Europeans opened up the vast areas of south-western forests. But the animals didn't always have it this good: like most areas in the South West, Batalling and the surrounding region has had a chequered history.

FARMS, COAL AND TIMBER

Alfred Hillman, a Government surveyor in the early years of the Swan River Settlement, was the first European to explore the area around Batalling and Darkan, the nearest township. Hillman explored the Hotham and Williams rivers in 1835 and began to survey a road from Albany to Perth. Williams was settled at around this time, and Hillman and his



friend Arthur Trimmer continued exploring the hinterlands, discovering the Arthur and Hillman rivers in 1850.

The first Europeans to settle in the Darkan area were Mr and Mrs William John Gibbs, who had emigrated from England in 1834, and were later engaged by the Government to discover new country suitable for settlement. They made their home near a rock outcrop known as 'Darkan' by local Aboriginal people. Their son William settled at Boolading Gully, just south of Batalling, in 1874. The trials and tribulations of their life in the bush were recorded by his wife Sarah-Anne. In those days, flocks of sheep had to be continually watched by shepherds to prevent them eating the poison shrubs (*Gastrolobium* spp.) which were common in the district, and sleeper-cutting and hunting were regularly undertaken to supplement meagre

financial and food resources. There was no time for conservation; the very challenge to survive meant that new natural resources were continually being sought for development. In the Collie-Darkan region this was achieved from two sources: coal and timber.

Although the Collie and Preston Rivers had been discovered and named as early as 1829, the town of Collie only began to materialise in 1883 with the discovery of coal. By the late 1890s, the coal industry and Collie were growing rapidly, coinciding with a world-wide demand for jarrah timber, and sleepers for the many railway lines forming

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Main: A pygmy by both name and nature, this tiny possum nests in tree hollows or blackboy leaves.

Photo - Gordon Friend

Inset top: Numbats have been reintroduced to the Batalling area and a recent monitoring trip showed they were breeding.

Inset below: The delightful brush-tailed phascogale is frequently caught at Batalling forest.

Photos - M & I Morcombe

Below: Intensive baiting for foxes at Batalling forest has resulted in a resurgence of native animals.

Photo - Kim Howe



transport webs throughout the Colony. Collie became the focal point for many timber mills, and the jarrah forest became interlaced with roads, railway lines and small settlements for timber workers.

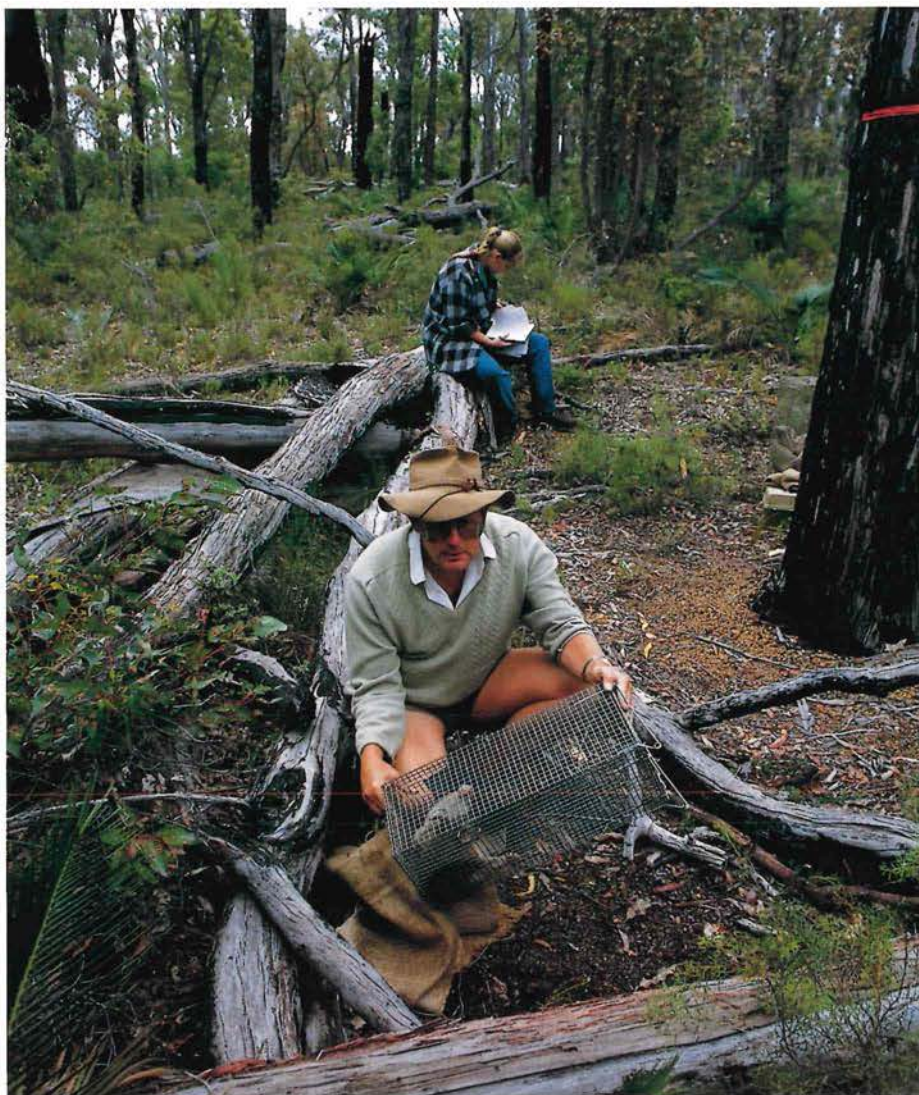
Two such settlements, Buckingham and Bowelling, sprang up just south of Batalling. Ernest and James Buckingham acquired a logging concession on the newly opened Collie-Darkan railway line in 1910 and built a sawmill. This mill operated for the next six decades, and Buckingham became a sizeable settlement. Unfortunately, much of it was destroyed in a wildfire in 1945. Similarly, Bowelling mill grew into a

Right: Wire-cage traps are baited with a tasty combination of peanut butter, sardines and oats - a gourmet delight for this brushtail possum.

Photo - Carolyn Thomson

Below: This young chuditch was about the same size as a grain of rice at birth, and will be weaned at around six months of age.

Photo - Jiri Lochman



major rail siding. The mill closed in the early 1980s, but the neat little rail siding and platform still stand today.

FOREST MANAGEMENT

These forests were harvested by small-scale selective cutting, over a long time period. Only large jarrah and wandoo trees capable of producing sleepers and mill logs were removed, with little if any marri being taken. Thus any one area in the forest may have had several cuttings over a long time frame, resulting in a multi-aged forest with a number of very large, old jarrah and marri trees, and many younger trees.

Fire has played an equally important role in shaping the features of the Batalling and surrounding forests, and this has been very well documented since the late 1930s. Agricultural development was in full swing in the years following the first and second world wars. Thousands of trees were ring-barked, left to die, then felled and burnt to clear the country for farming. Inevitably, these clearing burns escaped into the surrounding forests, causing frequent and often high intensity wildfires. Some areas were burnt as often as every 1-5 years, though it is unlikely that successive fires were of high intensity. Most of these fires burned unchecked as access was poor, and manpower and equipment levels were low.

After a series of wildfires in the late 1950s, regular prescribed burning was introduced. Over the next 20 years, most areas of the forest were burnt every 5-6 years by cool spring and occasional autumn burns. The frequency of burning has declined over the last 20 years, but it is clear that fire has been a major influence, alongside harvesting, in determining structure and pattern throughout the forest. However, clearing for agriculture and settlement, and the introduction of feral animals like the rabbit and fox undoubtedly had more of an impact on the animal life.

FERALS AND NATIVES

Prior to the coming of Europeans this area of the eastern jarrah forest probably supported about 26 mammal species, including at least six species of bat. Over the next century, as development gathered momentum, species numbers were reduced. Some of these species may

have been reduced through hunting, but long-term residents in the area state that many of the smaller species disappeared quite suddenly around 1910, supposedly from some kind of disease. Foxes followed the rabbits into this region in the early to mid-1930s and, from what we now know of their potential impact, undoubtedly sounded the local death knell for species like woylies, numbats and ringtail possums, already struggling to survive in an environment dramatically altered by clearing and other human impacts.

RECOVERY

In the early 1980s, CALM researchers Per Christensen and Tom Leftwich, then of the Forests Department, became concerned about the fact that woylies were confined to two small populations at Dryandra and the Perup Forest, near Manjimup. They wanted to expand the mammals' range and embarked on a

search for areas offering similar habitat. Noticing that Batalling had similar soils, vegetation and landforms to Perup, they released 56 woylies in the area in 1983.

Some fox control was done, but baiting techniques were not as sophisticated in those times and the woylie population remained at very low levels until 1991, when regular fox baiting with 1080 began. Woylie numbers have now increased dramatically. Trapping success has increased from only one woylie caught in 200 traps set in the late 1980s, to 15 in 100 traps set now. Woylies have also expanded their distribution in the forest and are no longer restricted to the heartleaf poison (*Gastrolobium bilobum*) thickets which provided protection from foxes before baiting programs were implemented.

The Batalling forest has now been designated a Fauna Reconstruction Site and CALM aims to return many of the





native animals that once occurred in the area, and to increase populations of those that still persisted. Numbats were reintroduced to the area by CALM research scientist Tony Friend in 1992 and 1993, and the success of this is currently being monitored. There are also proposals to establish populations of tammar wallabies and ringtail possums in the area.

In addition to these reintroduced species, several other medium-sized mammals also persisted in the Batalling forest. Until 1990, the chuditch, southern brown bandicoot (or quenda), brushtail possum and western brush wallaby had been recorded in low numbers. These increased dramatically after 1991, with the beginning of comprehensive fox control. Smaller species such as the mardo, brush-tailed phascogale and various dunnarts also persisted in the area, despite their disappearance from other areas.

So why is the area such a hotspot for fauna? The answer lies partly in the wide range of tree ages, from young to old, at Batalling. The hollow limbs of old jarrah and marri trees provide excellent refuge sites for brushtail possums and phascogales. Ground logs, both those felled for timber and left and those which have fallen naturally, develop hollows suitable for chuditch and numbats. However, many places throughout the jarrah forest have a range of tree ages, without corresponding diversity in the fauna. Site characteristics such as soils, vegetation and rainfall are probably the key to such diversity. Possums don't favour areas with a dense understorey. Woylies prefer clumped, relatively open vegetation with sandy soils that are easy to dig. They are rarely found in higher rainfall areas. The drier areas of jarrah forest with good soils, such as Batalling and Perup, appear to be the most productive for wildlife.

The mosaic of autumn and spring burning has also contributed to the diversity of wildlife. The heartleaf and



Opposite page: Participants on a *LANDSCOPE* Expedition to Batalling in November will have the rare experience of handling some of WA's secretive nocturnal animals.
Photo - Gordon Friend

Top left: When disturbed, echidnas often dig themselves into the ground, leaving their protective spines exposed.
Photo - Gordon Friend

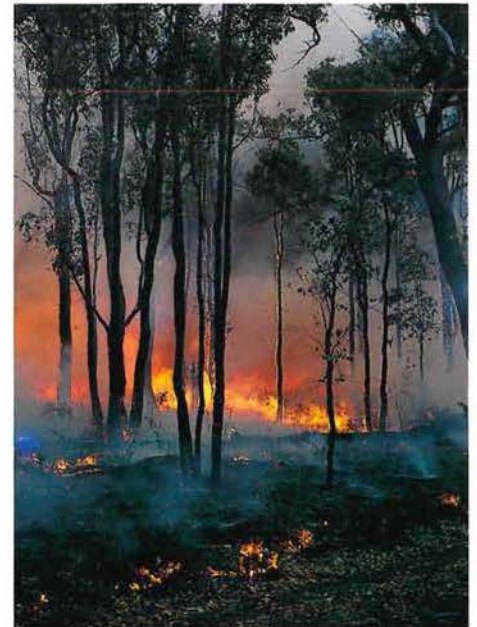
Top: CALM researcher Brent Johnson with a chuditch which has just been measured, tagged and weighed. Volunteer Alison Sampey records the data.
Photo - Jenny Daniels

Right: Research is under way on the effects of fuel reduction burns on the animals of the jarrah forest.
Photo - Gordon Friend

melaleuca thickets, which provide refuge for woylies and tammars, require infrequent hot fires to regenerate, while creeks and swamps that support bandicoots require only cool burns, which leave patches of unburnt vegetation.

A FOCAL POINT

The wealth of mammal life in the forest has made it an ideal area for scientific research. One of the first research projects was the reintroduction of woylies to Batalling in 1983, and subsequent monitoring. In 1991, CALM research scientist Keith Morris began investigating the impact of fox baiting programs on the chuditch (see *LANDSCOPE*, Summer 1992-93). Being a carnivore like the fox, it was feared that



this threatened species would also eat the poison baits laid to control foxes. However, by trapping and radio-tracking chuditch through several fox baiting sessions over three years, it was found that these fears were unfounded. In fact, fox control led to a significant increase in numbers of chuditch as well as woylies, bandicoots and brushtail possums.

After an approach from CALM's Collie District, research scientist Gordon Friend began investigating the impact of prescribed burning on animals of the jarrah forest in November 1992. Small mammals, reptiles and frogs are trapped using pitfall traps, small metal Elliott traps and wire-cage traps. They are then individually marked, measured and released. Many of the medium-sized

mammals are also fitted with radio transmitters and will be tracked closely for several months. Retrapping and radio-tracking of such animals provides valuable data on growth, breeding, movements and habitat use. The study will be carried out over five years and will provide feedback to managers on the effects of prescribed burning and fox baiting. This will allow them to develop management plans that take the multiple values of the jarrah forest into account.

With an increasing number of researchers visiting the area, CALM has leased an old farmhouse on a property adjoining Batalling. The farmhouse has become a haven for the district staff that manage the area, visiting researchers and school groups. The house has a rustic charm and can accommodate large groups. This facility has provided the opportunity to teach other CALM staff and paying volunteers about the department's scientific research. The CALM Bunbury operations staff and research scientists working in the area developed a mammal conservation course at Batalling for CALM staff, which has now been held twice since 1992. They use current research and monitoring projects to demonstrate animal survey and handling techniques, data recording and analysis and wildlife management techniques such as radio-tracking and fox baiting. Lectures are also given on the ecology and management of the forest fauna.

CALM and UWA Extension, of the University of Western Australia, have now run several *LANDSCOPE* expeditions, which bring people face to face with wildlife they wouldn't otherwise see and give them a chance to help carry out important research. 'Fauna of the Batalling Forest', to be held this November, will give paying volunteers the chance to see and handle secretive nocturnal animals such as chuditch, bandicoots, woylies and brushtail

Top: Small mammals, lizards and frogs are captured in a series of pitfall traps. Photo - Gordon Friend

Right: Goannas are quite long-lived. If this young animal is captured again it will provide interesting information about its growth. Photo - Jenny Daniels

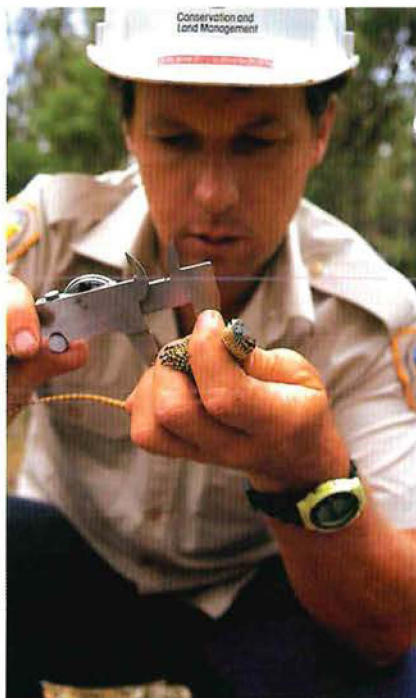


possums. Many people have enjoyed going on 'A Wild Weekend with CALM' to Perup forest (see *LANDSCOPE*, Summer 90-91). The Batalling course is similar, but will be something of a wild *week* with CALM.

CALM is to spend \$20 000 upgrading facilities at the homestead to support the development of nature-based tourism in the Collie region. The work is now under way and includes laying new floor coverings, installing a new shower and toilet and providing more comfortable chairs and beds. The farmhouse will then be available to tourist operators, allowing them to take up to 20 people on expeditions into the forest.

But perhaps one of the most important developments at Batalling is

the special co-operation that is occurring between researchers from CALM's Perth-based Wildlife Research Centre and the department's Collie District Office. All the planning and sampling for the studies at Collie have involved both scientific and district personnel. This has given district staff the chance to get hands-on experience and gain a practical understanding of ecological research. It has undoubtedly increased awareness about native animals and their habitat requirements throughout the district. As a result, virtually all management activities in the area are now undertaken in consultation with the researchers. In the end, it is the forest and its unique inhabitants that will gain from this relationship.



A *LANDSCOPE* Expedition to the Batalling forest will run from November 14-18. For further information, or to book, phone Jean Collins of UWA Extension on (09) 380 2433.

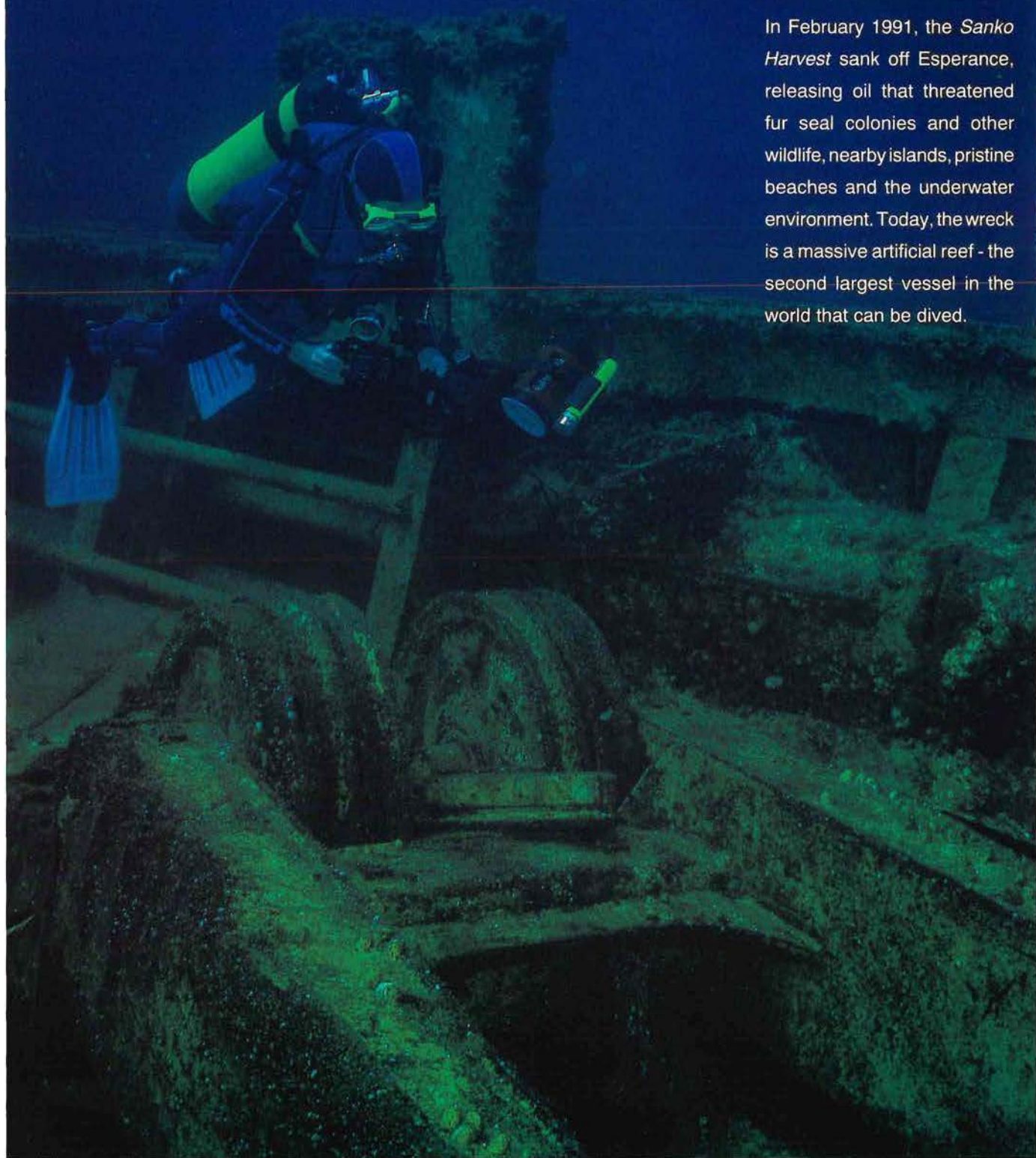
Gordon Friend and Keith Morris are research scientists at CALM's Wildlife Research Centre on (09) 405 5100. Carolyn Thomson is media liaison officer at CALM Corporate Relations Division (09) 389 8644. The contributions of Per Christensen, Peter Moore, Rob Brazell and Brent Johnson to this article are gratefully acknowledged.

H A R V E S T

from the  S A N K O

BY ANN STORRIE AND
GREG POBAR

In February 1991, the *Sanko Harvest* sank off Esperance, releasing oil that threatened fur seal colonies and other wildlife, nearby islands, pristine beaches and the underwater environment. Today, the wreck is a massive artificial reef - the second largest vessel in the world that can be dived.



The *Sanko Harvest* ran aground on Thursday 14 February, 1991 on a reef (later called Harvest Reef) 12 nautical miles off Esperance. The 30 000 tonne bulk cargo carrier was loaded with phosphate and bound for Esperance. While attempting to negotiate the Archipelago of the Recherche, the vessel struck the submerged reef near an important nature reserve. The State Combat Committee immediately swung into action, rigging booms around the ship to contain escaping oil (at that stage only a small leak). However, by Saturday the ship began to break up in heavy seas and large quantities of oil began to leak from the wreck. Before long, oil and phosphate spilled freely from the ship.

By Sunday 17 February, the oil had reached the New Zealand fur seal colony on nearby Hood Island and Seal Rock. A massive clean-up operation was begun by the Department of Conservation and Land Management, on behalf of the State Combat Committee and in association with other government departments and local volunteers. Over the next few weeks more than 30 CALM staff and 100 volunteers became involved in the rescue. Hundreds of oiled seal pups and other wildlife were captured and cleaned. Despite the best efforts of the rescuers, at least 15 seal pups and 30 seabirds died.

EFFECT ON MARINE LIFE

The spill's initial effect on marine life was obvious. At oiled sites, nerites



molluscs (*Nerita atramentosa*) were seen crawling high up on to granite boulders or well down in the pools, their shells and soft bodies covered in oil. The common crab (*Leptograpsus variegatus*) appeared to be badly affected, with most individuals being well oiled. Crabs were also seen feeding on oiled substrates. At one site, brittle starfish crawled out of the pools

Previous page
Ann Storrie looks at one of the *Sanko Harvest*'s pulleys on the deck.
Photo - Wayne Storrie

Top: The two deck cranes of the *Sanko Harvest* marked the spot of the wreck for about a year until they collapsed into the ocean.
Photo - Jiri Lochman

and on to rocks where they dehydrated. However, some animals were able to use the by-products of the spill to their advantage: in some inshore waters, large blue groper were seen darting under black oil slugs for cover.

Some tidal pools became filled with oil that they couldn't release, and intertidal life in these pools suffered. A



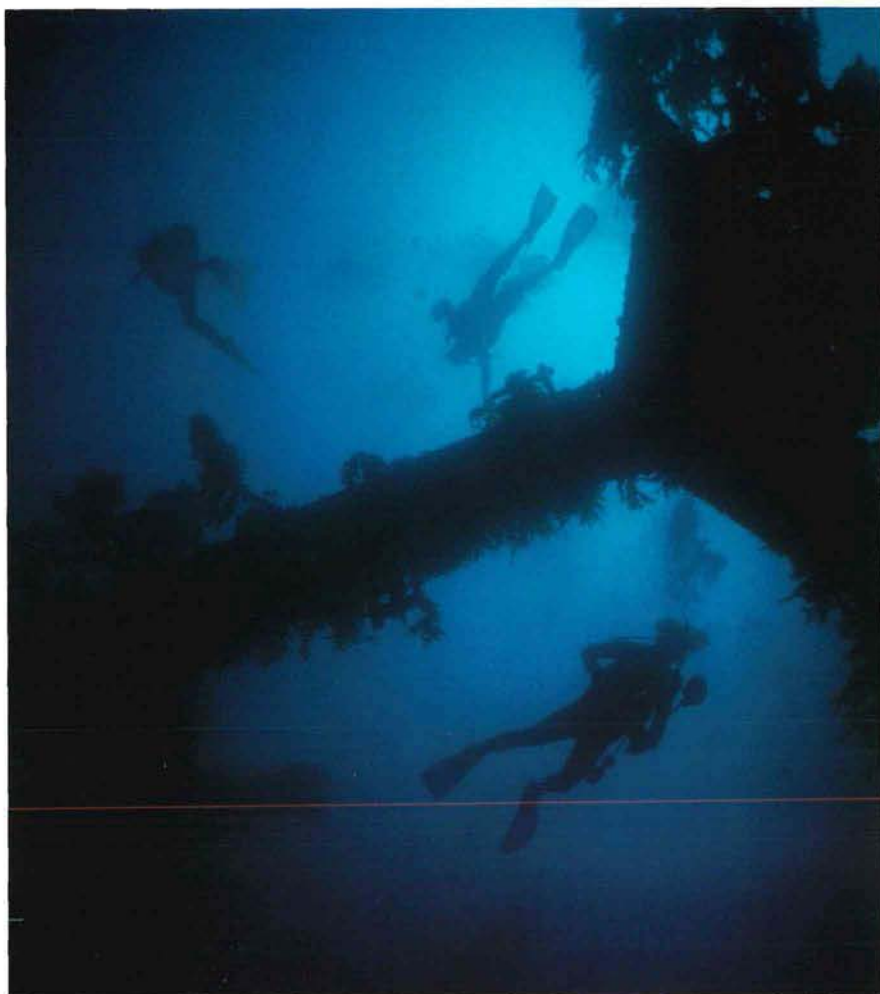
Left: The vessel, surrounded by oil containment booms, 24 hours after it was pinned on the reef; the flag indicates salvage divers were below.

Below left: The *Sanko Harvest* four days later. Bunker oil continued to escape and clouds of fertiliser drifted around the wreck. Studies showed no long-term impact.

Centre: Rock pools on the coast and islands remained heavily oiled for up to 10 weeks, and in some areas oil had to be physically scooped from the water.

Below right: The fur of these two-week-old New Zealand fur seal pups was badly contaminated with oil.
Photos - Greg Pobar





Left: Divers around the crow's-nest of the vessel - a good place for a decompression stop.

Photo - Ann Storrie

Below left: Anemones coat many of the railings around the ship. They are often the first animals to colonise new structures under water.

Photo - Ann Storrie



tidal pool on Figure of Eight Island, west of Seal Rock, remained polluted with thick bunker oil for four weeks, until it was flushed by a rising sea. Five months later there was still no life in this pool and the surrounding rocks were covered in oil.

However, in the six months after the spill there was no detectable reduction of commercial and recreational fish catches

as a result of the pollution. A year after the spill, there were still layers of weathered oil under beach sand but, in general, wildlife showed no signs of long-term oil effect.

BENEATH THE WAVES

Twelve months after the *Sanko Harvest* ran aground, few reminders of the disaster were visible. There was still

oil on the sea floor at Bunker Bay, but marine plants were growing in it and through it, apparently thriving on the hydrocarbons (low levels of hydrocarbons are found naturally in the marine environment). Ninety-nine per cent of the oil had dispersed or was buried and was gradually being broken down, no adverse effects of the phosphate were obvious and the New Zealand fur seal colonies were thriving. Only five metres of the ship's superstructure teetered above the water.

The last of the superstructure had disappeared beneath the surface by the winter of 1992. The vessel was slowly sliding down Harvest Reef. By later that year, the structure closest to the surface was a crane tower, which loomed three metres beneath the waves. The rest of the ship buckled and twisted down Harvest Reef to the sea bed. The bow, which pointed east-north-east, had dug into the sand at 43 metres, while the stern rested at about 26 metres. When the ship sank, the bridge split from the main hull and now sits about 50 metres from the rest of the ship.

THE WRECK NOW

The *Sanko Harvest* now generates very little interest, except for the diving fraternity. This relatively intact cargo ship is the second largest vessel in the world that can be dived, providing adventure and excitement for those brave enough to explore its awesome structure. However, the inclement weather often encountered on WA's southern shores limits the possible days for diving on the vessel. Blustering south-westerly winds, huge seas and strong currents have disappointed many would-be *Harvest* explorers.



By January 1993, when a dive by Ann and Wayne Storrie was undertaken, the crane tower had settled 10 metres below the surface and the vessel was hard to detect, especially as there was little wave action on Harvest Reef. A slight easterly breeze was blowing, similar to that on the eve of the *Sanko Harvest's* demise. With the aid of Global Positioning System navigation, they were dropped straight on to the deepest section, the bow, which was still intact at 43 metres.

Visibility was about 12 metres, yet the ship disappeared into the distance. Its size was awesome. Large gaping holes of jagged, torn metal beckoned the pair into the ship's bowels, where a fine layer of rusted metal and silt coated the interior. The ship was one huge resonating chamber from which the slightest noise echoed through the water. It was an eerie feeling to be inside the enormous, dark, silty, noisy hold, which was once full of phosphate.

ARTIFICIAL REEF

The *Sanko Harvest* is now simply an artificial reef. Devoid of its hazardous cargo, it has become a haven, enticing marine life to live and breed within a sheltered environment. A blue groper swam around the two divers, curiously peering at their shiny apparel and the bubbles emanating from them. It was soon joined by two more, and all three

fish stayed within sight for the rest of the dive.

Wrasse, swallowtails, sweep, moonlighters, boarfish, truncate coralfish, morwong, and many other species swam around the hull and the fittings that were left on the deck. Bolts, shackles, pulleys, chains, and rope littered the area, while steel cable draped in roller-coaster fashion from the crane towers to the deck. A crane dangled over one side of the ship, like an enormous fishing line waiting for a shark to take the bait. Thousands of small sea tulips (ascidians of Genus *Pyura*) had taken hold on the railings and edges of the ship, and white-striped sea anemones (*Anthothoe albocincta*) coated the door frames and sides of the hull. An amazing amount of kelp was growing everywhere, especially on a section of hull that draped over Harvest Reef at 20 metres.

CABINS AND KELP

Although care has to be taken to avoid the jagged metal surrounding holes and door frames, it is relatively easy to swim through the ship. Few furnishings are left within the rooms. The frames of the enormous ship's ovens lie at an acute angle in the kitchen while the mess is empty except for electrical fittings and wires dangling from the walls. One single bed bolted to the floor remains in the Captain's cabin and you can wander

Above: Blue groper are very curious about divers on the *Sanko Harvest*. Several have made their home around this artificial reef.

Photo - Ann Storrie

through to the bathroom and toilet. There is little left in the engine room. The controls lie 10 metres from the hull, half buried in sand and silt. Amazingly, the propeller is still intact. It is so big that at first it is hard to recognise.

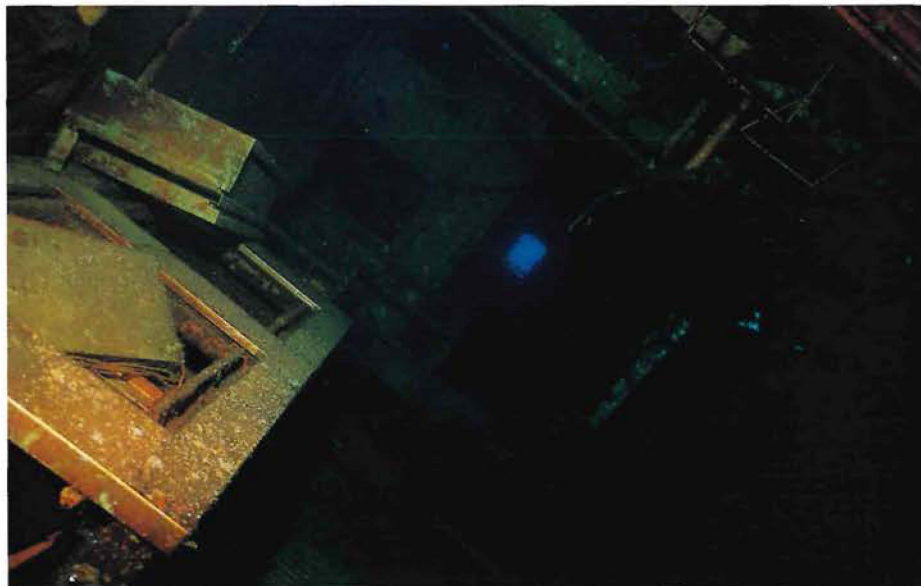
From the main hull, a huge trail of rubble and tangled metal leads to the bridge, where swallowtails often form large schools. Far above, the crow's-nest rises into a sunburst, silhouetting the fronds of kelp dragging over the railings. Together with the crane towers, it is a perfect structure on which to spend some time before rising to five metres for a decompression stop.

It took every minute of the three dives made by Anne and Wayne on the *Sanko Harvest* to see all this. They never put a fin in the same place twice, and there were many areas that were not covered. More blue groper joined them on each dive and several must now inhabit the wreck.



Above: Ann Storrie stands in one of the doorways of a crane tower, now encrusted with invertebrates.

Photo - Wayne Storrie



Above right: The frames for the ship's ovens lie on an acute angle in the kitchen.

Photo - Ann Storrie

LONG-TERM EFFECTS

Incidents such as the loss of the *Sanko Harvest* will continue to occur and their impacts and outcomes will vary. While the long-term effects of the *Sanko Harvest* wreck appear to be minimal, it could have been a different story. It is believed that, without the swift and intense clean-up operation, the newborn fur seals on Seal Rock and Hood Island could have been severely reduced in number and the breeding viability of the colonies affected.

Fortunately, the *Sanko Harvest* today is only another reminder of nature's amazing power of recovery. We must now value the right of the adaptable marine life, from the magnificent blue groper to the tiny anemones, to live in harmony with yet another of humankind's misguided judgements. Those privileged enough to dive on the wreck should remember the damage to wildlife it caused and the tremendous clean-up and rescue efforts by volunteers that it made necessary.

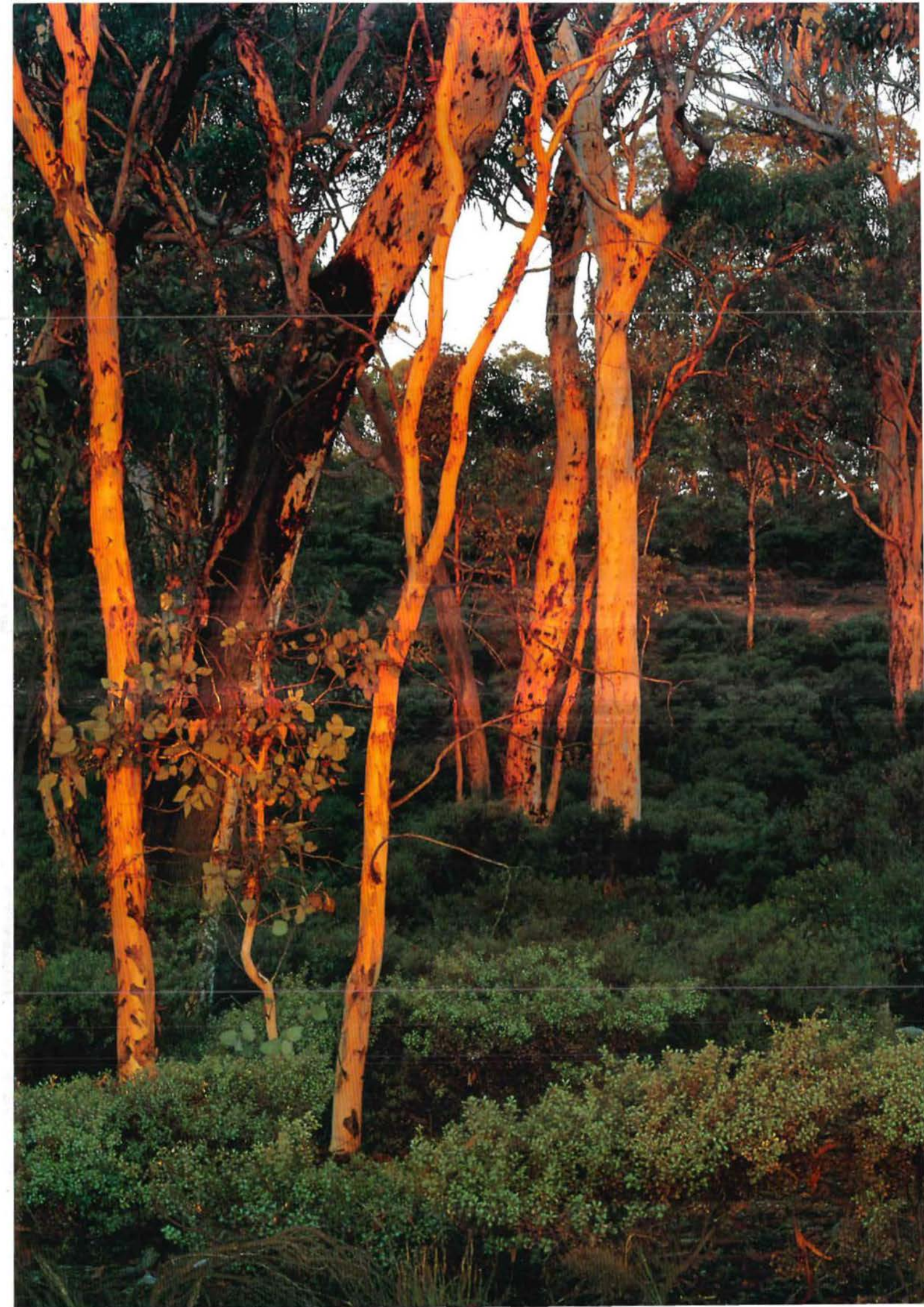
Ann Storrie is an underwater photo journalist. She can be contacted on (09) 385 9355.

Greg Pobar is the Environmental Manager at Rottneest Island Authority. He can be contacted on (09) 372 9727.



Below: Schools of swallowtail on the bridge.

Photo - Ann Storrie



*Woodland
Wonderland*

Two hours drive south-east of Perth lies an archipelago of 17 bushland islands amid a sea of wheatlands and grazing pastures near the Central South town of Narrogin. Together, they form Dryandra Woodland, the biggest tract of remnant vegetation in the western Wheatbelt and habitat for several of Western Australia's rare and endangered animals. The survival of these species hinges not only on the conservation of the woodland, but on future partnerships with surrounding land owners.

*By
David Mitchell
and
Nigel Higgs*

Dryandra Woodland lies on the boundary between the Darling and Avon botanical districts of the South West. It is a distinct transition zone between the jarrah-dominated forests of the Darling Range and the more arid Wheatbelt. Jarrah gives way to powderbark, wandoo and brown mallet. Marri begins to disappear from the mid slopes and the valleys host stands of York gum. This transition is also marked by stark contrasts in the vegetation structure - tall, open wandoo woodlands, dense sheoak forests, low, dense heathlands and granite outcrops. The heathlands, or kwongan, are the most species-rich vegetation associations and, in spring and early summer, yield a riotous display of wildflowers and birdlife. But at the beginning of the century, the area was important for very different reasons.

European settlers in Western Australia's semi-arid zone, now known as the Wheatbelt, turned to the native brown mallet (*Eucalyptus astringens*) as a source of revenue to develop farms. The tree's tannin-rich bark was a winner with the European leather industry.

In 1908, officials in the then Woods and Forest Department warned that the species was in danger of being cut out, and by the early 1920s, the mallet supply had become critical. Extensive surveys of land west of Cuballing resulted in the recently formed Forests Department reserving the first section of what is now



Dryandra Woodland to protect natural mallet stands and establish plantations.

In the Depression of the 1930s, extensive areas of Dryandra were sown to mallet by sustenance workers. At the same time, outstations from the main Dryandra block were established.

Previous page

Main: Dryandra's powderbarks (*Eucalyptus accedens*) can trick the uninitiated into believing they are wandoo (*E. wandoo*). Brush the bark with your fingers and you will discover the difference. Photo - Chris Garrett

Inset: The autumnal colours of shed wandoo bark are another aspect of the contrasts in the Dryandra Woodland. Photo - Marie Lochman

Above: Dryandra Woodland is home for one of the biggest populations of the woylie. Photo - Marie Lochman

Below: Plantations of brown mallet still have commercial uses, but their distinctiveness is now part of Dryandra's natural beauty. Photo - Jiri Lochman



Mallet plantations continued to be established periodically until 1962, by which time the market for vegetable tannins had collapsed in the face of competition from synthetics.

Today, these plantations extend over more than 8 300 hectares, about one-third of the area of the Dryandra Woodland, and supply a local tool-handle manufacturer and a few firewood licencees.

But if those early foresters thought Dryandra was established merely to preserve the commercial exploitation of the mallet resource, they were wrong. They created, perhaps unwittingly, what has become one of the most significant conservation areas in the Wheatbelt.

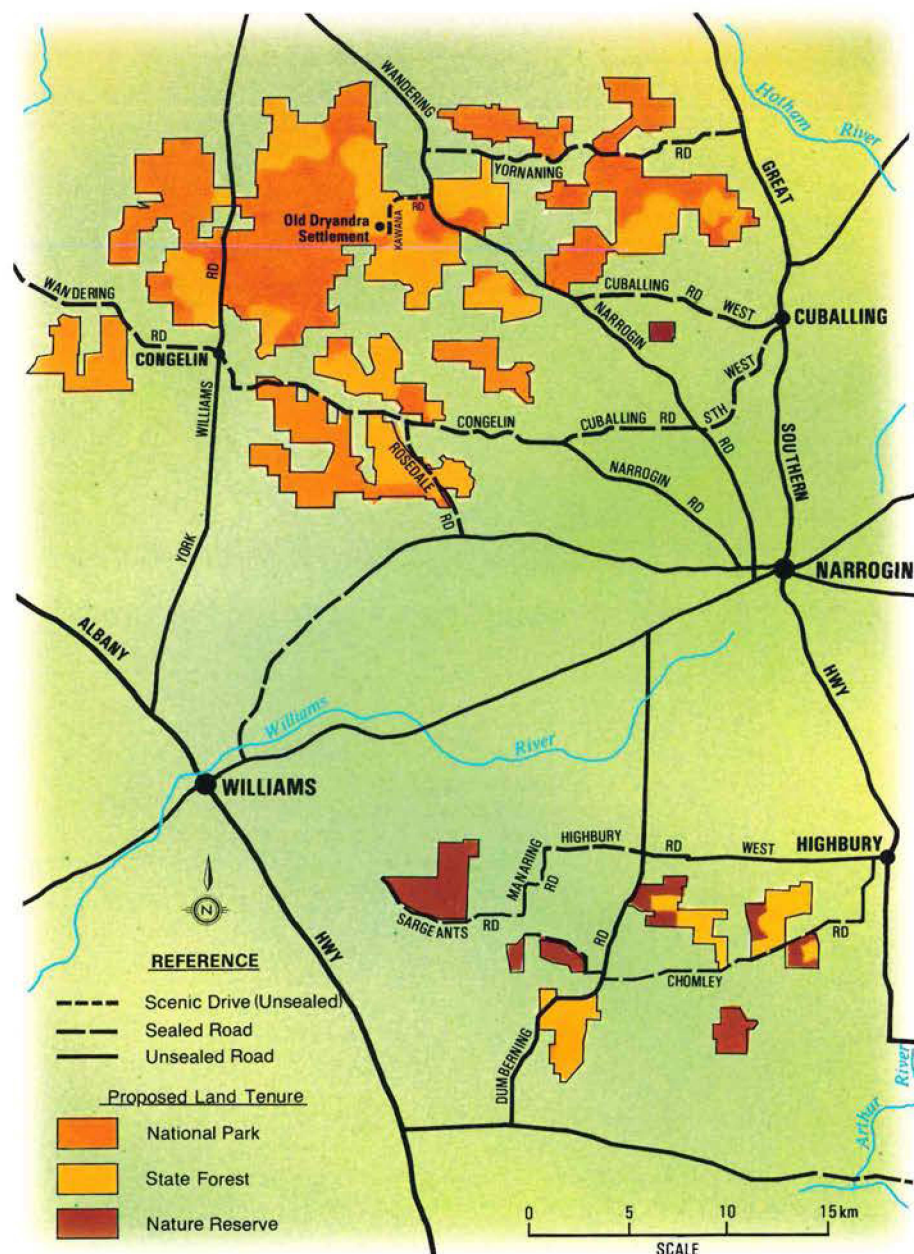
FLORAL RICHNESS

Dryandra has a relatively rich flora with 816 identified native plant species ranging from those common in the wetter jarrah forest to species peculiar to the semi-arid Wheatbelt. Its floral significance can be gauged from comparing it with other conservation areas - the nearby Tutanning Nature Reserve has 697 species and the Walpole-Nornalup National Park has 698 species (albeit Fitzgerald River National Park has 1 748 species).

The Department of Conservation and Land Management (CALM) maintains a reserve species list for flora that are poorly known and in need of further survey, or are in need of monitoring. Dryandra hosts 19 of these reserve species, which include the smooth-lipped spider orchid (*Caladenia integra*), two Darwinias, a mountain buttercup (*Hibbertia montana*), the narrow-leaved red mallee (*Eucalyptus latens*), Crowley's grevillea (*Grevillea crowleyi*) and the non-poisonous native pea *Nemcia stipularis*.

In 1988, CALM Operations Officer Greg Durell collected a specimen of the rare *Eucalyptus olivacea* from the Highbury section of Dryandra, believing it at the time to be a different species. However, the discovery was only recently unearthed after a chance look through Herbarium records confirmed that it was indeed the rare eucalypt.

Above: The smooth-lipped spider orchid is one of 19 reserve flora list species found in the woodland.
Photo - Babs and Bert Wells





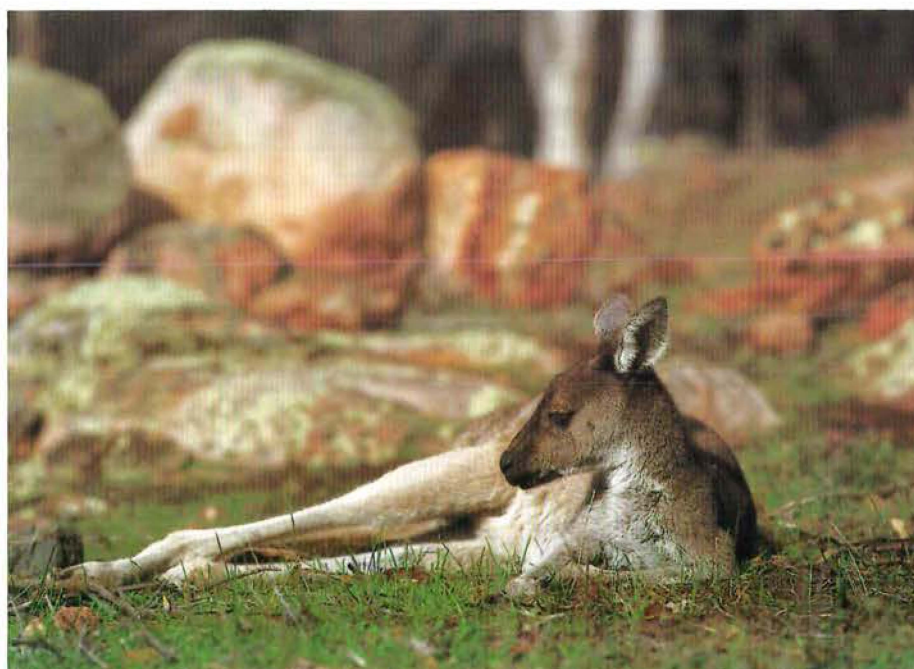
Eight species of poison pea (*Gastrolobium* spp.) abound in the woodland, often in dense thickets. The toxin in the peas is lethal to most animals, but not to many of WA's native mammals, which have developed a high tolerance to it (see 'Poison Peas: Deadly Protectors', *LANDSCOPE*, Winter 1991).

The dense thickets formed by poison peas provide perfect shelter for native animals. They are a fine example of Dryandra's microcosm of living partnerships, the sort that characterise WA's ecosystems. Another example is the relationship between the fungi and the woylie.

THE FUNGI AND THE WOYLIE

Only limited surveys of fungi, mosses, liverworts and lichens have been carried out, but more than 100 species of larger fungi have been recorded in the woodland. Many of these bigger fungi have underground fruiting bodies that are a major part of the diet of the woylie (*Bettongia penicillata*), a small wallaby-like marsupial that is one of the declared rare animals found in Dryandra. The spores of these fungi pass through the gut of the woylie and are spread to new locations in scats.

The importance of this relationship is highlighted when it is realised that many of these same fungi form symbiotic associations with the plants of Dryandra. They grow within or on the outside of the plant roots and increase the uptake of nutrients by the plant, thus enhancing its growth and survival. In part it is the dense vegetation, including thickets of poison plants, that in turn has assisted the survival of the woylie.



Top: The presence of the short-beaked echidna is revealed by the plethora of diggings it makes while seeking out ants and termites.

Photo - Jiri Lochman

Above: Dryandra also is a haven for the red-tailed phascogale. Fox control is retrieving this and many other marsupials from the brink.

Photo - Jiri Lochman

Left: Dryandra has an aura that even the native inhabitants, such as this western grey kangaroo, find far from the madding crowd.

Photo - M & I Morcombe

Bushwalkers in Dryandra might occasionally notice a commotion at their feet and a flash of a rapidly disappearing furry rump, betraying the location of a woylie's daytime nest: a neat ball of shredded bark, grass and leaves. Dryandra is a stronghold of this threatened species and the fact that bushwalkers can flush one from its nest shows how numerous they are.

Many overnight visitors at Dryandra Settlement are startled at night by what they think are huge hopping rats, right outside their hut. These are woylies, and up to 40 have been known to gather at the settlement at one time. At Dryandra, it is hard to believe their threatened status, but the species has declined dramatically from being one of the most widespread and common of the rat kangaroos in southern Australia, to a very small number of remnant populations in Dryandra, Batalling, east of Collie, and Perup, east of Manjimup.

A powerful torch or spotlight provides an intimate view of their activity as they feed on fungi, Guildford grass bulbs (*Romulea rosea*), seeds and food scraps left after an alfresco meal. A woylie growl or swift cuff with their legs soon sorts out a dispute over a particularly tasty morsel. Woylies also carry off seeds, especially

big ones such as those of the sandalwood (*Santalum spicatum*), and bury them so they may be recovered for a later feast.

OTHER ANIMALS

There are few places in Western Australia that have as rich or as visible fauna as Dryandra. A quiet walk or drive in the woodland could reward one with an encounter with the State's mammal emblem, the rare numbat (*Myrmecobius fasciatus*). Or you could catch an echidna (*Tachyglossus aculeatus*) out looking for its next meal of ants and termites.

Further from the settlement a spotlight reveals more of Dryandra's rich wildlife. Brush wallabies (*Macropus irma*), western grey kangaroo (*Macropus fuliginosus*), brushtail possum (*Trichosurus vulpecula*) and the rare tammar wallaby (*Macropus eugenii*) are frequently seen. Tammar wallabies are one of the four declared threatened mammals found in Dryandra along with numbats, woylies and the red-tailed phascogale (*Phascogale calura*). The phascogale is locally abundant but rarely seen, as it is small and keeps to the dense rock sheoak thickets.

But Dryandra is not all rare mammals. Other smaller species include the mardo (*Antechinus flavipes*), honey-possum

(*Tarsipes rostratus*), pygmy-possum (*Cercartetus concinnus*), dunnarts (*Sminthopsis* sp.) and 10 species of bat.

If very quiet, you might even get a glimpse of a malleefowl (*Leipoa ocellata*) as it fades out of sight into the undergrowth. The malleefowl faces enormous pressure in those remnant areas of the Wheatbelt from which it has not become locally extinct through predation or clearing of habitat for grazing lands and wheat fields. Recently, there has been an upsurge in concern for this species and many volunteer groups have projects to protect and enhance local populations. The Royal Australasian Ornithologists Union (RAOU) is carrying out a long-term project to monitor the breeding and survival of Dryandra's malleefowl.

The 36 species of lizard and 15 of snake, most of which are harmless burrowers, reflect the woodland's

Below: One of the species that lends its name to the Dryandra Woodland. This one is *Dryandra horrida*. In all, Dryandra is host to 816 identified native plant species. Photo - Jiri Lochman





position on the transition zone between the Wheatbelt and the jarrah forest. Several species exist at the eastern and western limits of their range. One, the carpet python (*Morelia spilota imbricata*), is declared specially protected.

As for most of Western Australia, invertebrate life in the woodland is not well known. But in common with elsewhere, invertebrates play a pivotal role in the biodiversity and conservation of the woodland. Termites, for example, those much-maligned 'house eaters', are keystones of the ecology of Dryandra. They perform a crucial role in recycling the nutrients in dead plant matter back into the soil and in maintaining soil structure. They are the 'earthworms' of Australia's arid and semi-arid areas.

The numbat eats only termites and the insects form a substantial part of the diet of the echidna. The big winged termites that swarm from their nests after the opening rains form a veritable feast for bird and beast alike.

One species of termite - *Coptotermes acinaciformis raffrayi* - is the only species that forms hollows in wandoo and powderbark trees. These hollows provide the numbat with nest sites and refuge from predators. Hollows in standing trees or in branches on the ground are important refuges for many of the other species in the woodland.

FOX CONTROL

The first fox control in Dryandra was a by-product of rabbit baiting introduced in the mid 1950s. Foxes predating and scavenging on rabbits poisoned with 1080-laced oats died from secondary poisoning. While this had some benefit for native wildlife, it wasn't until the early 1980s that researchers stepped up their efforts and attacked the fox head-on in parts of Dryandra with poisoned meat baits. Now, sightings of native animals, including numbats, woylies, tammar wallabies and brushtail possums, have increased dramatically.

The recovery of the woylies in particular is proving so successful that the experience forms the basis for reintroducing and establishing colonies in other areas of the species' former range, and there is every indication it may be taken off the endangered list within the next few years.

A NATURAL PLAYGROUND

Dryandra is one of the Central South's three major tourist attractions, attracting 30 000 people a year. This compares with the 66 000 people a year who visit the region's major tourist drawcard - Wave Rock at Hyden.

CALM surveys have shown that visitors frequently list beautiful open woodlands, naturalness, wildlife, scenery

and peacefulness as reasons for their visits. The same surveys show many people have a great curiosity about Dryandra and its values, and that their experience is heightened by a better understanding of the ecology and cultural heritage of the woodland.

Bushwalking features high on the list of visitor activities. While so far there is only one designated bushwalk, many people are content to explore the diversity of the woodland on foot using the many management tracks that run through the area.

The one existing structured walk, the Ochre Trail, has interpretive information on the ecology of the area and provides a link between Dryandra and the region's Aboriginal heritage.

Although not well documented, there is evidence of Aboriginal occupation in Dryandra, including an ochre quarry, scarred trees, stone arrangements and scatterings of artefacts. However, no comprehensive survey of the area has yet been done.

Above: Ninety-nine bird species have been recorded at Dryandra and an early morning walk to catch the dawn chorus is a popular activity. This blue-breasted fairy wren (*Malurus pulcherrimus*) busies itself with family matters.
Photo - Babs and Bert Wells

Picnicking, too, is popular and barbecue facilities have been provided at several sites throughout the woodland. These provide ideal focal points for other activities such as sightseeing, wildflower viewing and bushwalking.

NATURE STUDY

Most of the buildings in the old Dryandra Settlement, which followed the development of the mallet plantations, are now run by the Lions Clubs of Western Australia under a lease arrangement with CALM. Former forestry cottages - and Nissen huts for bigger groups - are bases from which to explore the woodland.

More recently, the Irabina Field Study Centre has been set up within the old settlement and is used by a variety of interest groups for seminars and workshops. There also are two Dryandra Woodland Ecology Courses run by CALM staff each year to introduce people to the local ecology.

It is this pressure for recreation and nature-based tourism, along with the distinct natural values of the Dryandra itself, that present the greatest challenge to the conservation effort for the woodland.

A 100-YEAR VISION

Last March, CALM released a Draft Management Plan for Dryandra Woodland in recognition of the need to balance the conservation, recreation and timber production values of the woodland. Although the plan presented a 10-year program, it was a vision that looked beyond that decade and virtually into the 22nd century.

This '10-year-plan with a 100-year vision' was based on the concept that the conservation of the woodland could not be viewed in isolation from its neighbours, nor indeed those small, but locally significant commercial entities that relied on access to the timber resource for their future. It also encouraged these neighbours to become involved in the nature conservation effort. For example, not only could tracts of native vegetation on private farmland create further corridors for native mammals to migrate, they could also play a role in the landcare efforts of the farmers within surrounding catchments.

Already some neighbouring landowners, assisted by local volunteers, have included bushland corridors



Above: The turtle frog (*Myobatrachus gouldii*) is found in Dryandra and is one of only two frogs that burrow forwards. It doesn't need open water to breed, but lays eggs underground. The embryos go through the tadpole stage while in the egg and emerge as miniature versions of the adults. Photo - Babs and Bert Wells

Top: The woodland is a refuge for the rare malleefowl. The bird's habitat has been severely curtailed through clearing for agriculture.

Photo - Peter Marsack/Lochman Transparencies

between some of the blocks of bush at Dryandra in their land conservation plantings. In the future, native vegetation plantings could offer a financial return through the prospect of sustained harvesting of the timber resource for local industries.

It is a vision based on integration through partnerships - the very partnerships that have helped create Dryandra as a woodland, and wildlife, wonderland.

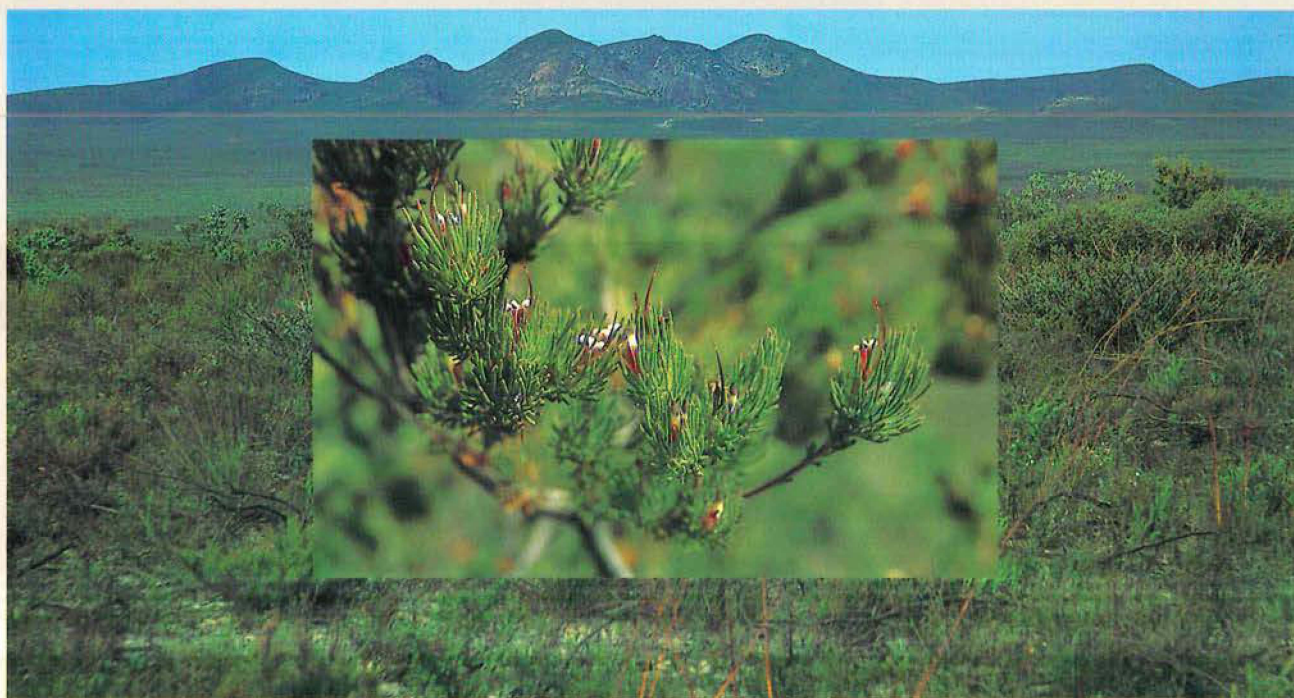
David Mitchell, Regional Ecologist for CALM's Wheatbelt Region, is a member of the planning team which prepared the Dryandra Woodland Draft Management Plan. He can be contacted at Narrogin on (098) 811 444.

Nigel Higgs is CALM's Principal Media Liaison Officer. He can be contacted on (09) 389 8644.

The authors acknowledge CALM's planning team members - Anthony Sutton, Tony Friend, Steve Gorton and Dennis Hilder.



ENDANGERED!



FITZGERALD RIVER WOOLLYBUSHES

Fitzgerald River National Park, on Western Australia's south coast, is home to around 1 800 plant species, of which at least 75 are endemic. The genus *Adenanthos* is represented by eight species and one subspecies. These woollybushes are the oval-leaf adenanthos (*A. ellipticus*), Gairdner River woollybush (*A. cacomorpha*), Labillardiere's woollybush (*A. labillardierei*), Fitzgerald woollybush (*A. dobagii*), veined adenanthos (*A. venosus*), yellow flowered woollybush (*A. flavidiflorus*), wedge-leaf woollybush (*A. cuneatus*), shiny-leaf adenanthos (*A. glabrescens* subsp. *exasperatus*) and mountain woollybush (*A. oreophilus*).

Fitzgerald woollybush and oval-leaf adenanthos have been declared as "rare flora". Fitzgerald woollybush is known only from three populations occurring on low quartzite hills in the east of the park. It has darker green foliage and cream and red flowers. Oval-leaf adenanthos occurs in a few scattered populations along

the coastal quartzite Barren Ranges system. First discovered on East Mount Barren, a population is now known from the Thumb Peak Range in the central wilderness. It grows as a sparse shrub to about three metres, with large elliptical leaves and pale orange flowers.

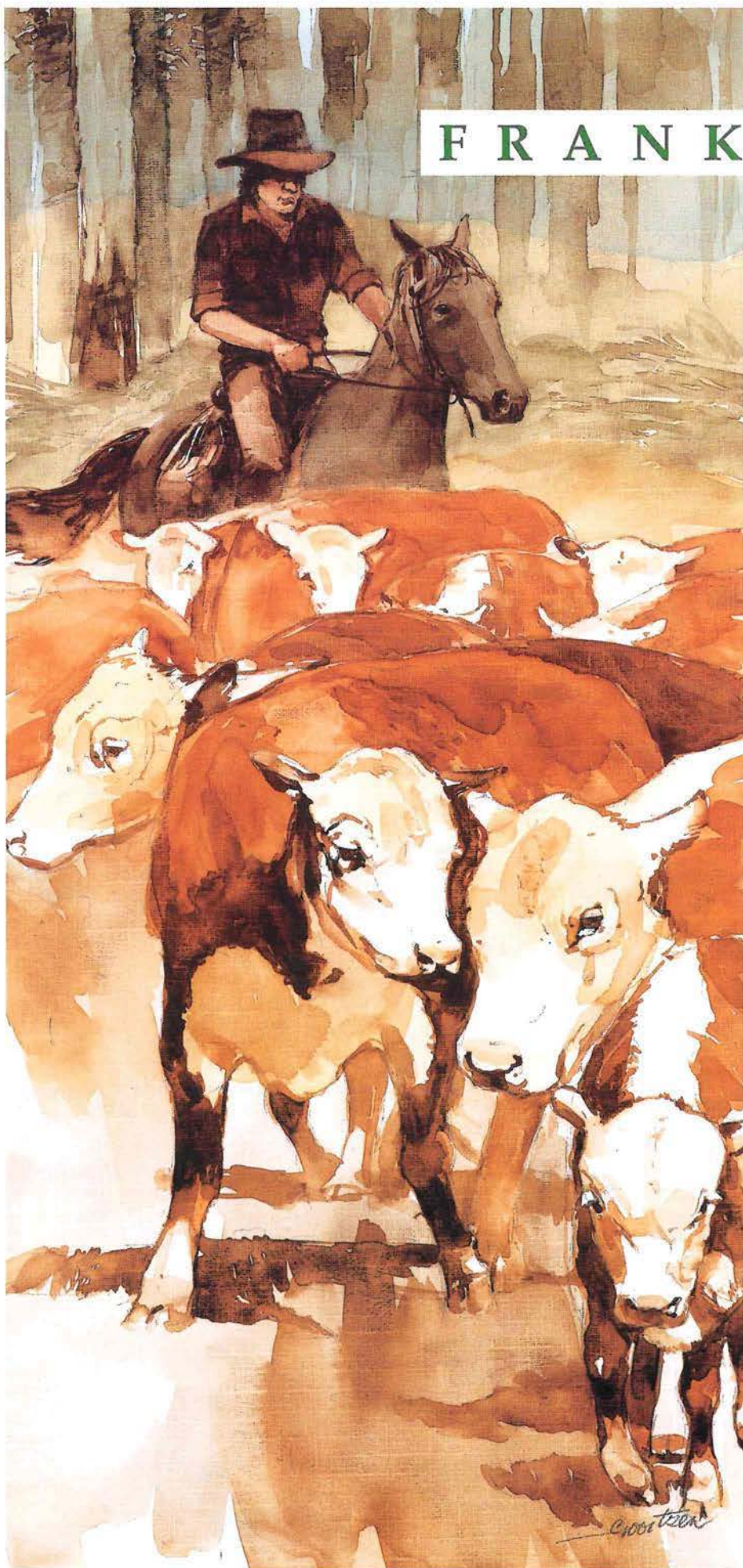
The Gairdner River and shiny-leaf woollybushes are rare, but require further surveys to confirm their conservation status. Gairdner River woollybush has not been collected since 1975 and is known only from three populations, one in the north-west of the park and the other two just outside the park, that are proving difficult to relocate. The species may be a hybrid between the yellow flowered and wedge-leaf woollybushes. Shiny-leaf adenanthos is known from only two populations separated by 150 km. One is in the mid-west of the park on low rises of dark lateritic gravel over clay, and the other on a hillside east of Ravensthorpe.

Labillardiere's woollybush is rare, but not considered threatened. It was named in honour of the French botanist Jacques-Julien Houtou de Labillardiere for his contribution to the knowledge of the genus. It occurs in scattered populations along the Barren Ranges from the central wilderness, east to the Eyre Range and north to Mount Drummond. It grows as an erect shrub to about a metre and a half, with distinctive claret coloured flowers.

The remaining species are not considered threatened.

Like many other plants in the family Proteaceae, *Adenanthos* are susceptible to dieback. Preventing the spread of dieback in the Fitzgerald River National Park is dealt with in a management plan for the park and, along with the implementation of the plan's other strategies, the long-term survival of the Fitzgerald River woollybushes looks brighter.

By Nathan McQuoid



FRANK HALL

WILD COLONIAL BOY

by Len Talbot

In 1860 a reward of the fabulous sum of £100 was offered for the apprehension of Frank Hall, wanted for cattle stealing in the Vasse and Blackwood districts. This was at a time when a married couple could be hired to work on a farm for their keep and £50 a year, or a labourer for £1 a week. A reward of £100 would have been a fortune to most people in the 1860s (it is perhaps equivalent to about \$40 000 in 1993). How did all this come about?

Frank Hall was the son of respected early Western Australian colonists. His parents were Henry and Sara Hall, pioneer settlers who arrived in Fremantle in 1830 and took up a land grant in what is today the Mandurah district; the present day Halls Head was named after the family. Frank was the youngest of eight children, and was one of the first Europeans born in Western Australia. Like so many boys who grew up in the bush in the earliest days of the colony, young Frank spent much of his boyhood among Aboriginal children and their families. He developed a close affinity with their race; he spoke the language fluently, understood their customs and no doubt learned bushlore from them, for he rapidly became an expert bushman himself.

In his early twenties, Frank moved south to the karri country. He took up the first cattle run, about where the town of Manjimup now stands. The lease was officially taken out in 1859, but it is evident that Hall had been operating in the forests of the South West and along the southern coast for several years before that. Subsequent events proved that he knew the country like the back of his hand, and was very familiar with the Aborigines of the Donnelly and Warren Rivers.

Hall named his cattle station Manginup - also spelled Manjinnup in some early documents. The word is Aboriginal, meaning 'the place of the manjin', referring to a plant that grew prolifically in local swamps. He used the station to run cattle, which he obtained from other settlers, before droving them to the Vasse district for reselling, usually in Busselton.

Hall seems to have spent a good deal of time at Busselton, then the nearest town to Manginup, leaving a stockman named Mottram in charge of the station during his absences. When in Busselton he made his base at Earnshaw's Commercial Hotel. He met pioneer businessman Mr Henry Yelverton, whose business included a sawmill. Yelverton's workmen worked hard and very long hours, and were big eaters. He provided them with three hearty meals of meat every day, and he needed a regular supply of cattle to be able to do so.

This was where Frank Hall came in. He bought cattle on Yelverton's behalf and held them at Manginup until they



were required for slaughtering; on delivery Hall was paid according to the weight of the animals delivered.

The arrangement between Yelverton and Hall worked satisfactorily for two and a half years, and may have gone on for many more, but it was discovered that the enterprising Hall, instead of buying the cattle that he had been selling to Yelverton, had been stealing them.

TROUBLE FOR HALL

In early September 1860, Constable Finlay of the Vasse made a routine visit to settlers along the Blackwood River. He learned that the Jones brothers of Southampton, the Hesters from Bridgetown and the Rose brothers at Wilgarup had all lost cattle, which they suspected had been stolen.

On his return to Busselton the constable visited the local tanners, where he found several hides that matched the descriptions of some of the missing cattle. Further investigation led to two of the missing cows being found on Yelverton's property. They proved to be part of a consignment recently delivered by Frank Hall, but not yet slaughtered because they were in calf.

Hall was located at the Commercial Hotel in Busselton, where he was immediately arrested and charged with cattle stealing. His publican friend Earnshaw put up the £50 bail for him, but the next day he was committed for trial and held in gaol. Cattle stealing was a crime against property and few crimes were more serious in those days.

The police then organised a muster on Hall's station at Manginup. They found more than 80 head of stolen cattle, whose owners' names read like a who's who of the pioneer families settled in the lower South West. The animals had been rebranded with Frank Hall's FH brand; in some cases the original brands had been altered or botched. The earmarks on the cattle had also been altered. It was an open and shut case.



Title page

Illustration - Gooitzen van der Meer

Opposite page: Hall moved to the karri country in his early twenties.

Photo - Robert Garvey

Right: The Hall family's house at the mouth of the Murray River, Mandurah

Photo - Courtesy of the Battye Library

Below: Hall was very familiar with the area around Warren River. This knowledge served him well in later years.

Photo - Dennis Sarson/Lochman
Transparencies



HALL ESCAPES

Hall was held in the Busselton gaol pending his trial, but a week after his arrest he escaped.

He had been taken outside for exercise but when the policeman guarding him was momentarily off guard, he bolted across the street to where a horse was tethered to some palings. Before the policeman could catch him, he unhitched the horse, leapt into the saddle and yelling a cheeky goodbye to the policeman, galloped off as hard as he could go.

Three mounted constables were immediately in pursuit. One of these was despatched to King George's Sound (Albany) to head off a possible escape from the colony by way of the steamers calling in there. The others tried to track Hall and make an early capture. But Frank was a far better bushman than any of his pursuers and he simply vanished into the forests of the South West that he knew so well.

The escape of a cattle thief caused a sensation, as well as embarrassment for the authorities. Soon all available

policemen in the colony, aided by native constables and trackers, were out searching for him. They failed to find so much as a trace.

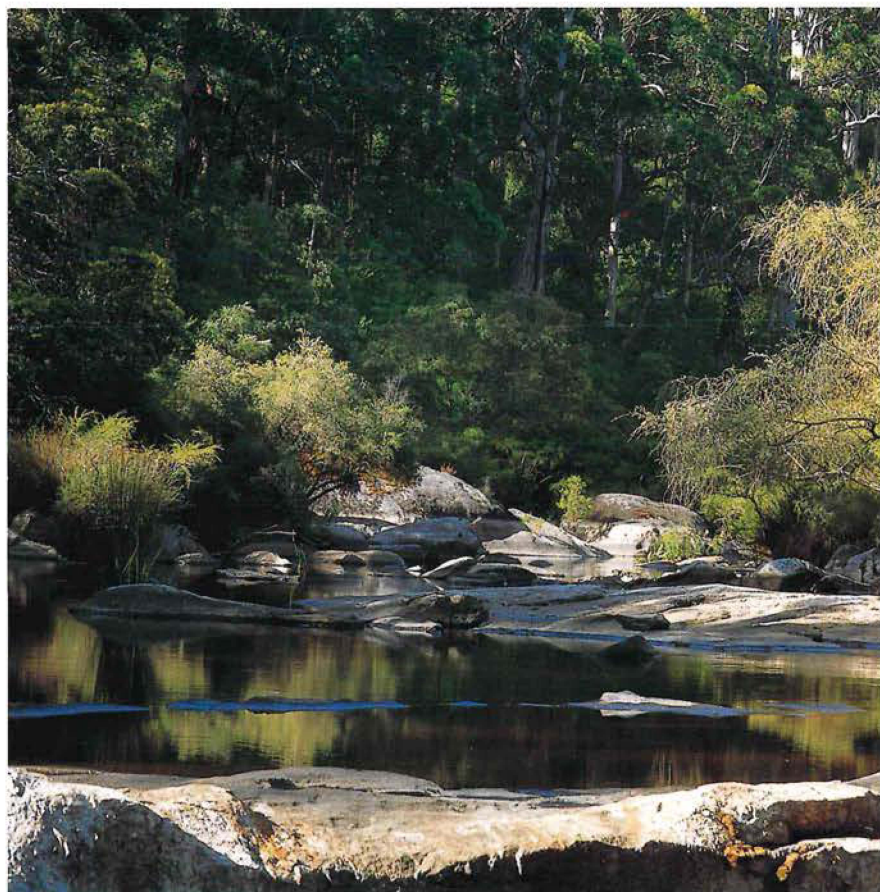
The intensity of the search was increased and a huge reward was posted. Hall had affronted the aristocracy of the colony by duffing their cattle, and they wanted him in gaol. Furthermore, there were many people eager to collect the £100 reward, not least the poorly paid policemen. So there was great excitement and wild speculation. The bush buzzed with rumours as harassed police parties rode back and forth over the countryside following up false leads. Hall's name was on all lips.

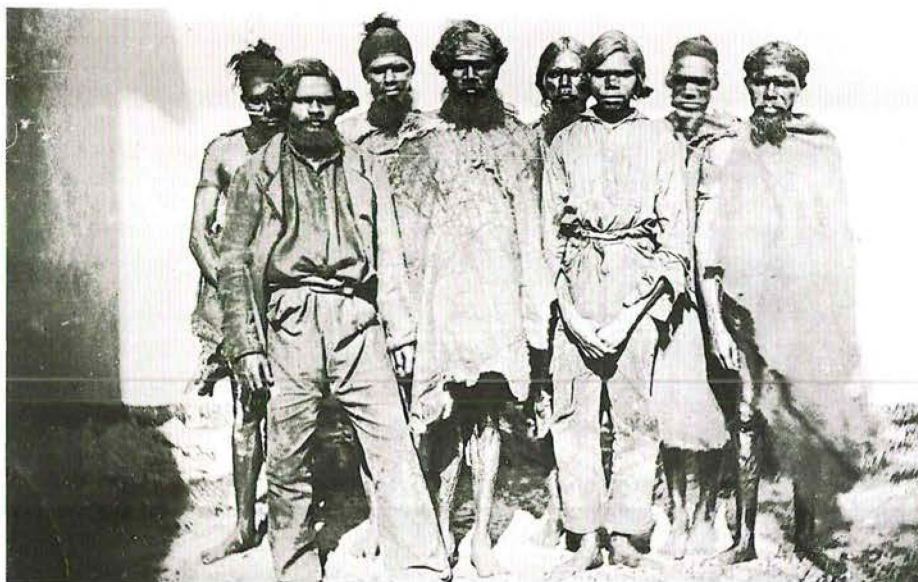
There were some clues. A horse stolen from the Bunburys' property was found on Spencer's run near Albany, showing signs of having been hard ridden, and shortly afterwards it was discovered that one of Spencer's best horses was missing. There was little doubt in anyone's mind that Frank Hall was in the neighbourhood and an even closer watch was kept on shipping in the harbour.

One night, the whaler *Offley* from Hobart town weighed anchor soon after dark and cleared out from Busselton. It sailed across Geographe Bay and anchored off Castle Rock for a day and a night. Rumour had it that Frank Hall was aboard. A week later the *Offley* returned to Busselton with a large whale, but no sign of the escapee was found on board.

ENTER THE ARISTOCRACY

The Superintendent of Police for the colony in 1860 was Sir Alexander Cockburn-Campbell, Bart., a pompous and arrogant man. He was particularly unpopular with the editor of *The Inquirer*





Top: Hall learned the language and bush skills of the local Aborigines.
Photo - D. Croft/The Batty Library



Above: Hall spent much of his time on the run in the coastal country now part of D'Entrecasteaux National Park.
Photo - Marie Lochman

newspaper, and it was with apparent relish that they reported the following incident concerning Sir Alexander and Frank Hall.

On his way to Busselton, Sir Alexander called at the house of Dr Brydges on the Capel River and there met Mr Robert Hester, who was lying on the sofa. Unknown to Sir Alexander, Robert Hester's wife, Letitia, was Frank Hall's sister. Dr Brydges introduced the two men and then with his wife left the room to arrange refreshments for the visitors. During their absence Superintendent

Campbell became suspicious that the man on the sofa was in fact Frank Hall, so he went outside and asked his orderly who the man was. The orderly confirmed his suspicions, and then in the words of the newspaper report:

'Sir Alexander then told his man to get a chain from his horse's neck and put it around the neck of Mr Hester. This was done despite protestations from Hester that he was not Frank Hall. The policeman held one end of the chain while the other was placed around Hester's neck. Hester was kept in this degrading position for several minutes, and he was only released from confinement upon Dr Brydges making oath that his name was Hester and not Hall. During the time Mr Hester was in custody, the Superintendent of Police went into the bedroom of his host and turned down the bedclothes, for what purpose it is difficult to conjecture, seeing that he had a chain around the neck of the presumed Frank Hall . . .'

Meanwhile the courts declared Frank Hall an insolvent and his property was sequestered for the benefit of his creditors - mainly Henry Yelverton. Notices were placed in the newspapers calling on him to appear in court on a certain date, or show cause why this should not be done; but of course he did not appear and the search for him went on.

The police continued to scour the forest country from the Blackwood south to the Warren. Their horses became jaded and knocked up from the constant working through the thick bush, and all the while the newspapers derided them for their failure to recapture Hall. One report stated:

'Hall has never been heard of since his escape. Notwithstanding the reward which has been offered for his apprehension, the array of police, the number of natives, the little army of spies, all anxious to have a share of the reward, not the slightest trace of him has been found, no clue to his whereabouts, and the police are as much abroad with respect to his movements and place of concealment as they were the first day he started . . . For aught they know to the contrary he may be out of the colony . . .'

HALL SURRENDERS!

A few days before Christmas in 1860, Hall suddenly appeared at Quindalup and gave himself up to Henry Yelverton, who then accompanied him to Busselton to surrender to the police. When they got to Busselton, however, there were no police in town - all were away in the bush searching for Hall! So it was decided that he should surrender to the Resident Magistrate, but even then it was only after considerable searching that the Magistrate was located.

The Magistrate instructed his clerk to accompany Hall to the lock-up and to confine him there; but at the lock-up the clerk could not find the key. So it was that the most wanted man in the colony found himself unable to get back into prison until his would-be captors returned from another fruitless search, and let him in.

Hall, his stockman Mottram and another man named Guerin who had helped him drive one lot of cattle to Manginup, were all taken to Perth under close guard and placed on trial. During the trial, Hall tried to exonerate his companions, claiming that they were

unaware that he had not purchased the cattle, and that his stockman, in branding them, was only carrying out his duty as his employee. Nevertheless, all three were convicted of cattle stealing. Mottram was sentenced to 10 years' imprisonment and Hall and Guerin each to 15 years' imprisonment in Fremantle Gaol.

A BRIEF REPRIEVE

In 1863, the Comptroller of Convicts in Western Australia, Mr H.M. Lefroy, set out to explore the country eastwards from York, including the area that 30 years later was to become the Eastern Goldfields. He obtained the Governor's permission to take Colonial Convict Frank Hall with him on the expedition. Lefroy wrote of Hall:

'His well known bush experience and familiarity with the natives, and his general cleverness and smartness has induced me to solicit His Excellency's permission to take him with me in the capacity of convict servant, which request His Excellency was pleased to accede to.'

Lefroy was greatly impressed with his convict servant during the expedition and he recorded several stories Hall told him of the Aborigines along the south coast between Albany and Augusta. It was apparent to Lefroy that Frank Hall had lived for some time with this tribe - including the period he had been on the run - mainly in the coastal country which is now the D'Entrecasteaux National Park. Hall told Lefroy that life had been very lean for the Aborigines along the coast at the time. Kangaroos were so scarce they would hunt one animal for three days, camping on the tracks overnight and continuing the hunt in the morning. Occasionally they trapped fish at the river mouths and in the shallow inlets along the coast, but their main diet was grubs and tubers. One of the tubers that formed an important part of their diet was the *mean*, the scarlet tulip-like roots of which were ground into a paste and then roasted. This stained the insides of their mouths purple, and this in turn was a distinguishing mark of those coastal tribes. (Later, the early European settlers used the same roots to make red ink; the plant is called *Haemodorum spicatum*, and still occurs abundantly in the South West.)

In his official report on his 1863 expedition, Lefroy commended Hall for

the way in which he had performed his duties, and he appealed to the Crown for a remission of Hall's long sentence. However, the crime against the landed gentry was considered too serious. Lefroy's appeal was dismissed and Hall was returned to gaol to do his full 15 years.

The authorities did eventually relent. He was pardoned in 1871, and moved to the Champion Bay (Geraldton) district, where he worked for a while as a teamster; from there he moved to the Gascoyne and to Shark Bay, where he became a pastoralist and a pearler. He died in Northampton in 1886. He had married in 1882; his widow eventually remarried and lived for another 64 years, dying in Fremantle in 1950.

Mottram and Guerin were also pardoned in 1871; Guerin sailed for India, but Mottram moved back to the forest districts of the South West. The Mottram name is well known and highly respected in the karri country today.

SPURNED

One further anecdote concerning Frank Hall has survived.

During his time at Manginup, Hall's constant companion was an Aborigine named Yowan. Yowan had helped Hall muster and drive cattle to Quindalup, and there is little doubt that his duties included running off stolen stock from other settlers' runs. After Hall's arrest, Yowan was taken to live at the house of the detective sergeant in charge of the case, and he subsequently became one of the Crown's key witnesses at the trial. Although his evidence was largely discredited because of his association with the detective sergeant, he was never charged with any crimes associated with Hall's cattle duffing.

After his release, Hall returned briefly to the south and, according to local legend, saw Yowan saddling a horse at Dickson's place on the Barlee Brook. Pleased to see his old companion again after so many years, Frank greeted him but was surprised to hear a curt reply. Hall asked 'Don't you know me, Yowan?' But without bothering to look up from what he was doing, Yowan answered, 'Yair, I know you awright. You're Frank Hall, the cattle thief.'

Today Frank Hall is regarded by popular history as a bushranger, but in

fact he did not hold up banks or mail coaches. Even Yowan's description is a bit hard. Maybe he could best be remembered as a pioneer of the South West forest country, a bushman and adventurer and a wild colonial boy from the early days of Western Australian settlement.

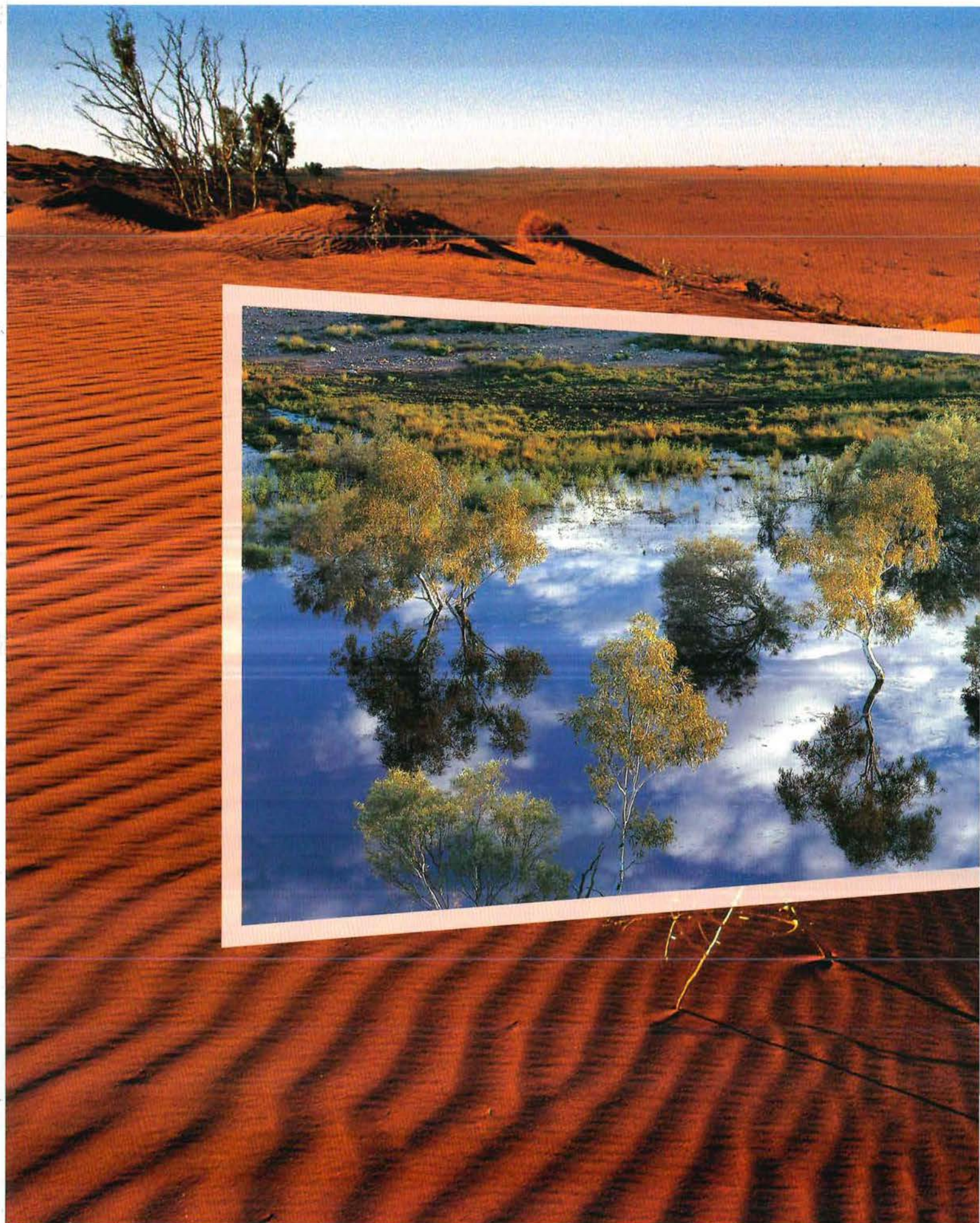
Len Talbot is a retired forester and local historian. He can be contacted on (09) 446 8535.

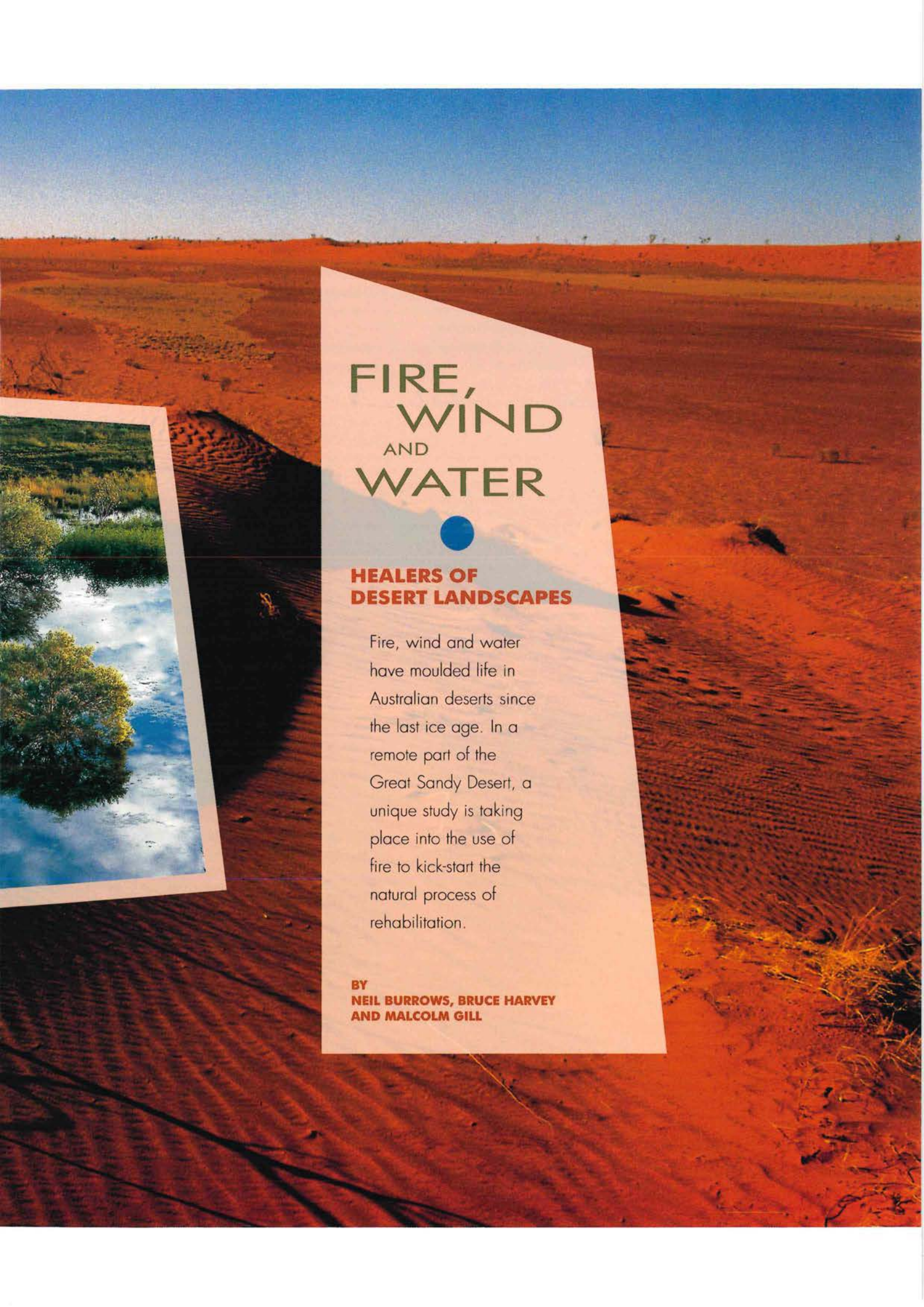
HENRY YELVERTON

Henry Yelverton was a pioneer businessman and sawmiller in Western Australia. He had arrived in the colony in 1841 on an American whaler and was initially in charge of the cooperage at the Fremantle Commissariat. Before long he entered the profitable sandalwood trade, as a buyer and exporter at Fremantle. He soon graduated to employing pitsawyers producing sawn jarrah from areas south of Rockingham and from the hills east of Guildford, and he supplied the piles and jarrah timber for the first bridge across the Swan River at Fremantle. He then took up leases in the Sussex (Busselton) District and established the first steam-driven sawmill in WA, at Quindalup. Later he built the State's first railway, a wooden-railed tramway which ran from his sawmill to the coast, and along which horses drew trainloads of timber to a specially constructed jetty in the Geographe Bay. This was the first deep-water jetty in WA from which timber could be loaded directly into ships.

Yelverton sent sawn jarrah railway sleepers to Ceylon (now Sri Lanka) and to the burgeoning Indian Railways, exported jarrah paving blocks to London, traded timber for wheat with businessmen in South Australia and won timber supply contracts with the colonial government in WA. The mill employed 270 men, mostly 'Ticketers' (i.e. ex-convicts with a Ticket of Leave from the Governor, which enabled them to work more or less as free men). They cut mainly jarrah but also karri, which occurred then in pockets as far north as Quindalup. Yelverton's men also cut tuart in sawpits at Wonnerup.

Yelverton's establishment was very substantial for the day. As well as the mill, there were houses and barracks, a blacksmith's shop, a carpenter's shop, long rows of stables, a foundry, a store and a dispensary. He also built a school and supplied a teacher.





FIRE, WIND AND WATER



HEALERS OF DESERT LANDSCAPES

Fire, wind and water have moulded life in Australian deserts since the last ice age. In a remote part of the Great Sandy Desert, a unique study is taking place into the use of fire to kick-start the natural process of rehabilitation.

BY
NEIL BURROWS, BRUCE HARVEY
AND MALCOLM GILL

Since European settlement, the remote and harshly beautiful deserts of Western Australia have lured explorers in search of pastures and precious metals. In the 1800s, Giles, Warburton, Carnegie, Forrest and other hopefuls led expeditions on horses and camels into the unknown and inhospitable interior. Since the 1950s, explorers using helicopters, bulldozers and trucks have searched the desert for tell-tale signs of oil and minerals. In the Great Sandy Desert, abandoned seismic lines and exploration tracks, which criss-cross the sand plains and dune fields, will take decades to revegetate. While some of the exploration tracks are useful for land managers and park visitors, many are ecological

intrusions and a hazard to wandering outback motorists who can become lost in the maze of tracks.

The only national park in the Great Sandy Desert is the Rudall River National Park. Declared in 1977 to conserve its unique landscape and wildlife, it covers 1.6 million hectares and is second in size only to Kakadu, the biggest national park in Australia. It stretches from Hanging



Rock in the west to Lake Dora in the north-east, and embraces the headwaters of the Yandagooe Creek and the entire drainage basin of the Rudall River.

The Rudall River is part of a large and spectacular desert drainage system, but it is also an increasingly important source of minerals. Mining and exploration have been allowed in the area since 1977, but with appropriate restrictions. Careful management of mining developments is required so that environmental health is maintained, and to ensure that the wishes of local Aboriginal communities can be realised.

The old, less precise methods of exploration, which resulted in the criss-cross of seismic lines and exploration tracks, have been overtaken by modern satellite, airborne and other remote surveying techniques that help to pinpoint more accurately, and thereby dramatically reduce, the size of areas for physical exploration. Use of these techniques has meant that drilling by CRA Exploration Pty Ltd (CRAE) in the Rudall River National Park during the past 10 years has disturbed about one per cent of the park's area. As exploration is completed, CRAE begins to rehabilitate the land, and where this occurs within the national park it will be monitored by the Department of Conservation and Land Management (CALM).

Once the tracks have been closed and rehabilitated, regeneration of ephemeral plants can be rapid, depending on rainfall. However, regeneration of woody shrubs and the return of the disturbed areas to a full community can take many years. This is particularly the case in areas of spinifex and acacia sand plain.

Previous page

Main: Dunes in a burnt area of the Great Sandy Desert.

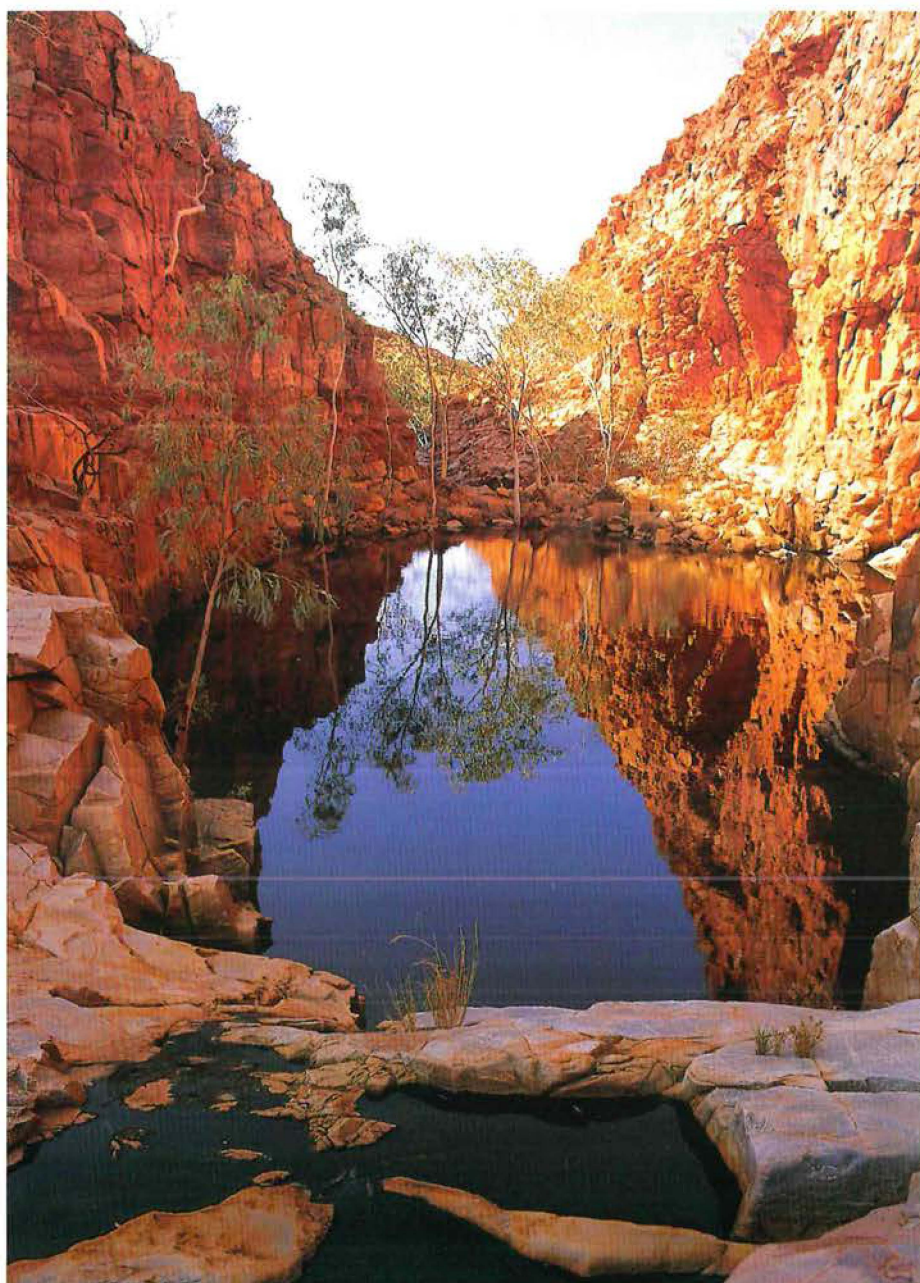
Photo - Chris Garnett

Inset: Great Sandy Desert after flood.

Photo - Marie Lochman

Left: Desert Queens Bath in the Rudall River National Park.

Photo - Marie Lochman



KICK-STARTING THE ENVIRONMENT

CALM and CSIRO scientists, supported by CRAE and local Aboriginal communities, have been investigating techniques for rehabilitating exploration tracks. For example, fire has the potential to accelerate the rehabilitation process. CALM scientists and CRAE geologists have observed that in some instances exploration tracks in areas burnt by wildfire quickly revegetated after rain, and within a relatively short time had become virtually invisible. Scientists believed this was because of the combined effects of the elemental agents fire, wind and water.

A collaborative experiment has seen CALM, CSIRO, local Aboriginal people and CRAE join forces to investigate the role of fire in rehabilitating old exploration tracks in the Rudall River area. When the processes are better understood, it might well be possible to use controlled fire to restore disturbed areas to a full community of plants and animals in a much shorter time. As well as conservation benefits, managing fire in this manner provides an opportunity for Aboriginal people to participate in an economic activity on their own terms, while at the same time ensuring that important connections with the land and traditional skills are fostered and maintained.

Assisted by a nearby Aboriginal community, several small experimental fires were set in September 1992 to rehabilitate old exploration tracks. The structure and composition of the vegetation was measured before burning. Immediately after the fires, sand traps

EXPLORATION AND REHABILITATION

In 1972, CRA Exploration Pty Ltd (CRAE) began exploring for a range of minerals in ancient metamorphic rocks along the Rudall River system in the Great Sandy Desert. The area was opened for exploration and mining, with strict safeguards to protect the environment, in the year it was declared a national park. In 1985, CRAE discovered the Kintyre uranium deposit straddling the park's northern boundary.

Other mineral discoveries in the region include the giant Telfer gold mine and the rich Nifty copper deposits north of the park. Along with other important geological clues, these discoveries indicate an emerging world-class mineral province.

In close consultation with the Department of Conservation and Land Management (CALM) and local communities, CRAE aims to explore and mine part of the land. When each stage of exploration is completed, CRAE intends to restore the land to a condition similar to that before exploration began. Rehabilitation takes place both inside and outside the park, but such work in areas within the national park will be closely monitored by CALM.



Above left: A light touch: helicopters are used when mineral exploration sampling is carried out.
Photo - Jiri Lochman

Above right: Auger rig specially designed to reduce machinery impact on vegetation and animals.
Photo - Jiri Lochman

Right: Aerial view of fire-induced vegetation patterns in Little Sandy Desert.
Photo - Jiri Lochman

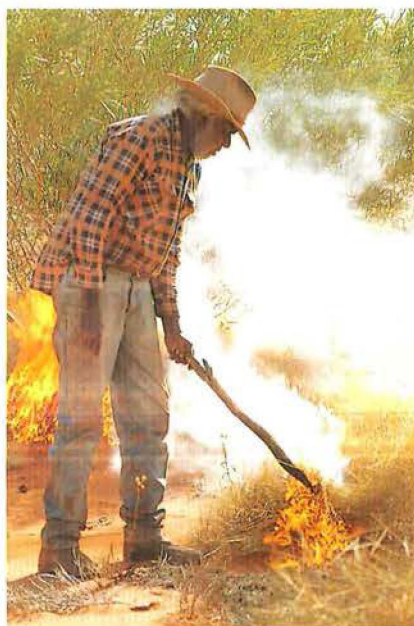
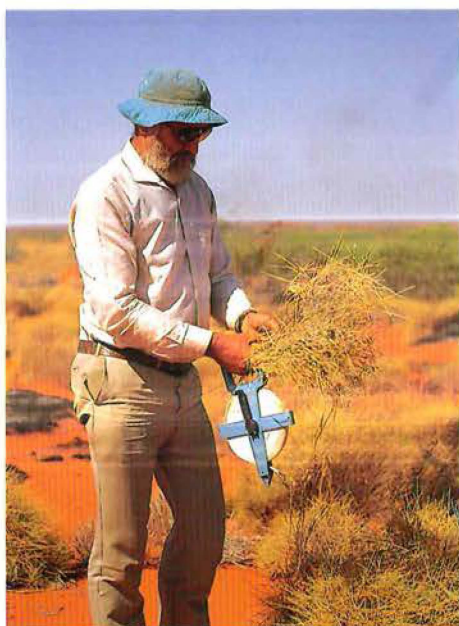


and erosion pins were established on the burnt areas, on the exploration tracks within the burnt areas, and on adjacent unburnt areas to measure and compare the movement of soil and seed blown around by the strong desert winds. The regeneration of vegetation on and off the exploration tracks is being carefully monitored.

PREPARATION: FIRE AND WIND

Fire has been a natural component of desert ecosystems for eons. It has been started naturally by lightning strikes and, until recently, by the traditional burning practices of Aborigines, for whom fire was an important and versatile tool and a vital part of their culture. In the past, much of the desert landscape was an interlocking mosaic of vegetation at different stages of regeneration, from recently burnt through to long-unburnt patches. Desert plants have evolved a wide range of adaptive traits to survive and regenerate in a fire-prone environment. Many species re-sprout following fire, which prepares some seeds for germination by cracking their hard, protective seed coats. Other species regenerate from seeds buried in the soil or encased in protective woody fruits.

Sand plains and dune fields of the Great Sandy Desert are covered with dome-shaped hummocks of flammable spinifex. Important for reducing wind erosion, they also trap wind-borne sand and seed. Fire temporarily denudes the land of vegetation, making the soil vulnerable to erosion and exposing the sand and seed once more to the strong desert winds.



Top: CSIRO and CALM scientists establishing sand traps and erosion pins to measure soil and seed movement after experimental fires.
Photo - Jiri Lochman

Above left: An environmental consultant assessing vegetation prior to an experimental burn to encourage regeneration on mining exploration tracks.
Photo - Jiri Lochman

Above right: A fire stick being used to burn spinifex in a rehabilitation study area.
Photo - Jiri Lochman

Left: Fire temporarily denudes the landscape of vegetation, allowing winds to redistribute soil and seed trapped by spinifex clumps.
Photo - Marie Lochman

In the first few weeks after the small experimental fires were set to rehabilitate the exploration tracks, hundreds of tonnes of sand and ash, and thousands of seeds that had accumulated beneath the spinifex hummocks, were redistributed by the wind. There was virtually no soil or seed movement on unburnt areas. Wind-blown soil and seed from the burnt areas accumulated on the exploration tracks, and the level of the soil surface on the tracks increased by up to five centimetres. The extent of sand drift after the fires varied, depending on the clay content of the soil, with most soil and seed movement occurring on the sandy soils. Within a short time, a firm crust began to develop over the soil surface, reducing further wind erosion of soil.

Seeds blown by the wind and perhaps prepared for germination by the heat of the fire lie buried in the sand awaiting the third and most critical element - water.

THE HEALING RAIN

Rainfall in the Great Sandy Desert is erratic and, although the annual average is about 200 mm, long droughts are not uncommon. The timing and the amount of rain are critical to the germination and development of seedlings. An assessment of seedlings on the exploration tracks after one year revealed that in the unburnt area there were no established seedlings of spinifex and shrubs, but in the burnt area there were numerous seedlings of these species. The density and diversity of seedlings on the tracks in the burnt area were not as high as was anticipated, but the low summer rainfall probably contributed to this.

Deliberately setting fire to rehabilitate areas disturbed by mining exploration, or to create buffers against severe wildfires, or to improve habitat, requires a firm understanding of the way in which fire behaves - when the spinifex will burn, how rapidly the fire will spread and how intense the fire will be. Wind and rain, for example, affect the flammability of the spinifex fuel. Further experiments are planned for September 1994, when small fires will be studied to develop models for predicting fire behaviour.

This unique experiment has already demonstrated that fire could play an important role in rehabilitating areas disturbed by mining in the arid zone.



Top: Pebble-mound mouse emerging from its nest in the Rudall River National Park.

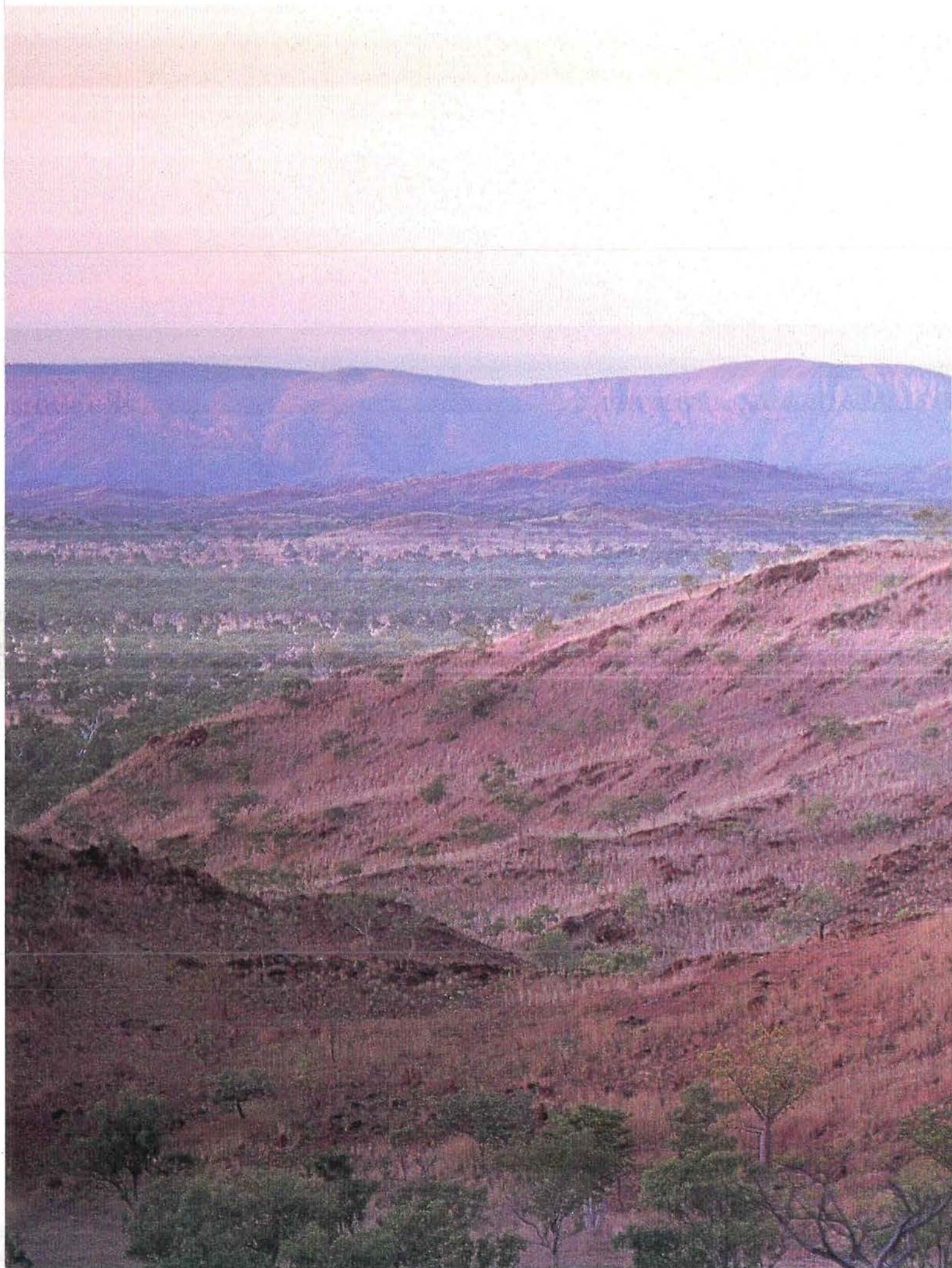
Photo - Babs and Bert Wells

Above: The Rudall River.
Photo - Jiri Lochman

Future research will examine, in more detail, the processes of soil movement and seed dispersal on different soil and vegetation types. If fire is to be used in a safe and controlled manner, it is essential that the behaviour of fire under different conditions of weather and fuel is well understood. This knowledge can be used in the planning and implementation of mineral exploration activities throughout the arid zone to further minimise the impact of these activities and to rehabilitate old exploration tracks.

Neil Burrows is a Senior Research Scientist in the Science and Information Division of the Department of Conservation and Land Management. He can be contacted on (09) 334 0303.

Bruce Harvey is a Chief Geologist with CRA Exploration Pty Ltd. He can be contacted on (089) 32 2766. Malcolm Gill is a Senior Principal Research Scientist with CSIRO Division of Plant Industry in Canberra. He can be contacted on (06) 246 5206.





OASIS IN THE LEOPOLDS

Late last century, the King Leopold Range was still thwarting explorers' efforts to pass through it. Now, in the midst of this rugged area, which will soon become a national park, is the oasis of Mount Hart, where the Department of Conservation and Land Management is making its latest venture into ecotourism.

BY CAROLYN THOMSON

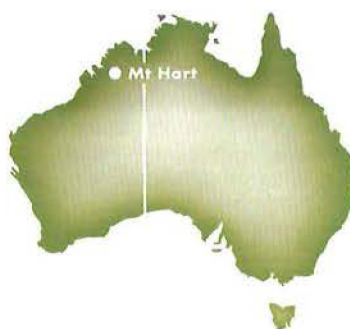
The King Leopold Range was first explored by Europeans in 1879 when Alexander Forrest was commissioned to survey the country from the De Grey River to the Northern Territory border for pastoral areas. Forrest reached and named the range on June 6. He described the area as rough, but said it had 'first rate feed and plenty of springs'. Despite the grandly beautiful scenery of the range, Forrest found it impassable. The expedition lost several horses and, as a result of their difficulties, names such as Devils Pass and Mount Hopeless were given to the area's features. Forrest named Mount Hart. He also named Mount Matthew after one of his brothers.

In 1898, stockman and explorer Frank Hann became the first European to cross the King Leopold Range. He discovered an 18-kilometre-long, well-watered pass near Mount Matthew that cuts through the King Leopold Range by means of a deep gorge. Boab trees along Hanns Pass still have his initials carved into their trunks.

Mount Hart was first taken up as a pastoral lease around 1919 by Edgar and Chalmers. The station was said to be 'badly infested with [cattle] tick, buffalo fly and dingoes'. About a third of the lease was regarded as unusable, due to the rugged nature of the country. It was a hard living and Felix Edgar walked off the lease broke in 1934. The lease was taken up again in 1936 and eventually transferred to 'Stumpy' Fraser in 1951. He moved into the original homestead,

near a low hill known as Mount Hart, but when the nearby waterhole dried up, built another about 16 km north. When this waterhole also dried up, he built the third Mount Hart homestead about a kilometre away. At this time the Gibb River Road had still not been built, cattle prices were bad and mustering was done on donkeys. In 1957, Stumpy also walked off broke.

The property eventually came into the hands of the Mt Hart Pastoral Co, owned by Charlie Telford and his family, in 1962. Charlie built the fourth homestead, which remains as a tribute to his bush ingenuity. He planted the original garden with grapefruit, frangipani, oleanders and lemons, all brought from Adelaide on the back of an old semi-trailer. Many of these plants still survive today. Old Charlie was 63 when he came out to the area. He sold out in 1967 and, after a series of owners, the Department of Conservation and Land Management (CALM) acquired the area in 1992 to create the proposed King Leopold Range National Park.



MAN-MADE OASIS

On assuming the management of Mount Hart station, CALM was left with a major dilemma - what should be done with the homestead? Mount Hart homestead sits on the bank of the Barker River. This man-made oasis in the rocky ranges is surrounded by eight acres of lush gardens.

The homestead structure is a unique example of Kimberley station architecture. There are no doors or windows and it has a central breezeway to ensure air circulates through the building. It was constructed with handmade concrete bricks, each with a long-necked beer bottle in the centre to save on materials. Every bedroom has a built-in wardrobe because furniture was hard to get and susceptible to termites. The building can comfortably accommodate nine guests.

The homestead would be expensive to maintain, but an important example of pastoral history would be lost with its demolition. The department came up with a unique solution. CALM appointed Taffy and Jenni Abbotts as homestead managers to operate a small tourist venture. Mount Hart's isolation (it is 50 km and at least 2-3 hours drive from the Gibb River Road, itself a wilderness adventure to travellers), old-fashioned bush hospitality and comfortable accommodation now attract visitors from far and wide. People drive in from the Gibb River Road for an overnight stay or fly in for a shorter visit.



Previous page

Main: The King Leopold Range.

Photo - Jiri Lochman

Inset: The homestead of the former Mount Hart station.

Photo - Col Roberts/Lochman Transparencies

Left: Mount Hart is an important destination on the 'Ibis Aerial Highway', which will make remote parts of the Kimberley accessible to tourists.

Photo - Carolyn Thomson

Taffy and Jenny have painted the building and made other improvements, such as resurrecting an ancient tennis court. A new amenities block was built with the help of CALM staff, and Taffy is extending the homestead with a stone dining area. As part of the area's conversion to a national park, contractors are currently destocking the area of cattle.

Mount Hart is a good base from which to explore Matthew Gorge and small pockets of semi-deciduous rainforest below nearby Mount Matthew. It is an ideal spot for groups of bushwalkers, birdwatchers and other nature lovers.



Top: Jenni and Taffy Abbotts manage Mount Hart homestead, which provides old-fashioned bush hospitality and comfortable accommodation for visitors. Photo - Carolyn Thomson

Above left and right: The gardens at Mount Hart homestead and the Barker River. Photos - Carolyn Thomson

Left and right: Dragon tree (*Sesbania formosa*) grows along the creek and nectar myrtle (*Xanthostemon paradoxus*) grows on the sandstone around Mount Hart. Photos - Kevin Kenneally

Below: The lush gardens and streamside vegetation of Mount Hart attract numerous birds including the star finch. Photo - Babs and Bert Wells

Below right: The gardens around Mount Hart homestead were established by Charlie Telford in the 1960s. Photo - Carolyn Thomson





WILDLIFE

The homestead and its lush surroundings are a magnet to wildlife. Sugar gliders, northern quolls, and brindled bandicoots live in the gardens, and native bush rats are sometimes flushed from beneath the oven. Euros and two species of wallaby live in the bushland. Bats live in the old mess. It was planned to demolish the ramshackle old building until CALM scientist Norm McKenzie advised that it was home to one of only two known colonies of the yellow-lipped bat, which is endemic to the western Kimberley. Horseshoe bats and bentwing bats also inhabit the building. However, after the last wet season most of the 40 or so animals moved camp and only a handful are now found there.

Two of the more colourful garden residents - a green tree snake and a northern brown tree snake - have even been given names by the homestead managers. Cherabin, black bream and northern long-necked tortoises inhabit the creek. After rains, a chorus of frogs call to their mates and numerous green tree frogs have to be evicted from the homestead.

The bird life is rich, especially in November. Breeding pairs of the red goshawk, regarded as being very rare in the Kimberley, have been recorded in the immediate area and colourful but elusive Gouldian finches and purple-crowned wrens are sometimes seen along the creekline. A resident azure kingfisher delights visitors with its morning display of aerobatics in the river. Other avian visitors include corellas, channel-billed cuckoos, mangrove robins, yellow orioles,

Above: Green tree frogs invade the homestead in the wet season and often have to be evicted from the house.
Photo - Jiri Lochman

Left: Sugar gliders can glide for at least 50 metres. This helps them exploit food resources and avoid predators.
Photo - M & I Morcombe

and crimson and star finches. Predators include wedge-tailed eagles and peregrine falcons. Taffy Abbotts reported seeing a peregrine falcon with a freshly killed ibis in the garden.

Wild donkeys are the scourge of Mount Hart. In September 1993 the Agricultural Protection Board killed 1 200 in three days. In the 1960s Charlie Telford even had a donkey cannery operating, using a team of Aboriginal shooters to supply the meat.

AN AERIAL 'HIGHWAY'

The ancient Kimberley landscape is punctuated with astonishing gorges and waterfalls, spectacular cave systems, lush rainforest patches and abundant wildlife. It is like nowhere else on Earth. But, until recently, to see this aspect of the Kimberley, travellers had to take on the tortuous Kalumburu-Gibb River Road. This red, dusty, boulder-strewn track was the cattle road that linked outback stations to the ports of Derby and Wyndham. The route also links up to Tunnel Creek, the Mitchell Plateau and other remote sites. Travellers had to be prepared for wilderness camping with no facilities. This meant carrying in all food supplies, plenty of spares and water. The Kalumburu-Gibb River Road was, and still is, a wonderful adventure that compares with tackling the Gunbarrel Highway across the red centre or driving the Canning Stock Route. The trouble is, few people have the time, the means or the resourcefulness to undertake such a journey in this rugged country.

The Kimberley's attractions are separated by vast distances and only



Above: The yellow-bellied sheath-tail bat is found throughout tropical Australia, including Mount Hart, in the winter months. The rarer and much smaller yellow-lipped bat sometimes lives in the old mess near the old homestead.

Photo - Babs and Bert Wells

Above right: Donkeys are the scourge of Mount Hart, which had a donkey cannery operation there in the 1960s.

Photo - Jiri Lochman

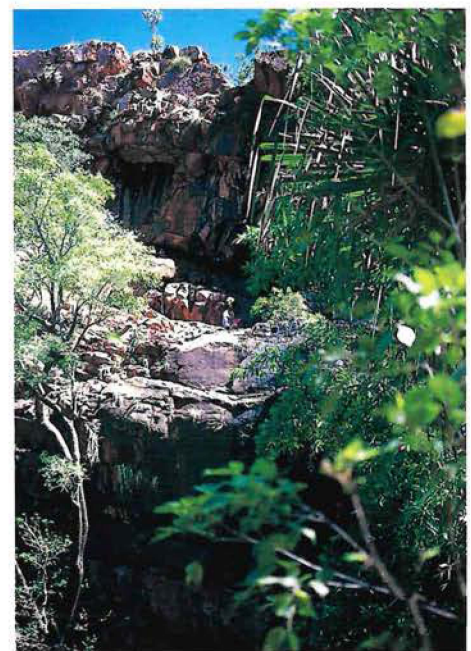
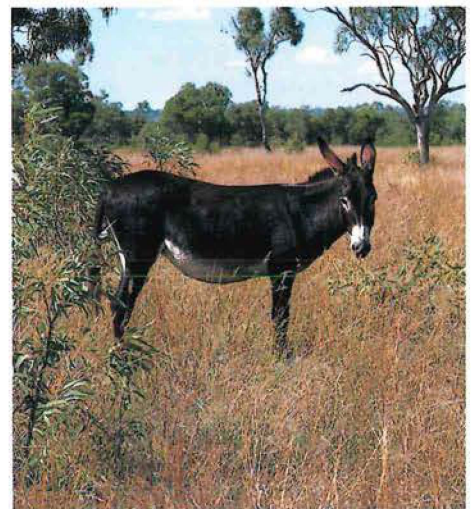
Right: A gorge near Silent Grove campground is one of the attractions of the proposed King Leopold Range National Park.

Photo - Kevin Kenneally

accessible by four-wheel-drive for part of the year. The 'Ibis Aerial Highway', to be launched in the 1994 tourist season, is about to change this. Tourists will soon be able to close the vast distances between watering holes by flying over the magnificent Kimberley landscape. Airstrips have been built at the main visitor points, such as Bell Creek Gorge, Windjana Gorge and El Questro, to enable sightseers to join ground tours. Mount Hart is an important link in the aerial highway, providing a convenient stopping point and a chance for visitors to get a taste of outback life. Already, six airline companies visit the homestead, stopping for morning tea or lunch and to admire its lush gardens and learn something of its pastoral history.

CLOSER TO NATURE

Like the Ibis Aerial Highway, the Mount Hart homestead can help bring people closer to nature in the Kimberley. When the proposed King Leopold Range National Park is finally declared, it will protect the contorted sandstone range, majestic gorges, rainforest remnants and rare wildlife. Visiting the homestead will help visitors appreciate the Kimberley wilderness and its special values and the lifestyle of those who pioneered this rugged region.



Carolyn Thomson is a media liaison officer for CALM and a contributing editor for *LANDSCOPE*. She can be contacted on (09) 389 8644. The assistance of Taffy and Jenni Abbotts, Allen Grosse, Norm McKenzie, Kevin Kenneally and Daphne Edinger in writing this article is gratefully acknowledged. The phone number for the Mount Hart homestead is (091) 91 4645.

URBAN ANTICS!

MUSK DUCK

It had been a long dry summer. Multicoloured hover flies danced on the waving leaves of long grass as the last warm rays of an autumn sun beat down on the near empty Perry Lakes.

I leaned back under the copious canopy of eucalypt woodland, closed my eyes and let the cacophony of ravens, lorikeets, coots and swamphens take control.

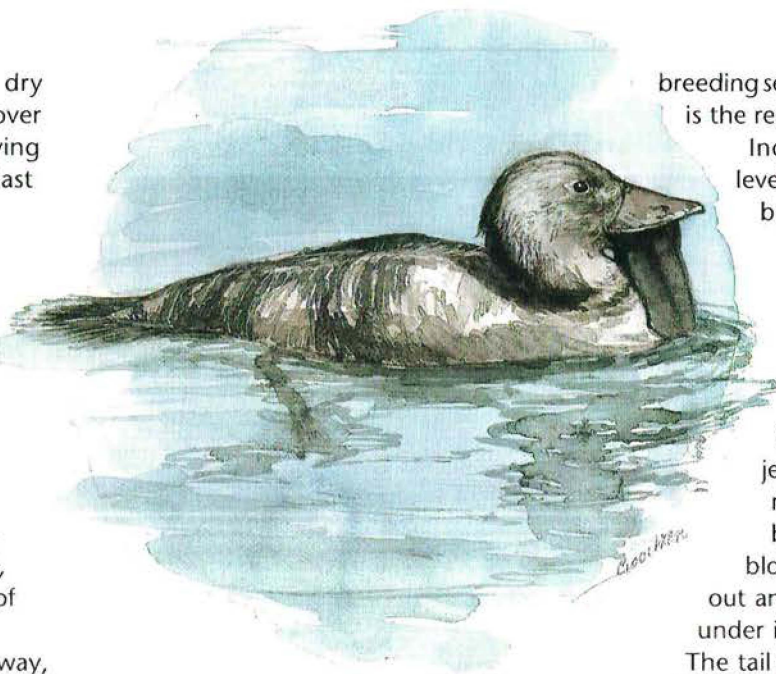
Suddenly, from the depths of a beautiful noise, I was awakened to a set of staring black beady eyes.

There, not two metres away, was the ugliest of all ugly ducklings; a bumbling, stumbling, fat, odd-ball "quacker" that looked as if it had staggered from the catastrophe of an ocean oil spill.

I had never seen a musk duck out of water before, let alone up close, for they are usually the secretive denizens of deep, open water or aquatic thickets. This bird had obviously been used to human visitors, but because of low water and resultant diminished food supplies, he had tried the brash begging approach, more usual of silver gulls and black ducks.

The appearance of the creature was extraordinary. A sort of grotesque and prehistoric-looking beast that seemed to find walking on solid ground most difficult. This fine male specimen had a large curious pouch-like leather comb hanging loose under the lower bill, which further enhanced its reptilian appearance.

Alas, I had none of the live aquatic animals that would have been his normal fare and after a few minutes of agitated indecision, he shuffled toward the lake, slipped into a nearby pool and disappeared among thick weed.



About this time of the year, large numbers of musk ducks (*Bizura lobata*), also called divers or steamers, can be seen spread across newly replenished open waterways, apparently keeping themselves to themselves. Although not a rare bird, the musk duck is usually observed only at a distance where it swims partly submerged like a cormorant.

The blackish, seemingly waterlogged feathers, goose-like triangular beak and stiff, pointed tail feathers are features quite different from most other species of duck. When swimming, the tail feathers lie flat on or just below the surface of the water.

The bill shape indicates that this diver feeds almost entirely on aquatic insects, mussels, snails, crayfish and frogs, which are sometimes collected on deep and extended dives to the bottom of a lake. To escape detection, the bird will sink until only the eyes and nostrils are exposed, then dive silently to swim away and surface under cover.

The musky odour of the oil preen gland on the male, especially in

breeding season, is exceptional and is the reason for its naming.

Increasing winter water levels are the trigger for the breeding season to begin and the male musk duck, with its remarkable courtship performance, is one heck of a show pony.

The bird sails out into a clear pool and kicks jets of water up to two metres above and behind. It raises its head, blows its neck and cheeks out and expands the bladder under its bill into a large disc. The tail feathers are raised fan-like and spread over its body.

On nights near open water if you hear a tremendous "k-plonk" and an ear splitting whistle you will know that it's not a bunyip, or a UFO, just an amorous musk duck.

JOHN HUNTER

DID YOU KNOW?

- Musk ducks are seldom observed on the wing as they are thought to fly mainly at night. They need a wind assisted take off and fly well, but more often than not, crash-land on water.
- Females are smaller than males, and have only a small rudimentary lobe under the bill.
- No pair bond is formed. The flamboyant courtship attracts females, and as each arrives she is fertilised and goes off on her own to build a well-concealed nest in a clump of cumbungi.

PERFECT PARTNERS

These two books are perfect for exploring
Perth's great outdoors.

Just released, *Family Walks in Perth Outdoors* is the first of its kind in Western Australia. This 176-page book encourages you and your family to go walking in Perth's wonderful natural environment, to learn something about the plants and animals that live there and to enjoy yourselves at the same time.

Published in late 1992, *Perth Outdoors* continues to be a best seller. It contains 180 pages of full colour photographs and detailed information on almost 300 natural recreation areas within a day's return drive of Perth.

Both books are excellent sources of information about things to see and do and places to visit at weekends or during school holidays. They give 'guided tours' of some of the most beautiful and interesting places in and around Perth, and are punctuated with frequent fascinating features on the plants and animals of Perth Outdoors.

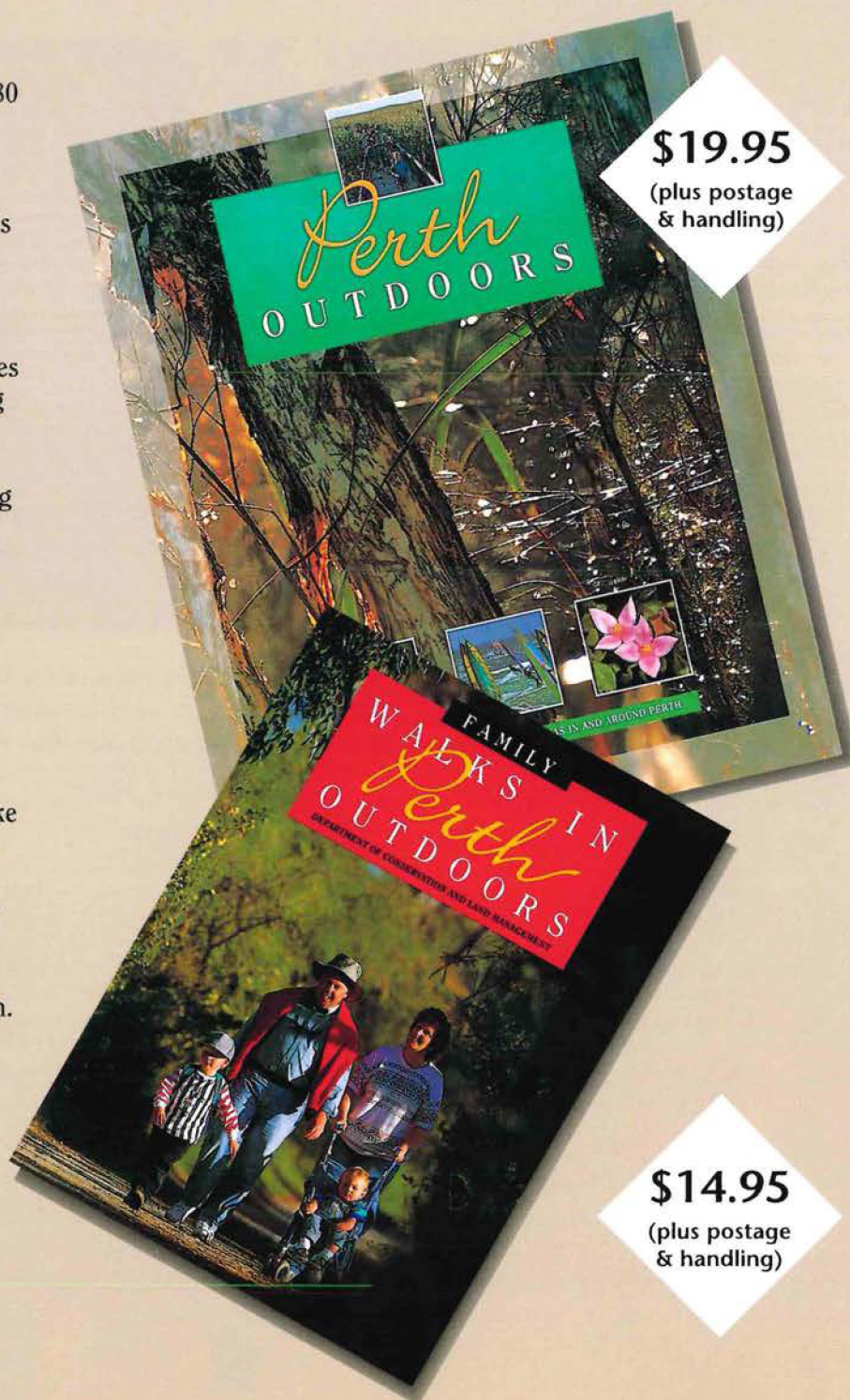
Great Gifts!

Perth Outdoors and *Family Walks in Perth Outdoors* make excellent gifts for friends and relatives both at home and overseas. These superb books are available from CALM offices, booksellers and good newsagents throughout Perth. Postal orders are available.



Department of
Conservation and
Land Management

PO Box 104, COMO WA 6152
Tel: (09) 334 0333





The transition from the jarrah-dominated forests of the Darling Range to the more arid Wheatbelt is marked by stark contrasts, such as the appearance of open wandoo woodlands.

Photo - Marie Lochman



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