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LANDSCOPE



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What does the future hold for our karri forest? Research provides some interesting insights. See page 18.



**VOLUME FOURTEEN NUMBER 4, WINTER 1999** 



The photographic exellence of WA team Babs and Bert Wells was driven by a love of the job. See page 10.



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'Growing Gnangara Park', on page 35, continues the story of WA's largest proposed outer suburban native parkland.

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Many WA women have played important roles in the conservation of our natural resources. Some of them feature in our story on page 41.



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Partnerships are important. Many private sector businesses and individuals are active partners in protecting our natural heritage. See page 47.

Executive Editor: Ron Kawalilak Managing Editor: Ray Bailey Editor: David Gough Story Editors: Mandy Clews, Verna Costello, Louise Johnson, Mitzi Vance, Penny Walsh Scientific/technical advice: Andrew Burbidge, Greg Keighery, Ian Abbott, Neil Burrows, Paul Jones and staff of CALMScience Division Design and production: Tiffany Aberin, Maria Duthie, Sue Marais Illustration: Gooitzen van der Meer, Ian Dickinson Marketing: Estelle de San Miguel 🕿 (08) 9334 0296 Fax: (08) 9334 0498 Subscription enquiries: = (08) 9334 0481 or (08) 9334 0437 Colour Separation by Colourbox Digital Printed in Western Australia by Lamb Print © ISSN 0815-4465. All material copyright. No part of the contents of the publication may be reproduced without consent of the publishers. Visit LANDSCOPE online on our award-winning Internet site NatureBase at http://www.calm.wa.gov.au



Published by Dr S Shea, Executive Director

# 0

The Dampier collection returns briefly to Western Australia for an exhibition at the WA Museum. The specimens' scientific interest is limited, but their historical significance is immense. The illustration is of the Sturt pea, and Dampier was the first person to collect this unusual but magnificent plant. (See page 28)

Illustration by Philippa Nikulinsky

Department of Conservation and Land Management, Dick Perry Avenue, Como, Western Australia

#### PARTNERSHIPS FOR POSTERITY

This edition of LANDSCOPE reports on the return of William Dampier's botanical specimens to Western Australia 300 years after they were collected. As the State heads for what will probably be one of our best shows of spring wildflowers, it's appropriate that we remind ourselves of the international significance of our flora. It is ironic that the extreme weather conditions which caused such distress to communities north of Perth will also bring widespread germination of billions of seeds of wildflowers.

It's easy to forget in these days of environmental awareness that our recognition of the wonderful natural assets that Western Australia has been relatively recent. During the post-war housing boom, huge swathes of urban Perth were cleared of every vestige of native vegetation for housing estates without a murmur from the community. Even scientific recognition of the uniqueness of our flora has been relatively recent. Indeed, even the great naturalist and scientist Charles Darwin wasn't impressed by the vegetation that he observed around Albany—

"... We did not during our voyage pass a more dull and uninteresting time ... Everywhere we found the soil sandy, and very poor ... The general bright green colour of the brushwood and other plants, viewed from a distance, seemed to promise fertility. A single walk, however, was enough to dispel such an illusion; and he who thinks with me will never wish to walk again in so uninviting a country".

Charles Darwin 1836 (Albany)

The south-west of Western Australia is now recognised as one of only 19 "megadiversity hotspots" in the world. In this area some 8000 different species co-exist, about seven per cent of which can be found nowhere else in the world. Unfortunately, 23 of our unique plants are extinct, 327 are threatened and 95 are ranked as critically endangered.

If we are to be successful in protecting the treasure-trove of plants that we are lucky to have in Western Australia we must continue to develop a community approach to managing and protecting them. The plight of our threatened species emphasises the fact that preservation of our ecosystems in reserves won't be sufficient to conserve many of our unique natural assets. Apart from the fact that many of our reserves are threatened by processes for example salinity—that are generated by activities outside the reserves, many of our natural assets, including a number of our threatened plant species, occur outside the reserve system.

While the technical challenges of saving our threatened plant species are large, they are not insurmountable. But even with the most sophisticated scientific technology in the world we won't succeed without community participation and support.

Fortunately, along with increased appreciation of our natural environment, we now have a large groundswell of on-the-ground support from individual and collective groups from the private and public sector throughout the State. Too often the fantastic contribution that is being made by these individuals and groups is lost in the general debate over environmental issues. This edition of LANDSCOPE (see 'Take Your Partners') documents part of the huge support network that CALM enjoys.

One of the reasons why we have seen a dramatic increase in community awareness and support for conservation of our natural assets is because of the work of the relatively few number of people who have patiently recorded the unique wonders of Western Australia and reported them in a way that everybody can understand and appreciate. Two of the people who have made an outstanding contribution in this way are Babs and Bert Wells (see 'For Love of the Job'). CALM is very fortunate to have access to their outstanding photographic collection which is used, and will continue to be used, to remind us of what a wonderful natural inheritance we have in this State.

Dyd Alea The Publisher

4 LANDSCOPE

## **NEW CD-ROM ON MARINE LIFE**

Dive into the undersea world of Western Australia, swim with manta rays and whale sharks, and take a peep at tiny colourful creatures like nudibranchs all without getting wet!

CALM's colourful and exciting new CD-ROM, Marine Life in Western Australia, leads you through the different marine habitats, such as mud flats, mangroves and coral reefs, that surround our coastline, and gives a close-up view of the amazing animals and plants that live there. You can also visit the growing number of marine reserves in this State, search simple identification keys, find out about mystery plants and animals, and understand how introduced species can create problems in the marine environment.

Video clips, voice-overs, interactive keys and the option to print text make the CD easy to use, explore and learn from. It's an ocean lover's paradise, at the touch of a button.

The purpose of this CD is first of all to raise community awareness and increase understanding of our State's fascinating



environments. The second aim is to encourage the community to become involved and participate in, and contribute to, the environmental monitoring programs currently being developed by CALM in partnership with the Australian Marine Conservation Society (WA).

coastal and marine

The CD runs on Windows (PC) and Macintosh. The CD was designed and developed by CALM and DUIT Multimedia, in association with the WA Museum. Coastwest/ Coastcare and the National Heritage Trust's Coasts and Clean Seas Program provided funding, to bring this exciting world into our homes.

Costing only \$35.00, Marine Life in Western Australia is available from CALM's WA Naturally visitor information centre, 47 Henry Street, Fremantle, WA, 6160, phone (08) 9430 8600 or fax (08) 9430 8699; and from the Department's Como premises, 50 Hayman Road, Como, phone (08) 9334 0481, or fax (08) 9334 0498.

> You can also order it through the NatureBase online bookshop.

So dive in, enjoy the fun, learn, become more aware—and get involved!

oral Reefs (Hard Corals)

## PUTTING THE FINGER ON FROG FUNGUS

Research into a major potential threat to Western Australia's unique frog species has received a \$20,000 boost from the Department of Conservation and Land Management (CALM).

The fungus—named Batrachytrium dendrobatidis—has been identified as a possible cause of significant local extinctions of frogs in eastern Australia and central America, and was identified in WA for the first time late in 1998.

The research will involve examining tissue samples from frogs to determine the distribution of the fungus, and an assessment of its potential conservation significance.

Key steps include:

- investigating samples from frogs and tadpoles already in collections, with priority to be given to species currently classified as threatened;
- field sampling of threatened species; and
- screening of tadpoles currently sold in pet shops.

Early follow-up work was undertaken by the WA Museum, with assistance from CALM, staff from James Cook University (Townsville), The Australian Animal Health Laboratory, and members of the Alcoa of Australia Frogwatch Program.

In February, CALM established a working group to plan conservation actions. The group comprises experts from CALM, WA Museum, The University of Western Australia and the WA Quarantine and Inspection Service. Among the key recommendations of the working group were:

- the study into the distribution of the fungus;
- implementation of a wetland quarantine program, involving restrictions on field research, survey licences issued under the Wildlife Conservation Act, and promotion of a standard quarantine protocol to all people working in and around south-west wetland areas;
- continuing the moratorium on the sale of tadpoles in WA pet shops;
- seeking Federal Government sponsorship of a national workshop on management of the threats posed by the fungus;
- awareness campaigns, targeting fruit and vegetable importers, seeking notification of frogs detected in stock shipments; and
- developing a program of fungus-susceptibility trials for key frog species.

All recommendations are being implemented and the study is expected to be completed before the end of 1999.

It is estimated that there are about 80 frog species in WA, about half of which are found only in this State.

Scientists involved in the research would like the whole community to work with them in limiting the spread of the fungus. People can help by not releasing frogs or tadpoles into the wild, and those who have them as pets could



phone CALM's Wildlife Branch on (08) 9334 0455 or the WA Museum on (08) 9427 2826 for advice.

People finding dead frogs are urged to report their location to the WA Museum or CALM's Wildlife Branch as soon as possible. The public is also asked not to transport wet soil or other material from one wetland area to another.

Copies of the quarantine protocol are available from CALM or via the Internet at: http://www.jcu.edu.au/ school/phtm/PHTM/frogs/ ampdis.htm Above: *Motorbike frog* (Litoria moorei), *sometimes known as green and gold bell frog*.

Photo - Babs & Bert Wells/CALM

## -

## SHOWCASING SUCCESSFUL FARM FORESTRY VENTURES

A new course recently brought together three key groups of people in farm forestry-those who influence farmers' decision making, those who provide farm forestry services and forestry farmers themselves.

The three-day Introduction to Farm Forestry course showed participants how this business venture worked, and who the key contacts were for specialist support.

Agriculture WA's Bunbury **Regional Economist Peter** Eckersley and CALM **Busselton Farm Forestry Unit** Manager Richard Moore designed the course, in collaboration with Bridgetown Forestry Farmer David Jenkins of Jenkins Agroforestry Developments.

The course was based in Bridgetown and involved mainly field visits. On the first day, participants inspected several examples of farm forestry and heard from the farmers why they had become involved and what they were getting out of it.

The second day focused on the timber industry and markets for wood. Several processing plants were visited, including a pine



sawmill and a posttreatment plant.

Day three concentrated on the factors to be considered in developing long-term plans that incorporate commercial tree crops with other farming activities.

Participants met key players in farm forestry development, extension and operations, in both government agencies and in private enterprise.

CALM presenters were Senior Technical Officer Bob Hingston, Farm Plan Advisor John Winchcombe and Farm



Presenters from Agriculture WA included Bunbury Catchment Hydrology Manager Richard George, Catchment Hydrology Technical Officer Don Bennett and Manjimup Project Officer Andrew McLaughlin.

Feedback from participants was very positive. Keith and Trudy Clothier, who run a plant nursery, were enthusiastic in their praise of the course.

"It was a steep learning curve for us, as we knew very little about what was involved after the actual tree-growing process, but it was well worth the time and effort," Trudy said.

"We came away with a much clearer understanding of all aspects of the operation, right through to marketing the product. We also have a lot of farmers coming to us for advice, so talking with farmers like David Jenkins and others, who'd made farm forestry a profitable

Above: Participants inspecting sawn pine, left to right, Dave Gardner and Gary Hartnett (CALM), Michelle Long (consultant), David Guille (CALM), Tom Mitchell and Peter Eckersley (AgWest), Cathy Lyons (Land Conservation District Committee member), Ryan Denham (AgWest), Richard Hartwell (Whittakers Pine Mill Supervisor), Richard Moore (CALM), Andrew McLaughlin (AgWest), David Jenkins (Farm Forester and Course Coordinator), Pat Hatfield (Rivercare), Mark Lush (CALM).

Photo - Ben Rose

Left: Looking at and listening to a farm forestry success story.

Photo - Richard Moore

venture for themselves, was probably the most useful part of the course for us."

Further courses are planned. Anyone interested in finding out when and where they will be held should telephone Richard Moore on (08) 9752 1677, fax him on (08) 9754 1675 or email him at: richardmo@calm.wa.gov.au



## SANDALWOOD—AND ITS SWEET SMELL OF SUCCESS

A Western Australian company that successfully promoted emu oil to the world's cosmetics and therapeutics industry has embarked on a new venture that will put the State to the fore as the leading supplier of another native oil—sandalwood.

Albany-based Mt Romance Australia Pty Ltd and CALM have signed a contract for the supply of up to 1,000 tonnes of sandalwood a year. The value of the contract is conservatively valued at \$40 million over 10 years.

Mt Romance was awarded the contract following a nation-wide call for expressions of interest in the production and marketing of sandalwood oil.

The company was selected from a highly competitive range of proposals. The selection criteria addressed several points including the location of processing facilities, competitive pricing, technical and marketing expertise, and the quantity of sandalwood to be processed.

Mt Romance has an active research and development program that is continually identifying and creating new sandalwood-based products.

Although the main focus is on the cosmetic and therapeutic uses of sandalwood, the company's long-term aim is to become a major supplier of sandalwood oil to the international perfume and pharmaceutical industries.

The contract also opens the way for the development of a stronger domestic market for sandalwood oil and products, not only in WA, but also in Australia as a whole.

Essentially, this will be a 'new' market for sandalwood products, which, ironically, were one of the first exports of the Swan River Colony.

The contract represents the realisation of a policy of value adding to WA sandalwood wherever possible. It would also complement the State's traditional markets in Asia.

The contract is expected to provide an additional incentive for farmers to incorporate sandalwood into their tree crops programs.

CALM has developed new techniques that make it possible to grow sandalwood as a tree crop. It is now one of the major supplementary species the Department is offering to farmers who are establishing maritime pines under the State Salinity Action Plan.

Apart from its economic value, sandalwood planting contributes to restoring the biodiversity of the Wheatbelt, because it occurred there naturally before the area was cleared for agriculture.

It is expected that a further 50 hectares of sandalwood will be established this year on cleared farmland as part of CALM's maritime pines project.

Above right: Sandalwood tree Right: Sandalwood flower Photos – Jiri Lochman





## DISSOLVING BRYDE'S MARRIAGE TO SALINITY

The Lake Bryde wetland complex, south-east of Lake Grace, has been nominated as a recovery catchment for natural diversity under the State Salinity Action Plan.

The National Parks and Nature Conservation Authority (NPNCA) and the State Salinity Council (SSC) have endorsed the nomination, following a proposal from CALM.

The move brings the number of recovery catchments for natural diversity under the Salinity Action Plan to four. (The others are the Lake Warden complex near Esperance, Toolibin Lake east of Narrogin and the Muir-Unicup complex between Manjimup and Mount Barker.)

Under the Salinity Action Plan, CALM is able to develop and implement a coordinated Natural Diversity Recovery Program, to ensure that critical and regionally significant natural areas, particularly wetlands, are conserved in perpetuity.

It is expected that effective management in partnership with the local community will see natural assets protected, while integrating with other land uses, such as agriculture and recreation, and providing an important means of developing techniques to combat salinity.

The Lake Bryde complex consists of a chain of freshwater and naturally saline lakes in the headwaters of the Lochardt catchment, which is a subcatchment of the Swan-Avon basin. The catchment is about 110,770 hectares, of which 40 per cent is in reserves.

Lake Bryde and East Lake Bryde act as drainage sinks, collecting salt and other sediments. They are habitat for a threatened ecological community, comprising unwooded freshwater swamps of the southern Wheatbelt, dominated by lignum and samphire species. This community is listed as critically endangered and extends over 145 hectares (see 'Endangered', LANDSCOPE, Autumn 1999).

The wetlands and their associated vegetation are an important sample of woodlands with species more typical of further north, and to the south. They also have quite different characteristics from other wetlands, such as Lake Toolibin, 120 kilometres to the westnorth-west.

The lakes contain more than 80 species of aquatic invertebrates—a relatively high level of diversity. Monitoring by CALM has also revealed up to 69 species of birds, including the threatened malleefowl and 19 species of waterbird, 10 reptile, three frog and four native mammal species.

Dominant tree species include salmon gum, red morrel, gimlet, Kondinin blackbutt, flat-topped yate, tall sand mallee and paperbark.

Until the early 1980s, Lake Bryde was a popular recreation area and provided the local community with water during droughts.

By the early 1990s, salinity was becoming more evident. This lead to significant changes in the wetlands' vegetation.

Degradation of natural bushland and surrounding cleared farmland appeared to be the result of surface water flooding and saline groundwater rising.

There is strong local community support for the area to become a recovery catchment, with most landholders aware of the issues and keen to be actively involved. This interest has led to local landholder Anne Rick being appointed a Land for Wildlife Officer in CALM's Above: Esperance Lakes area Photo – Dennis Sarson/Lochman Transparencies

Land for Wildlife Scheme, which helps landowners manage remnant bushland for conservation.

National Parks and Nature Conservation Authority chairman Tom Day has welcomed the adoption of the wetlands as a recovery catchment.

"Conservation of our natural biodiversity requires cooperative effort between State and local government agencies, landholders and local community groups," he said.

"The nomination of Lake Bryde and surrounding lakes as a recovery catchment will also help restore an area that will have important recreation and potential nature-based tourism impacts. The viability of agricultural production will also be improved," he said.



## ALL YOU EVER WANTED TO KNOW ABOUT TIMBER ...

... can probably be found in *The Timber Book*, which was published recently. According to Scientific Adviser Graeme Siemon, "It succeeds in presenting a wellbalanced story without the emotion sometimes attached to anything forest-based."

Graeme, who is with CALM's State Forest Resources Business Unit, was consulted by the authors because of his technical expertise in wood science.

"I'm impressed with the published result, as the authors have gone to great lengths to seek expert technical advice," he said.

"For example, the book details the difference between hardwoods and softwoods. The fibre length in hardwoods is shorter, making it suitable for highgrade paper. Softwoods have a different cell structure that makes it a lot easier and quicker to dry. Hardwoods also have different structural properties, ideally suited to exposed beams, feature furniture and flooring.

"Readers need to know these facts to understand why plantations can't always replace native species."

While descriptions are detailed, the text is lively, with full-colour photographs and illustrations, graphs, maps, flow charts and, for the children, suggested activities and riddles.

It should appeal to a wide age-range of readers, and is an excellent reference source. The authors have worked hard to present the essence of farm forestry, softwoods and hardwoods, forest management, silviculture and Australia's wood needs.

CALM Corporate Relations Senior Project Officer Tammie Reid was among many nation-wide contributors to The Timber Book.

Tammie, who is a mother of three, said that it was particularly reassuring to see a book that helped children learn in a little more depth some of the rationale and science behind forest management and farm forestry.

"This would make a marvellous birthday or Christmas gift for anyone



over the age of 10," she said.

Published by the Kondinin Group, *The Timber Book* is directed primarily at students and their teachers, but with plenty of appeal for adults of all ages.

To order *The Timber Book*, readers should Freecall 1800 677 761 or Freefax on 1800 657 509.

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You're terrific. Thanks to you and the *LANDSCOPE* Conservation Visa Card from BankWest, the Gouldian finch's threatened habitat at Pumpkin Spring is increasingly protected. Your support—and this card—are helping other threatened species and ecological communities: the dwarf bee orchid, Gilbert's potoroo, mound spring communities, the western spiny-tailed skink etc.

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# KODAK 5045 22 EB 100 For the Love of the Job

The Babs and Bert Wells photographic collection, numbering 17,470 transparencies, was bought by the Department of Conservation and Land Management (CALM) in 1994.

> These are extraordinary photographs, produced by a partnership between two extraordinary people.

> > by Mandy Clews

he amateur eye may take it for granted, but a professional photographer knows it's a virtually impossible shot. A rainbow bee-eater leaving its nest is captured mid wingbeat, each of its feathers visible in sharp detail, the background showing clear blue sky, green tree and vellow grasses. It's as if this moment-a fraction of a second-froze itself for the camera. This photograph is no accident. It and hundreds of others like it are the result of years of hard work and dedication by international award-winning wildlife photographic team Babs and Bert Wells. The amazing part is that Bert did not pick up a camera until he was 55 years old.

### STARTING OVER

Bert Wells first became interested in photography late in life through a hobby course run for staff at his workplace. He describes himself as the dunce of the class, but later, through a long-standing interest in wildflowers and a close friendship with renowned wildlife photographer Michael Morcombe, Bert was encouraged to develop his photographic skills. By 1970, their four children having left the nest, the Wellses decided to take the plunge and retire. After 30 years in a job that Bert said 'bored him sideways', they were ready to embark on a new career and make their love of wildlife photography into a business.

Today, Bert looks back on his role of 'dunce' in that early photography class and remembers a valuable lesson. He says he will never forget how the instructor patted him on the shoulder and told him that in the end, even the best photography was a matter of trial and error.

'Sure enough, when we decided to go professional, we were lucky to get three or four good shots out of a hundred,' Bert says. 'Sometimes you had to accept that the shots you were taking were trial shots, and continually go back and build and improve on what you'd done, and you had to learn early to set the bar pretty high, or you would never be able to compete in the publishing world.'

But compete they did, with considerable success. Bert's membership of the Australian Photographic Society (APS) and the Photographic Society of



#### Previous page

Main: The vivid colours of this shield beetle are captured by Bert's photograph. Insets: (top) Photographing small species, such as these pygmy possums, was one of Bert's specialities. (centre) Gould's wattle bat photographed with high-speed flash leaving its nest hole. (below) A brown songlark feeding its young. *Above:* A rainbow bee-eater blasts out of its nest tunnel in the ground. Frozen in time, this image captures what the eye could never see.

America (PSA) enabled him and Babs to submit their work for overseas exhibitions, where they twice earned a rating of fifth in the world by the PSA. Eventually, they established themselves as foundation contributors to the Stills Library of Oxford Scientific Films in England, and to the National Photographic Index of Australian Wildlife at the Australian Museum in Sydney. These organisations acted as agents for Babs' and Bert's work, reaching publishers worldwide. Commissions also came from the American Museum of Natural History in New York, and from publishers in Japan and Italy.

In the end, Babs and Bert attribute their success to three important decisions. The first was to limit their *Right:* Bert's photographic skills captured two honey possums at play—one in flight!

Below right: Up close—the compound eye of a mud daubing wasp. This striking image features in the NatureBase 'Plants and Animals' screen saver.

material to Western Australia. 'We decided to stick with our corner of the world, and do it really well,' Babs recalls. 'We knew we were going to have to spend a lot of time building up our knowledge of the biology of the wildlife we were photographing. A good photo doesn't happen by chance. You have to know your subject in depth, you have to know what you're looking for, where to find it and how it's going to behave, or you're wasting your time. We made Western Australia our focus and scoured every inch of it.'

The second decision was to take no 'ordinary' photos. 'In the early days our business was sustained by the Education Department's demand for film-strip stills,' Bert says. 'Our work was pretty mediocre in those days, and when we stopped supplying the Education Department we made a pretty firm undertaking that we weren't going to take any more ordinary shots. We were going to pursue what was interesting, what was different, what hadn't been done before.'

### TEAMWORK

The third and by far the most important decision the Wellses made about their business was to set up and maintain a division of labour within an equal partnership. 'You see a photo of wildlife and if you give any thought at all to how it was taken, you think of a camera with one person behind it,' Bert says. 'It can't be over-emphasised how meaningless the person with the camera is to it all, without the backup of knowledge and support in the field. Not one of these photos would have been possible without the work that Babs put in. Not one.'

Babs describes her job behind the scenes as ranging from camp organiser and cook to porter and field scout. 'We'd be in the bush, in one spot, for weeks at a time getting a shot,' she says. 'The location of the shot might be

## A FRUITFUL RELATIONSHIP

A long association between Babs and Bert Wells and staff from CALM's Western Australian Wildlife Research Centre has been productive for both. Babs and Bert not only photographed animals, such as the long-tailed dunnart, sent to Perth from the field; they also joined biological survey expeditions, camping out with wildlife scientists and technical staff and working with them to record the animals of the area under examination.











two or three kilometres away from the camp, and there was heavy equipment, far too much for one person, to be carried all that way. Then while Bert was waiting in a hide or stalking, waiting for hours for the right moment to fire, I'd be out scouting around for the next subject.'

So skilled was Babs at scouting, particularly for birds' nests, that her eagle eye and intuition for finding subjects earned her a reputation among colleagues. Bert describes her as 'a wizard'. 'We used to boast that we could go anywhere, to any spot in WA, and find something exciting and absorbing to photograph, that would keep us interested for hours, even days,' he says. 'Babs' ability to find subjects, especially birds, was uncanny.'

Babs attributes her skill to her love of the subject. 'If you're fond of birds, for example, and I'm passionately fond of birds, you can tell by their calls what they're doing,' she explains. 'You start to know if they're mating or feeding young or just larking about. You just get to know their world as you get more and more experienced at watching them. You know the nest centres them; it's their base and their reason to hang around a particular spot. Once you spot their nest, you have a fix on them.'

## A CLOSE CALL

Bab's extraordinary nest-spotting prowess landed them one of their favourite shots, but not without a moment of drama. She had managed to identify, at about 20 metres in the air, the nest of a varied sitella, in a fork of dead wood at the very top of the forest canopy at Dryandra. Bert set about shooting the bird feeding its young, by climbing a ladder to the nest. As he was fiddling with his camera, he didn't notice the

Above left: Babs, deep in spinifex, reporting back to base with her twoway radio after scouting for subjects.

Above right: Bert, high atop three extensions of ladder, sets up a remote high-speed camera focused on a scarlet robin's nest.

*Left:* Varied sittella photographed in an inverted chick-feeding posture that is characteristic of this species. This shot almost cost Bert his life.













ladder was teetering. Suddenly he realised that the ladder had left the tree and was swinging back. He was about to fall 20 metres to the ground.

'I reached out and it was through sheer luck, will power, and a sort of super-human strength that my fingertips managed to stretch to reach a little branch and pull myself back to safety,' Bert recalls. 'If that little branch had snapped, I would not be here now. It was something I shouldn't have done, letting safety slip. . . . But how else would you get a shot like that?'

It is technically and aesthetically an excellent photograph. The shot shows the bird in the act of feeding its young. Included in the frame is the fork of the dead branch into which the nest is *Top:* Bert setting up the 'Wells highspeed special' to photograph the flight of a female Dawson's burrowing bee as it returns to its nesting burrow. (*Above*) The resulting photo.

wedged—a significant feature of sitella nests—and Bert notes with some satisfaction the good colour balance. 'Even the bird matches the colour of the nesting material,' he observes.

## TIME AND MOTION

As Babs was becoming more and more expert in the biology of the wildlife they pursued, Bert too was entering a new dimension of expertise, with the use of the high-voltage, highspeed flash. This was developed from vintage equipment that had been *From top:* This sequence of four photographs of the flower wasp's mating ritual won Bert the Scientific Professional Photographer Award.

phased out of use because of its unwieldy weight (and its tendency to electrocute the user). The special technique to balance daylight and synchronise the high flash speed (1/10,000 of a second) with the relatively slow speed of the shutter (about 1/60th of a second) was pioneered by Michael Morcombe. Michael's results in capturing the flight of birds in sharp detail set new standards in the quality of wildlife photography. Very few Australian photographers had both the passion



and the priceless antiquated equipment required for the technique.

Bert took this a step further by designing and assembling modern equipment that enabled sharp, closeup, high-speed flash shots of insects in flight. The 'Wells Special' could be hand-held, or placed on the ground or on a tripod, and fired with a button switch at three frames per second. Many shots were wasted, as the insect flew into and out of the frame, but often a top photograph was achieved. A sequence taken with this unusual array of gear, of a flying male flower wasp attracted to a flightless female, won Bert a Scientific Professional Photographer Award. This winning photographic sequence captured the species' mating ritual-a phenomenon that has never been witnessed close up before or since.

## CHARACTER

The 'Wells Special' may be a custom-made marvel of ingenuity, but Babs considers the achievement of the spectacular flight photos to depend equally on the character of the photographer. 'Bert took shots of the burrowing bee that were an epic of

Left: Pollination of the rose mallee by a yellow-throated miner. This image was taken with an obsolete high-speed flash at 1/10,000 sec.

Below left: A pebble-mound mouse emerging from its burrow.

*Below:* A southern yellow robin landing at the nest to feed its young.



determination,' she recalls. 'He had to lie there on his stomach, stock still, for two hours to get those shots. That takes a rare kind of determination, steadfastness, and patience. You have to have the expertise, but you have to have some very special personal qualities as well.'

The combination of unusual personal qualities that characterises Babs' and Bert's partnership has been vital to the remarkable scope and depth of their work. Babs' knowledge, passion for her subject, and organisational skill provided the perfect complement to Bert's determination, artful eye, steadfastness of purpose, and limitless patience. Added to this winning combination was a profound love of their work.

Babs and Bert have now retired, but the fruit of their labour resides with CALM and can be found in almost all issues of LANDSCOPE, and in many other CALM publications. The collection plays an essential part in CALM's community education program, with many of Bert's photographs used to increase awareness of WA's native plants and animals. From nature conservation and forestry to tourism and recreation, the collection is a major resource that is treasured by CALM and all those who are continually captivated by wildlife. Bert's photographs of threatened mammals can be found in publications for CALM's wildlife recovery program Western Shield. The collection also provided the foundation for CALM to produce its popular Bush Book series-full-colour pocket guides to plants, animals and special places of WA. Similarly, images from the Wells collection can be seen in full colour on CALM's NatureBase website, and in the free screen savers available for downloading across the Internet.

Though professionally Bert has closed the lens of his camera, his many photographs, coupled with Babs' rich knowledge, have left a pictorial legacy for Western Australia and the world.

Mandy Clews is a freelance writer and a regular contributing editor to *LANDSCOPE*.

All photographs by Babs & Bert Wells/CALM

#### A RARE MOMENT

The hand-written catalogue that comes with the Wells collection documents the huge range of wildlife and covers more than 20 years of work: mammals, fish, crustaceans, insects, reptiles and plants of every description. Because of their broad public appeal, photographs of wide-eyed furry mammals tend to make it onto posters and into magazines and books, and become the best-known and most widely exposed examples of a wildlife photographer's work. This is as true of the Wells collection as it is of any other. But these are not the challenging or interesting shots for Bert.

'Mammals are a passive subject,' he says. 'There's nothing stimulating about snapping off a roll of film of a bunch of captive sitting ducks. Amateurs can do that, and they're welcome to it. The real art in photography is in getting rare shots, of rare moments.'

One exception to Bert's general disaffection for mammal photography was an occasion when they photographed a long-tailed dunnart that had been discovered in the Gibson Desert. The animal had been thought to be extinct. The specimen was sent down to CALM's Wildlife Research Centre at Woodvale, and Babs and Bert were commissioned with the task of getting it on film.

Rock specimens and sand from the habitat had been sent down with the animal. Babs and Bert set up a mock habitat in their studio, using materials sent and samples of spinifex from Kings Park and Botanic Garden. Night after night they got up at 3 a.m. to catch the nocturnal animal while active. It moved, in Bert's words, 'like greased lightning'. Every time the dunnart darted behind the rocks, Babs chased it back out into view again. Finally they got the shot: tail sticking straight upwards and all in the frame, demonstrating the length of the tail at two-and-a-half times the length of the body. No one has taken such a photograph before or since.





# KARRI FOREST

A fully-grown karri tree, with its towering trunk and massive crown of leaves, is certainly breathtaking. But behind the beauty of a single tree lives something even more majestic—the forest itself. If we can understand enough of its complexity, we can sustain the karri forest for ever.

Jack Bradshaw, Martin Rayner and Margaret Kierath

B irth, infancy, adolescence, maturity, old age. The familiar cycle of human life involves challenge, diversity and change, not only for the individual, but also for the whole community. By overseeing each new generation through to maturity, we ensure the health and survival of the race.

So it is with forests. The individual tree matters, but communities of trees matter more. Forests must remain balanced if they are to survive and remain healthy; they will do so only if groups (stands) of varying generations of trees, not just old growth, are always present. Only if there are younger generations ready to take the place of older trees, no matter where they are in the forest, can there be any certainty of a thriving karri forest in the centuries to come.

To look after a forest properly, management plans must be able to predict the way it is likely to grow over a

A stand of karri midway through the 'immature' stage. It is already 50 metres in height. Photo – Chris Garnett/CALM



long period of time. In the case of the south-west karri forest, the main belt, approximately 70 per cent of the total forest that contains karri, has recently been studied for that purpose. The study aimed to develop a way of predicting the karri development stages, based on ageing areas of forest, and finding out how they might change over time. Information about the present forest's

#### Previous page

Main: The characteristic conical crown of a 'juvenile' stand. It has already reached its maximum growth rate and will soon enter the immature stage. Photo – Chris Garnett/CALM Inset: A young child looks up in awe at a giant karri that began its life 300 years earlier.

Photo - Cliff Winfield/CALM

*Left:* A seedling begins the struggle for survival. In the natural course of events it has less than a 1 in 200 chance of living to old age.

Right facing page: Young saplings in the 'establishment' stage struggle for dominance over the understorey. Photos – Chris Garnett/CALM

composition was fed into a computer program, which then modelled the changes over the next 100 years.

# LIFE AND DEATH IN THE FOREST

Trying to predict the forest's future must begin with a knowledge of how karri trees live and die—their natural patterns of birth, growth and decline.





The natural cycle of birth and death begins when there is a disturbance in the karri forest, usually caused by fire. If mineral soil is exposed, if seed is present, and if there is vacant space in the canopy, a stand of karri trees can regenerate. Competition with all the understorey species is fierce, but after about eight years, the canopy of the surviving saplings is closed and the stand moves into its juvenile stage. The trial of strength resumes, and when the trees are 25–30 years old, there remain perhaps 500 individuals per hectare from an earlier population of 5,000.

The subsequent period—the immature stage-is also a period of competition, although this is less intense than before. The number of trees reduces to about 150 per hectare. Small gaps in the canopy are created by the death of individual trees, but the surrounding vigorous trees quickly reoccupy the spaces. By the time they are 60-70 years old, they have reached about 90 per cent of their final height. Still further on, at about 120 years of age, the immature stage concludes and the mature stage begins; the individual tree crowns have reached the point where they can no longer expand, whether or not there is space available.

The mature stage is relatively stable. The diameters of the trees steadily increase, but individuals can neither occupy more of the site nor increase their crown diameter beyond 20–25 metres. Individuals slowly decline in vigour, but dominant trees maintain their growth rates. When an individual



dies, a gap in the canopy results. This is an opportunity for new growth, for a new generation to emerge. When the trees are about 200–250 years old, the mature stage comes to an end.

The final period, the senescent stage, is a story of rapid decline. The crown declines and major branches break, providing entry points for fungi that rot the woodland and further weaken the tree. Between 200 and 280 years of age, the number of trees quickly reduces, followed by a more gradual As the canopy closes at the beginning of the 'juvenile' stage, the young karri have won the race against the understorey. Now they begin to challenge each other. Photo – Chris Garnett/CALM

decline until there remain only a few rare individuals over 350 years old.

## FIRE KILLS—AND REGENERATES

There are about 70 days a year when the karri forest is dry enough to carry a fire. Both the frequency and severity of





the many fires that occur have a profound effect on the structure of the natural forest. If the fire intensity is extreme, many large patches of the trees in the overstorey will be killed and the development cycle will begin again. Extremely intense fires that completely replace the stand are not as common in karri as they are in other forests, such as the boreal forests of Alaska and the mountain ash of eastern Australia. However, multiple severe fires can have the same effect as one very intense blaze.

Less intense fires create smaller gaps in the canopy, as do storms and old age. This is another chance for regeneration, and a stand with trees at different stages of development will eventually result. It may comprise two or more generations (cohorts), of different ages, and the dominant cohort—the one with more than 25 per cent crown cover—will suppress the younger individuals. Younger cohorts with more than 25 per cent crown cover are significant, however; they become the dominant group in the future when the dominant cohort declines.

At any stage, another severe fire may completely halt the cycle, causing it to begin again. Alternatively, it may kill only part of the stand and introduce a new cohort. Views of the forest from above:

(*Top*) A wildfire in 1951 killed almost all of the original stand. The new stand is now in the immature stage. A few old senescent trees still stand. (*Right*) As old trees die in this senescent stand, new regenerating trees take advantage of the gaps in the canopy.

Aerial photos – Reproduced by permission of Department of Land Administration under Copyright Licence 565/99.



A fire of almost any intensity will be enough to kill the understorey layer and initiate another shrub cycle. Thus, there may be many cycles of understorey development during the life of the overstorey. For many of the forest vertebrate and invertebrate species, the understorey influences populations more than the overstorey.

The varied stages of karri development exist because of these

disturbances and ageing processes. All need to be represented in sufficient proportions to guarantee that the total structure is maintained into the future. Old forest, for example, cannot continue to exist if there is insufficient younger forest to grow old and take its place.

Aiming for such representation is a common feature of northern American forest management plans, but has not been widely used in Australia. One



obstacle has been the difficulty of estimating the age of a stand of trees, particularly where there are different generations within the stand.

# HOW VARIED IS THE KARRI FOREST?

The first step in computermodelling the future forest was to map the present one. Each dominant cohort was categorised and mapped according to one of the development stages. This was done through age records and interpretations of colour aerial photography. From the immature, mature or senescent categories, 121 field plots were selected; the age of both dominant and significant cohorts was estimated by measuring the diameters of trees and by using a previously determined age-diameter relationship.

Within the samples, there are few mature stands older than 230 years. The oldest stands are 370 years, and all stands are senescent by 300 years. However, senescence may occur earlier, usually as a result of damage by fire.

The present virgin (unlogged) forest, approximately half of the total, has a mean age of 170 years, and consists of both single and multiple cohort stands. The secondary cohorts vary in age from 30 to more than 200 years of age.

Left: These 140-year-old trees have won their struggle to early maturity. Photos (left & below) – Chris Garnett/CALM

*Below:* The graphs show the present age and the structure of the virgin forest with its preponderance of middle-aged stands, and the present age distribution of the whole of the karri-dominant forest.



The picture that emerges of the virgin forest prompts questions. What is the reason for the distribution of ages? Why is there a low proportion of stands in the 50–150 year age group? Will there be much less virgin forest aged 150–250 years in 100 years time?

The low number of stands aged between 0 and 50 years is partly due to the fact that most of these stands, created by recent severe fire damage, have been salvage-logged. This meant that, for the purposes of the research, they could not be described as virgin stands. The slope at the older end of the graph is due to the rapid mortality of trees older than about 250 years.

Fire in the karri forest also contributes to the overall pattern of age distribution, particularly to the proportion of multi-aged mature stands. Forests that are extremely sensitive to fire, such as the boreal forests of Alaska, often have standreplacing fires. As a result, they have a very high proportion of young forest with progressively smaller proportions of older forest. The pattern is different in karri, which has a greater resistance to fire. It is true that fire is increasingly likely as a cohort ages, but because stands are less commonly replaced by a single fire, multi-aged stands are more often produced. When the older cohorts die, perhaps of old age, they are replaced by the younger significant cohorts, not by completely new regeneration. This helps to maintain the age pattern we see today.

The age distribution for the whole karri dominant forest (the virgin and the previously harvested forest) shows a much higher proportion of younger stands, reflecting a history of past disturbance. Harvesting in the main karri belt began about 1913, and until 1928, all harvested areas were cleared for agriculture. From 1938 to 1967, selective logging resulted in relatively few stands in the 50–100 year age group.

## THE FOREST IN THE FUTURE

Mapping the existing development stages is important, but what about the future? Making reliable predictions entails looking at both the areas set aside for timber production and the conservation reserves that develop naturally.



Under CALM's current management plan, more than half of the future regrowth forest will be managed to a rotation age of 250 years. Most of the remainder will be managed to a rotation age of 100 years. By 2045, existing mature stands set aside for timber will have been harvested. Previously harvested and regenerated areas will be thinned progressively, but not re-harvested for the second cycle of regeneration until after 2045. To arrive at a picture of these stands in 50 and Space doesn't remain vacant for long in the forest. The death of an old tree is life for a new cohort of regeneration. Photo – Chris Garnett/CALM

100 years time, natural ageing and proposed harvesting schedules were factored in to the computer model.

The model had to take account of reserved areas, including national parks, nature reserves, road, river and stream zones, and patches of retained mature forest within multiple-use



forest. In these areas, stands between 250 and 400 years of age were assumed to have an attrition rate similar to the existing virgin forest. In the model, stands that 'died' during the projection period were replaced by a second generation or a secondary cohort. The process was repeated for each 50-year period.

By adding together the multiple-use and reserved areas, the model produces a complete picture of the forest a century from now. One of its most interesting findings is that we can expect a relatively stable representation of development stages to be maintained within a robust forest structure. If old stands are depleted more slowly than predicted, the proportion of senescent stands would increase slightly. If severe fires occur more frequently than in the past, there would be an increase in younger ages at the expense of stands of middle age. Less severe fires should have little effect on the overall pattern of development stages.

This study, the first of its kind in

Australia, suggests that the present diversity of the development stages can be maintained into the future. Individual stands will, of course, change; some will become older while others will make way for younger generations in a vigorous drama of renewal. The young forest of today will, after all the challenges, become tomorrow's old forest. Early morning in a mature karri forest in the Warren River valley. Photo – Chris Garnett/CALM

Jack Bradshaw is the former Manager of the Forest Management Branch in CALM. He is now a forest consultant.

Martin Rayner is a forest scientist and currently is the Acting Manager of the Forest Management Branch.

Margaret Kierath is a freelance writer with an interest in the environment.

The following scientific papers describe the study in more detail:

Bradshaw, F.J. and Rayner, M.E. (1997). Age Structure of the Karri Forest:

 Defining and Mapping Structural Development Stages. Australian Forestry 60(3), pp. 178–187.

Bradshaw, F.J. and Rayner, M.E. (1997). Age Structure of the Karri Forest:

 Projection of Future Forest Structure and Implications for Management. *Australian Forestry* 60(3), pp. 188–195.



ENDANGERED!



## STIRLING RANGE TRAPDOOR SPIDER

Trapdoor spiders abound among the Western Australian fauna as a series of diverse and ancient lineages that have survived through the aeons and adapted to the modern dry climates. They have done this through numerous behavioural and morphological changes. Some spider groups trapdoor have remained relatively unmodified and are nowadays restricted to isolated patches, usually in areas of higher rainfall in the south-west corner of the State.

One such lineage, the Migidae, is represented in Western Australia by the genus *Moggridgea*, which is elsewhere known only from southern Africa and Kangaroo Island, South Australia, making it a true Gondwanan relict. Of the three known Western Australian species, only the Stirling Range trapdoor spider is currently listed as threatened. All known populations are small, fragmented (they are generally restricted to shaded, south-facing slopes and valleys), and extremely vulnerable to fire. The animals live in short burrows, which are too shallow to resist the immense heat generated at ground level in a hot bushfire. Any survivors are vulnerable to the subsequent drying out of their local environment through the temporary loss of the tree canopy, or from the smothering effect of rushes and acacias that rapidly regrow after fires. Re-establishment of high-density spider populations takes at least 20 years after a hot fire.

In 1996, the Department of Conservation and Land Management (CALM) arranged for a survey of the Stirling Range trapdoor spider by experts from the Western Australian Museum and The University of Western Australia. The fieldwork

> By Mark S. Harvey and Barbara York Main Photos – Jiri Lochman

located 12 populations, some of which were very small. The survey also highlighted the species' susceptibility to high intensity fires, and noted that some populations had been greatly diminished by recent wildfires. This information was used in developing the management plan for the Stirling Range National Park, which aims to protect these populations from fire.

Our knowledge of the Stirling Range trapdoor spider is not complete, as there is still some uncertainty regarding the taxonomic status of the various populations—is there only a single species represented in the Stirling Ranges, or is there a species complex similar to that of plants such as Darwinia? Only further collecting and analysis can answer this perplexing question. If there are many species, the conservation status of the surviving species is extremely uncertain.

The survival of these precious, ancient creatures relies on careful management of their existing habitat.



## Dampier's plant collection is back!

William Dampier was the first Englishman to collect botanical specimens from Australia. His journeys excited the imagination of Jonathan Swift and were made fully 70 years before Joseph Banks visited Botany Bay

by Neville Marchant

In August this year, after 300 years to the month, Dampier's specimens will be back—returning for public display in Western Australia.

t's a small but fascinating collection of dried plants, gathered by William Dampier at Shark Bay and other points in the north-west of the State in 1699 (see 'William Dampier: Voyages to New Holland' in LANDSCOPE, Winter 1993). They are returning briefly from their home at the Sherardian Herbarium of the Department of Botany at Oxford University, in order to go on show at the Western Australian Museum in August. This is a joint project of the Museum and the Department of Conservation and Land Management (CALM). The specimens' scientific interest is limited, but their historical significance is immense. They are the first Australian plants to be collected by a European, and by a fascinating historical figure to boot.

Born in 1652, William Dampier (navigator, naturalist, hydrographer and part-time buccaneer) lived at a time when readers were eager to learn of other cultures, particularly if they seemed utopian, of accounts of noble savages and strange plants and animals. Dampier's detailed observations of the flora and fauna he encountered on his travels, including graphic descriptions and some drawings of birds and fish. were welcome fodder for the hungry public imagination. It is likely that his botanical work influenced Joseph Banks. Before his death in 1715, Dampier made three circumnavigations and published five books on his travels. Many of his



books were reprinted and some were translated into other languages.

During 1675–1678 Dampier was involved with buccaneers, and was among the best known and probably the most intelligent of the groups who thwarted the Spanish ships attempting to take the wealth of the Pacific and the Americas to Spain. It is not known what sort of role he played on these voyages. It is possible that he merely found Previous page

Main: Flying Fox Passage near Sandy Island in the Dampier Archipelago. William Dampier landed near here in 1699. Photo – Chris Garnett Background: HMS Roebuck, under the command of William Dampier, sketched by John Allcot. Inset: A parekeelya (Calandrinia polyandra), the same species as collected by Dampier in 1699.

Photo - Alex George

Left: William Dampier—navigator, naturalist, hydrographer, and with a reputation as a buccaneer—captured the imagination of European readers with his stories of the new world. Illustration – David Gough

*Below:* Safe anchorage in the blue waters of Shark Bay. The scattered shrubs on red sand dunes characterise the areas where Dampier collected plants. Photo – Eva Boogaard/Lochman Transparencies

pirate ships, and government-sanctioned privateers, a convenient way to travel. He appears to have spent most of his time observing and writing up his journal.

The term 'buccaneer' is a little ambivalent. It was not regarded in his time as too lowly an occupation, although some authors used it to mean 'pirate'. Dampier did not merit this description. A competent scientist, he conducted research, eventually



**Right:** Wireweed wattle (Acacia coriacea) occurs throughout arid Western Australia and other States. It flowers in June to July, too early for Dampier to have collected the yellow flower heads seen. Photo – Bruce Maslin

Below right: A high number of blue flowered plants in 'New Holland' was observed by Dampier. Hoary dampiera (*D. incana*) is endemic to the north-west coast. Photo – Alex George

publishing *Discourse on Winds*, *Breezes*, *Storms*, *Tides and Currents*, and justifiably questioned accepted notions regarding the longitudinal width of the oceans.

In 1679, Dampier set off on his first voyage around the world, a 12-year journey. He visited Western Australia twice, once in the *Cygnet* in 1688, and the second time in the *Roebuck* in 1699. His now famous descriptions of the people, plants and animals of Western Australia were typical of the many published accounts based on notes made during his three long voyages to the Pacific, Asia, Australia and America.

Everywhere he travelled he gathered considerable knowledge of the economic botany of the places he visited. He published details of edible plants, fishing and farming methods, and foresaw the value of tropical fruits such as the capsicums, pineapples and limes of the New World, and coconut, sago and breadfruit in the Pacific and Asia. Dampier detailed the use of breadfruit on Guam 83 years before Joseph Banks studied the same species on Tahiti and 100 years before Bligh's ill-fated Bounty expedition was mounted to collect plants from the Pacific to take to the West Indies. He also commented on durian and jackfruit. No wonder he expressed disappointment with the aridity and consequent lack of edible plants on the coast of Western Australia.

## WESTERN AUSTRALIA BOUND

Dampier was not the first European to sight the western coast of 'New Holland' or its offshore islands. There



are many accounts of English and Dutch shipwrecks and approaches to the coast, and there are some plant specimens almost certainly collected by the Dutch. Dampier was, however, the first Englishman to land on the West Coast, from the *Cygnet* in 1688, at what is now known as Karrakatta Bay at the western entrance to King Sound, north of Derby. He was 36 years old.

The *Cygnet* needed to be careened, and Dampier took the opportunity to describe the landscape, people and plants he saw. He was confronted by a flora and fauna unlike anything he had seen before, despite his wide travels. His published works described them in terms of those he had seen in far away places: the Pandanus plants were 'Dragons Blood tree', and he also mentioned dugong ('manatee') and turtle. The people he also compared with South Africans, whom he had not yet seen; it seems he embellished his descriptions somewhat for print.

In 1699, Dampier's reports from his earlier voyage interested the British Government enough to sponsor an expedition that same year. The expedition was originally planned to travel from England to Cape Horn and then to approach New Holland from the east. Had this plan been followed, Dampier would have discovered eastern Australia 70 years before Captain Cook. But Fate was not on his side. Delays in departure meant that winter closed in, making Cape Horn unsafe. Instead, the 290-ton *Roebuck* followed the wellestablished Dutch route from South Africa across the Indian Ocean, sighting land off the west coast of *Terra Australis*, near present-day Geraldton.

For just more than five weeks he explored the west coast, landing first in Shark Bay, which he named.

'The Sea-fish that we saw here—or there was no River Land or Pond of fresh water to be seen—are chiefly Sharks. There are an abundance of them in this particular Sound that I therefore gave it the name of Shark's Bay.'

He then landed in the Dampier Archipelago, near present-day Karratha, and finally at La Grange Bay, south of present-day Broome. It was in these places that he made his famous plant collections, pressing and drying them between pages of books, including:

'besides some Plants, Herbs, and tall Flowers, some very small flowers, growing on the ground, that were sweet and beautiful, and for the most part unlike any I had seen elsewhere'.

## A HISTORIC COLLECTION

It was a wonder that the specimens survived the long journey to England.

## A PEA BY ANY OTHER NAME

Dampier was the first person to collect the magnificent Dampier pea. There were no leaves on the original specimen, only flowers and a young woolly pod. Originally called the Dampier glory pea, the species now known at least in the eastern States as the Sturt pea extends from Shark Bay across central Australia to western New South Wales. It has had a chequered nomenclatural history. The species was not formally described as new until 1832. The description of *Donia formosa* referred to a specimen collected on the north-west coast of New Holland by Captain King in 1818.

The Dampier pea was later regarded as belonging to the same genus as the New Zealand *Clianthus* ('glory pea'), because of a superficial resemblance. However, careful comparisons in the 1980s led to the discovery that the Dampier glory

pea was really more closely related to the members of the genus *Swainsona*, hence its modern-day name of *Swainsona formosa*.

There have been claims that Dampier brought back seeds of S. formosa, but this is unproven, and considering the loss of the Roebuck at Ascension Island, highly improbable. Clianthus formosus, now regarded as S. formosa, was first recorded in cultivation in Europe in 1851.



Photo - Chris Garnett

After collecting them, Dampier sailed to Timor and along the north coast of New Guinea. The *Roebuck* foundered in March, 1701, off Ascension Island in the south Atlantic. The crew sheltered on the island and, fortunately, an East India Company ship rescued them, Dampier returning home with his journal and precious herbarium.

On his return, he gave the specimens to Dr Woodward, a friend of William Sherard, founder of the



Sherardian Chair of Botany at Oxford. Woodward gave some Dampier specimens to Plukenet, who made illustrations in his Amaltheum Botanicum, published in 1705. Woodward is sometimes credited with the authorship of the plant descriptions given in Dampier's A Voyage to New Holland (1703). It is more likely that he translated descriptions from the Historia Plantarum, a huge work produced by John Ray, widely regarded as the father of English natural history. who had received some of Dampier's specimens.

In 1710, Woodward gave his herbarium to the care of Sherard and they have remained in Oxford ever since. The Dampier collections comprise 23 specimens, including the Dampier pea, now known as *Swainsona* 

Left: The Dampier Archipelago, near present-day Dampier and Karratha, are vegetated with low hummock grasses and shrubs. Photo – Dennis Sarson/Lochman Transparencies

*Right:* The common, shingle-back or bobtail (*Tiligue rugosa*) fascinated Dampier, who described it in detail. Photo – Jiri Lochman

Below right: The annual redflower lotus (Lotus cruentus), a member of the pea-flower family, is a low herb that flowers after cyclonic rains. Photo – Alex George

Below far right: Adriana tomentosa, related to the castor oil weed, is a common arid shrub with greenish flowers and rough-skinned fruits. Photo – Stephen van Leeuwen



*formosa*. They have been examined by a number of botanists through the ages, who have studied the flora of Australia and have variously labelled the specimens.

their Apart from immense significance as the first collections of Australian plants, the specimens are of little scientific value. Unfortunately, not all the specimens were available to George Bentham or Ferdinand von Mueller when they compiled the Flora of Australia. As the beginning of botanical nomenclature is set at 1753 with the publication of Linnaeus' Species Plantarum, the older phrase names have no priority. Even the common name of Dampier pea for Swainsona formosa was later replaced by the more widely accepted South Australian name Sturt pea. However, in this case, there are no rules of priority, and we can call this remarkable species the Dampier pea if we wish.

### FLORAL WONDERS

It was at Shark Bay that Dampier made his often quoted observation of the frequent blue flower colour of Australian plants:

'The Blossoms of the different Sort of Trees were of several colours, as red, white, yellow &c., but mostly blue.'

One of the best known of Australian plants, and one where most species have blue flowers, commemorates Dampier. The genus *Dampiera* was named by Robert Brown, who accompanied Flinders' voyages around



Australia, and who was later to become the first Keeper of Botany at the British Museum. In 1810, he published *Dampiera*, using the specimen Dampier collected at Shark Bay in 1699.

A moss specimen in the Dampier collection may be the first Australian record of that group of plants. The given location for the specimen *Leucobryum candidum* is New Holland, although there is some doubt that the material was collected there. It may have been collected in Timor or New Guinea. Even though this moss is usually found in climates moister than that of Shark Bay, it could occur there in sheltered habitats, and it would be worth searching for.



## A LIZARD'S TALE

Plants were not the only strange and wonderful living things to make their way back to England with William Dampier's unique descriptions. He also met that well-known denizen of Perth suburbs and the south-west, the 'bobtail':

... a sort of Guano's, of the same shape and size with other Guano's decrib'd but differing from them in three Particulars; For these had a larger and uglier Head; and had no Tail: And at the rump, instead of a Tail there, they had a stump of a Tail, which appeared like another Head; but not really such, being without Mouth or Eyes: Yet this creature seem'd by this means to have a Head at each THIS MEMORIA, CREST WAS PRESENTED TO THE TOWNS PEDFLE OF BROOME BY THE COMMONICAL THE OVERAMMENT AND THE IT A HISTORICAL SOCIETY LIVE UNVELLED. BY COMMANIES A ROOMEINS & AN THE LS SUDAL DIVITURE SCH COTVERS (355)

Above and right: Although Dampier didn't visit Roebuck Bay near Broome, it is a fitting place to commemorate his two visits to Western Australia. Photos – Pamela Butt

end; and which may be reckoned a fourth difference, the Legs also seem'd all four of them to be Fore-legs, being all alike in shape and length, and seeming by the joints and bending to be made as if they were to go indifferently either Head or Tail foremost. They were speckled black and yellow like Toads, and had Scales or knobs like those of Crocodiles, plated onto the Skin, or stuck into it as part of the Skin. They are very slow in motion; and when a Man comes nigh them they stand still and hiss, not endeavouring to get away.'

Dampier then goes on to describe the liver and smelly insides, declaring them to be unpalatable ('both in Looks and Smell of them being so offensive').

Apart from the description of the colour as 'speckled black and yellow' this description enables us to identify the species as the 'shingle back' or 'bobtail'. There is considerable variation in the colour of this species, but the yellow is more accurately a very dull yellow or tan colour.

# INFLUENCE THROUGH THE AGES

Jonathan Swift's Gulliver's Travels, a novel about 'a person of quality in Terra Australis incognita', borrowed heavily from travel accounts of his time for style and source material, and mentions William Dampier by name. It has been claimed that the imaginary land of Lilliput was based on the writing of Dampier in his description of his 1699 visit to Western Australia. Other writers of the relatively new genre of prose fiction were thought to have been influenced by Dampier's published accounts of his travels: Defoe's Robinson Crusoe may have been partly based on Dampier's experiences.

## PRESSING THE POINT

Plant specimens can be preserved for perpetuity if they are pressed between papers so that they dry but are not exposed to air. The papers are changed during the first week or so in order to dry the flattened specimen as much as possible. Once the specimen is too dry to support mould or insects it can be mounted on a sheet and made available for botanical studies.

Any specimen, if it has been preserved in the usual way, can be studied in detail by researchers. A flower, for example, can be carefully removed and soaked in ordinary household detergent. It will swell to its original size, shape and disposition of organs to become three-dimensional, just as it was when it was alive and selected for a specimen.

Some material is too valuable to be subjected to such treatment. Then we rely on a careful comparison of the dried specimen with other material.

Dampier was to live for only threeand-a-half years after returning from his third circumnavigation. He was 63 and had spent 42 years wandering the Earth. His contribution was great, but he was unlucky. He could have achieved more discoveries of New Holland if he had had the opportunity, but the wars of the Spanish succession diverted British attention from the southern lands, and it was not until the mid-eighteenth century that interest resurged with the voyages of Captain Cook.

A memorial to Dampier was unveiled on 30 October 1938, at Broome, in the Bay named after Dampier's ship. Even though Dampier did not visit this section of the coast, it is a fitting memorial to the ship and its naturalist-hydrographer leader. The inscription has a fitting couplet especially written by John Masefield:

'We little guess which deed a future year May mark to mortals from our passing here.'

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# GNANGA by Caris Bailey

Getting pines to grow on land cleared of native vegetation around Gnangara was not all that easy in 1926—in fact, the first seedlings turned bright yellow and wouldn't grow.

Trial and error showed that a missing fungus was responsible, one that helps roots to take up nutrients from the soil. The Gnangara nursery was growing healthy pines by 1929, but they still grew slowly in the plantation, until the right fertiliser regime was discovered.

The reverse problem now presents itself—how is native vegetation going to grow on land cleared of pines in the new Gnangara Park?

n the summer of 1994–95, two massive fires swept through Gnangara pine plantation, near Wanneroo, burning out 1,900 hectares of pines and banksia woodlands. The second of these fires, in February, took more than 100 firefighters about 15 hours to bring under control and another two days to mop up. Hundreds of hectares of blackened pines were later harvested to salvage as much timber as possible, and the treetops and other litter were burnt off.

And then, green shoots began to appear. Despite the fires and the fact that some of the burnt sites had been under pine for up to 43 years, native plants began to re-sprout from previously-dormant roots. Following the winter rains, many other species germinated from hard seeds in the soil.

About 50 species regenerated naturally, although at a lower density

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Recreation is one of the four key values identified for Gnangara Park—walkers are already able to explore the area on the Coastal Plain Walk Trail. Photo – Therese Jones/CALM



than the original bushland. The 1994 - 95fires had inadvertently provided the Department of Conservation and Land Management (CALM) with its biggest revegetation trial at Gnangara. This area, along with other, smaller, areas where native vegetation has re-established itself, has been examined by CALM scientists as plans to transform the plantation into Gnangara Park are being developed.

The new park will be a massive green belt for the rapidly growing residential and rural areas of Perth's north-west corridor, and the future growth areas identified in the northeast corridor. The decision not to replant harvested areas of pine has been made possible by CALM's program of



planting pine crops on already cleared farmland, where the trees will lower water tables to prevent salinity and waterlogging problems. At the end of last winter, a total of 4,200 hectares of pines had been planted. Assisted by farmers, CALM's target is to plant 150,000 hectares of maritime pine within a decade, and to attract private investment

Above left: Moitch is one of three timber shelters along the Coastal Plain Walk Trail, where walkers can stop for a meal or camp overnight. Photo – Therese Jones/CALM

Below: One of the older sites in the plantation. These pines were planted along Gnangara Road in 1941. Photo – Chris Garnett/CALM





for the project to reach an overall planting target of 500,000 hectares.

## CONCEPT PLAN

A Concept Plan for Gnangara Park has been released for public comment. A Technical Working Group with officers from CALM, the Water and Rivers Commission, Water Corporation, Ministry for Planning, Department of Minerals and Energy and Department of Environmental Protection determined a study area of 91,000 hectares, roughly the size of the entire Perth metropolitan area.

This is almost twice the size of the 50,000-hectare park originally proposed (see 'Park for the People', *LANDSCOPE*, Autumn 1997) and is made up of about 20,000 hectares of pine plantations, 47,000 hectares of other CALM-managed estate and 23,000 hectares of other lands, including vacant Crown land and land leased by the Department of Defence. This brings together in one proposal a number of areas that have long been recommended for conservation, recreation and groundwater protection.

The study area covers much of the underground water reserves known as the Gnangara water mound. The Gnangara mound supplies nearly 40 per cent of Perth's drinking water, and this figure is likely to increase to about 50 per cent within the next 15 years. The groundwater also supports many of the area's environmental values, such as wetlands and vegetation.

The study area includes a large area of relatively undisturbed native woodland that stretches across the northern Swan Coastal Plain from the coast almost to the Darling Scarp. The Park will include most of the landforms present on the northern Swan Coastal Plain and contain more than 30 distinct vegetation types. These range from coastal herb fields, through heathlands, scrublands on dunes, limestone ridges



and wetlands, sedgelands in wetlands, low woodlands of banksia, paperbarks or mallee eucalypts to tall woodlands of tuart and jarrah and/or marri.

The area also has a large number of wetlands, most of which contain open water only occasionally or for short periods each year. The wetlands within native vegetation areas are largely undisturbed and of high conservation value. There are also some wetlands with conservation value within the pine plantation.

More than 750 species of native flora have been recorded in the area—a number that is likely to rise as further surveys are undertaken. Two declared rare species, *Eucalyptus argutifolia* and *Caladenia huegelii*, and 18 species listed on the CALM Priority Flora lists occur in the Park. *Eucalyptus argutifolia* grows *Top left:* Sand is one of several resources extracted from the Park. Current and future operations will be managed to minimise impacts on other Park uses.

*Top:* Some native species quickly reestablished in former pine plantations burnt out by fires in the summer of 1994–95.

Above: Marri and jarrah have grown around the pines on this site. Photos – Chris Garnett/CALM

only in the Park and immediate vicinity.

Large numbers of emus and western grey kangaroos are still found in the study area, as well as populations of western brush wallaby, quenda (southern brown bandicoot), western brushtail possum, honey possum, mootit (native bush rat) and echidna.

Two Aboriginal Dreaming trails

Four primary values have been identified as a framework for the concept plan: nature conservation (which is the focus of this article), resources, recreation and interpretation and heritage, each of which has a number of key objectives (see box). The number of different objectives that have to be balanced, highlights the complexity of planning Gnangara Park and the importance of integrated planning.

Nature conservation	Resources	Recreation and interpretation	Heritage
Protect and enhance existing biodiversity, threatened species, wetlands and vegetation communities.	Protect and enhance quantity and quality of groundwater and public drinking water supply.	Develop a wide spectrum of recreational opportunities and public access.	Protect natural and cultural (Aboriginal and non-Aboriginal) values.
Restore flora and fauna habitats and remove feral predators.	Harvest pines within the next 20 years.	Interpret primary values to enhance visitor awareness, experience and enjoyment.	Provide opportunities for appropriate interpretation of natural and cultural values.
	Extract sand, limestone and other resources.	Provide opportunities for nature-based tourism.	ere and the second second

Key objectives for the four primary values identified as a framework for the Gnangara Concept Plan.



cross the study area and features of early European settlement include two stock routes and the old Gnangara town site and tree nursery.

The Concept Plan for Gnangara Park has had to take into account multiple planning requirements, including the soon-to-be-released draft Gnangara Land Use and Water Management Strategy. The plan has also had to consider the interests of a large number of stakeholders, including those using the area for a wide variety of recreational activities and those involved in timber production, mining for basic raw materials (mainly sand and limestone), wildflower picking and beekeeping.

## REVEGETATION

Natural revegetation after the 1994–95 fires and after thinning on other sites in the pine plantation, provides a wealth of information for a managed revegetation program. It is already clear that some native species regenerate more readily than others and that different soil types and landforms are more easily revegetated.

The next step will be to map all remnant vegetation in the pine plantations to help identify key areas and examine how the revegetation program can be integrated with forestry operations. In some areas, for example, pine falling techniques could be modified to increase the survival rate of remnant undergrowth species and the harvesting schedule could be planned to clear the most favourable sites for regeneration ahead of more difficult sites. Fire management will also be an issue-a balanced fire management program will be required to provide the necessary protection for the remaining pines (which are killed by intense wildfire), and for the revegetation.

The Concept Plan proposes different priorities for revegetation, which will be carried out over 20 years—the scheduled time for the all the pines to mature and be harvested. Research and monitoring trials undertaken in the

Above left: Coastal heath in the northwest section of the Park.

Left: Yeal Lake is one of many wetlands in the Park, but unlike most, it usually contains water throughout the year. Photos – Chris Garnett/CALM



early years will allow for the program to be improved year by year.

The highest priority will be given to revegetating good quality native vegetation buffers around existing high nature conservation values, such as populations of threatened species, threatened ecological communities and conservation category wetlands. High quality native vegetation corridors will also be revegetated between significant remnants of vegetation. The aim is to recreate vegetation at each of these sites that is as close as practical in structure and diversity to intact native vegetation.

Specific revegetation programs will be carried out in some areas to maximise recharge to groundwater for nature conservation or water supply purposes. Other revegetation programs are proposed on cleared sites in the plantations to enhance amenity values and recreation, tourism and interpretation opportunities.

Experimental plantings to date include scarlet flowering gums, tuarts and river red gums. A trial plot of everlasting seeds from Paynes Find, on the Goldfields, has also been sown.

Less intensive revegetation is proposed in the remaining areas as the pines are progressively removed. Natural regeneration in these areas will initially be supplemented by planting five to 10 native tree and shrub species, at an appropriate density. The aim is to create self-sustaining native vegetation communities that support a diversity of fauna and provide linkages and buffers to high value nature conservation areas in a cost-effective manner.

Seed will be collected from the



existing native woodlands for use in the rehabilitation of degraded areas, either within Gnangara Park or elsewhere. The seed store will be used for both direct seeding and for raising seedlings, as appropriate.

The management and control of weeds will be the biggest challenge for the revegetation program, given that the ability to use certain herbicides in the groundwater protection area will be limited. Strategies to control weeds are still being developed.

## WESTERN SHIELD

A key goal under the Concept Plan is to increase available habitats for a range of fauna species and encourage fauna to be reintroduced into the Park. CALM's Western Shield program to control feral predators and conserve native animals will be extended to Gnangara Park. Above left: Bushwalkers enjoy the panoramic views from Yanchep Rose Lookout, on the circuit trail linked to the Coastal Plain Walk Trail. Photo – Therese Jones/CALM

Above: This Banksia menzesii is one of the overstorey species that CALM plans to re-establish following the removal of pines. Photo – Chris Garnett/CALM

Baiting will begin in the large existing areas of native woodland found at the northern end and eastern side of the Park. These include Yeal Nature Reserve, the adjacent vacant Crown land and the proposed Wilbinga-Caraban Conservation area.

Existing fauna will be monitored before and after predator control. It is expected that populations of the existing fauna, including the western brush wallaby, brushtail possum, quenda,



honey possum, dunnart, echidna and possibly the chuditch, will begin to increase in numbers and range.

The next step will be the reintroduction of fauna once found in the area, but no longer present. Species likely to have been found around Gnangara include the numbat, chuditch, brush-tailed phascogale, tammar wallaby, quokka, rakali (water rat), boodies, woylie, dibbler, mardo and ring-tailed possum. Western Shield will then extend into the former pine plantation.

## PEOPLE'S PARK

Gnangara Park, because of its size and its proximity to growing residential areas and the city, will be an important area for recreation and public use. The opportunity for people to experience both natural areas and open spaces will also make it a destination for nature-based tourists.

The Concept Plan divides the park into six zones, each one focussing on the features of a particular area, with appropriate proposals for nature conservation, resource use, recreation and interpretation and heritage. The plan recognises existing recreation pursuits and proposes new facilities in the different zones, including a visitor Left: The tammar wallaby is one of the native animals thought to have occurred around Gnangara before European settlement and one likely to be reintroduced under Western Shield. Photo – Babs & Bert Wells/CALM

Below left: Paperbarks growing on the edge of Yeal Lake are part of the diverse flora already found in the proposed park. Photo – Chris Garnett/CALM

centre, new tracks for walking, cycling and horse riding, picnic sites, scenic drives and a lookout. Recreation opportunities in the coastal Wilbinga-Caraban zone, for example, include the development of walking tracks to the beach, with access roads and parking for conventional and four-wheel-drive vehicles. The main visitor centre and a key recreation site are proposed near Gnangara Road. All facilities and activities will be sensitive to the need to maintain the quality of the water mound and other environmental values.

This is a long-term plan, but CALM and others have already begun working to improve the plantation and State forest and to prepare for the transformation into Gnangara Park. Projects undertaken include the development of the first 46 kilometres of the Coastal Plain Walk Trail, which opened in 1997, and an agreement with Clean Up Australia 2001 to help clean up the study area.

Public comments on the Concept Plan will continue to shape future developments at Gnangara Park as it grows into a unique conservation and recreation park—a park for the people.



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The assistance of Alan Sands, Greg Keighery, Sandra Krupa, Tracy Churchill, Lyndon Mutter and Clayton Sanders is gratefully acknowledged.

Copies of the Concept Plan can be viewed at the CALM offices in Wanneroo and Como and at shire offices and libraries around Gnangara Park, or purchased from CALM for \$5.00 each plus postage.

# OING WHAT COMES NATURALLY Delebrating women in conservation in Western Australia

For many generations, there have been thousands of women in Western Australia for whom conserving, studying and managing the environment has been a way of life, a crusade, a means of self-expression, a career, or any combination of these. We pay tribute to a notable few of them.

by Tammie Reid, Suzanne Curry and Mandy Clews

his year, Western Australia celebrates 100 years of women's suffrage. At the same time, we celebrate the achievement of women in conservation and land management, a constant factor in the face of monumental social change.

The story of conservation ethics in this State belongs as much to women as to men. Long before Europeans arrived, Aboriginal women were gathering plants for food and medicine. During and after colonisation, women worked on the land through agriculture, botanical collection and illustration, conservation and politics. All through history, women's presence in the landscape has been as constant, their practices as influential, and their contribution to knowledge and sound environmental practices as significant as men's. Here, in a series of short 'snapshots', we pay homage to just a few Western Australian women who have shaped the way we understand and interact with our environment.

Above right: Wedding portrait of Georgiana Molloy, painted in London just before she emigrated to WA. Photo courtesy of the Bunbury family and in memory of their own daughter, Georgiana

Below: (Main) Opening of Kings Park terraces by Lady Margaret Forrest. (Inset) Photo portrait of Lady Margaret Forrest.

Photo courtesy of Don Forrest

Below right: A beautiful glimpse from one of the Kings Park grottos, showing Melville Water and the Canning River in the distance. Photo courtesy of Kings Park archives



## GEORGIANA MOLLOY: A LONELY PASSION

In 1830, when delicate, cultured Georgiana Molloy left behind the comforts of wealthy society in England to settle in Augusta, on the south-west coast, with her husband Captain Molloy, she would have had no idea of the hardship and loneliness that lay ahead. With few other families around, she was left to cope alone for long periods while her husband attended to business in Perth. She bore seven children, buried two of them, and suffered hunger and sadness through year after year of poor harvests and social isolation. It was Lady Stirling, wife of Governor Stirling, who came to her rescue by suggesting to her cousin, amateur botanist Captain James Mangles, that he write to Mrs Molloy proposing an exchange of botanical specimens. Over the years, collecting and describing specimens and seeds to send to Captain Mangles in London became a passion. By the time her life was tragically

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Top: A view through one of the Kings Park grottos to the Swan River. Photo courtesy of Kings Park archives. Centre: Brenda James, wife of retired National Park Ranger Jack James. Photo – Chris Garnett/CALM Below: The CALM Bush Rangers program looks set to inspire a whole new generation of women in conservation. Photo – Rolf Perey

cut short by the privations of pioneer living, Georgiana Molloy's enthusiasm and talent for botany had made Western Australia's remarkable floral heritage known throughout the world.

## MARGARET FORREST: QUALITY OF LIFE

Although history credits Western Australia's first Premier, Sir John Forrest, with the proclamation of Kings Park, anecdotal evidence shows it was a decision strongly influenced by his wife, Margaret. Certainly, Margaret Forrest believed strongly in the role of nature in civilising a community; in the importance of having parks where families could seek recreation and contact with the environment. Although she was a skilled botanical artist, her ongoing contribution to Kings Park was more intellectual than practical; she took the opportunity of frequent trips to England to gather ideas for the landscape architecture of the Park.





## MAY HOLMAN: FOREST COMMUNITIES

Politics and trade unions were flowing in May Holman's veins when she became the first Labor woman to be elected to Parliament in Australia. She succeeded her father in 1925 as the Member for Forrest, a federal electorate in south-western Western Australia, having served as his confidential secretary when he had been General Secretary of the Timber Workers' Union. She knew intimately the way of life of the small timber towns in the south-west forests, and understood, perhaps better than anyone else of her time, the place of communities in the forest and the delicate balance of social needs and natural resource management. Within her first year of entering Parliament she introduced the Timber Industry Regulation Bill, enacted in 1926, which improved the conditions of workers in the timber industry.

## JUNE CRAIG: A STRONG COMMUNITY COMMITMENT

Another 50 years were to pass before Western Australia appointed its first female minister with a forestry-related portfolio and its second-ever female cabinet Minister, June Craig. It was June's life in the rural town of Dardanup, as a mother, farmer and employer of new migrants, that brought to her attention the disturbing lack of community support, both materially and emotionally, for migrants and rural women. In 1972, June established the Citizens' Advice Bureau and Good Neighbour Council in Bunbury. In 1974,

Above right: In the 1920s, May Holman travelled extensively along bush tracks and forest roads within her timber industry based electorate. Photo courtesy of the Australian Labour Party

Above far right: Bessie Rischbeith, pioneer feminist and environmental activist, confronting the bulldozers at Mounts Bay in 1961. Photo courtesy of the West Australian Newspaper Archives.

**Right:** June Craig in her role as Minister for Lands and Forests 1977–78. Seen here in 1978 at a gift exchange of an agile wallaby from the Perth Zoo to Japan's Meno Zoo. Photo courtesy of June Craig



she became the Liberal member for the former seat of Wellington and went on to become Minister for Lands and Forests in 1977-78. During this time, she was responsible for the development of the General Working Plan for State Forests in Western Australia No. 86. This Plan represented a milestone in the history of forestry in WA. For the first time, the whole range of forest land-use objectives, together with the policies and management strategies designed to achieve them, were stated in a single document and made public. Her strong community involvement continues to this day and has included her becoming Australia's first female national president of the Save the Children Fund. In 1994, June was awarded an AM (Member in the Order of Australia) to honour her contribution to community and charities.



## BESSIE RICHSBIETH: THE CRUSADER

It was a cold winter's day in 1964 when 89-year-old Bessie Richsbieth hitched up her skirt and waded into the Swan River to confront bulldozers in protest against further reclamation of land to complete the Narrows Bridge. Since her youth, she had been devoted to campaigning for women's and children's rights, and a few years earlier had led a successful fight to preserve Kings Park from a recreational aquatic centre development. But nothing captured the public imagination more than this simple and powerful display of elderly woman's will and an determination. Although attempts to stop the reclamation of the land were unsuccessful, her gesture set a whole generation of Western Australians free







Above: Magda Wittwer was inspirational to all those who came in contact with her in appreciating and understanding WA's native flora. Photo courtesy Brian Moss

Left: Darwinia wittwerorum named in honor of Magda. Photo – Bob Dixon



to express their passion for the environment through activism. In 1994, the Conservation Council of Western Australia created an award in her honour: the Bessie Richsbeith Conservation Award is presented annually to celebrate and acknowledge the efforts of people working to protect Western Australia's environment.

## MAGDA WITTWER: A QUIET ACHIEVER

Shy and reclusive by nature, botanist Magda Wittwer made an enormous contribution to Western Australian conservation through the survey and mapping work she carried out as assistant to then Director of Kings Park, J.S. Beard, in the 1960s. But perhaps her greatest gift to the State was through her voluntary work in training people to propagate native plants and helping schools to set up native plant nurseries. Her quiet dedication and determination were inspiring to all who met her. Many credit her with introducing and establishing in Western Australia the novel concept that there is value in cultivating native plants in their own environment, and appreciating their intrinsic rather than their exotic value. Fittingly, her name is commemorated in a beautiful Western Australian plant, Darwinia wittwerorum. It was on a field trip to the Stirling Range to continue work with her husband, collecting, studying and identifying the remarkable Darwina species, that Magda suffered an untimely and fatal aneurysm.

## MARION BLACKWELL: FLYING HIGH

For many, the name of Marion Blackwell is synonymous with conservation in Western Australia. Her achievements demonstrate that women can make an esteemed career in conservation and be at the centre of decision-making and policy direction. Marion established herself as a

Left: Marion Blackwell in the Chinese Garden, part of the award-winning landscapes she designed for Murdoch University. Her particular interests have centred around the appropriate use of adapted plant species in landscape design to increase quality of life. Photo – Chris Garnett/CALM

professional botanist. landscape planner and designer, as well as a wellrespected academic, before being appointed a member of the State Environmental Protection Authority and an inaugural member of Western Australia's National Parks and Nature Conservation Authority, of which she is deputy chair. She has brought her botanical expertise and broad background knowledge of the State, in particular the arid areas, to many boards and advisory bodies in Western Australia and Australia, including the West Australian Flora Industry Advisory Committee, the Western Australian Threatened Species and Communities Consultative Committee, the State Salinity Council, the State Gravel Council, and the Western Australia Weed Strategy Steering Committee.

## RICA ERICKSON: INSPIRING OTHERS

The many books written or illustrated by prominent botanist, author and artist Rica Erickson have inspired hundreds of amateur and professional Western Australian flora enthusiasts. Rica has produced many publications, from technical papers to glossy books, not least among them the orchidspotter's bible. Orchids of the West, and the seminal Flowers and Plants of Western Australia (co-authored with A.S. George, N.G. Marchant, and M.K. Morcombe). Rica is also a mother, historian, farmer's wife, sportswoman, naturalist and Country Women's Association (CWA) activist. She has been awarded an honorary doctorate from the University of Western Australia for history, the Order of Australia, and WA Citizen of the Year prize for 1980. Dr Erickson's name has been commemorated in at least three species of plants in Western Australia (including the orchid Caladenia ericksonae), and more recently in part of Western Australia's conservation estate: the Rica Erickson Nature Reserve is located in the Moora District, about 15 kilometres south-west of Calingiri.

## EILEEN CROXFORD: SELF-TAUGHT RIGOUR

A fascination with the wildflowers that grew around her house, near the airport in Albany, led florist Eileen Croxford to teach herself the botanical



Above: Eileen Croxford shares her commitment to flora with daughter Hazel Dempster. Hazel is the manager of a large nursery and has always advocated the propagation and value of native plants. Photo courtesy of Hazel Dempster

*Right:* Eileen Croxford reflects on the humble beginnings of the Regional Herbarium she was instrumental in establishing.

Photo - Barbara Madden/CALM





specifications of much of the south coast regional flora. She organised the opening of a new Albany Wildflower Society Branch and developed a regional herbarium. Although she had not been formally trained, the rigour of her method of collecting and recording gave the collection a scientific integrity that led to a partnership with the State Herbarium. That partnership is now coordinated by the Department of Conservation and Land Management (CALM), where more than 7,500 of her collections are now housed.

## A WAY OF LIFE

From the earliest days of rural enterprise in Western Australia, a tradition has evolved of women on the land, because farming is not a one-man show. Rural women's consciousness of Above: (left to right) Penny Hussey (CALM's Land for Wildflife Coordinator), Dr Neville Marchant (CALM Herbarium), Dr Rica Erickson and Angela Kellsall (Victorian Plains Shire) at the naming ceremony for the Rica Erickson Reserve. Photo – Penny Hussey/CALM

environmental issues is evident from very early times. The inaugural Country Women's Association Conference in 1925 resolved, among a list of initiatives to improve social conditions for women and children, 'that CWA views with alarm the wanton waste of timber now going on and urges upon those in charge of forests and agricultural departments the need for drastic action to stop the waste'. The advocacy tradition continues today, with broad representation from women on Land Care District Committees around the State.





## SUSANNE DENNINGS: MALLEEFOWL'S FRIEND

Another example of a committed rural conservationist, fourth generation Ongerup farming descendant Susanne Dennings believes passionately in grassroots action, working at the community level to address local conservation issues.

Her concern for the malleefowl, endemic to the area but under threat from loss of habitat and introduced predators such as foxes and cats, led her to join the inaugural meeting of the Ongerup-based Malleefowl Preservation Group in 1992. Her drive and enthusiasm have seen the group's membership build to more than 1500 people, who collaborate with CALM, other agencies and sponsors to protect the malleefowl.

Susanne's leadership of the group sets a prime example for conservation partnerships that can be developed between government agencies, sponsors and people on the land.

## BRENDA JAMES : RANGER COMMUNICATIONS

Historically, botanical collection, illustration, and even public advocacy have been well suited to the passions and position of many women. However, for others, working with nature came about through the traditional partnerships they shared with men. Marriage, for example, was at one time a preferred condition of employment for National Park Rangers, because it was understood that the job could not be done without someone to coordinate the 'home base' while the Ranger covered his beat. Many hundreds of women filled the role of 'ranger's wife'-operating radios, communicating with the public, providing the domestic and social backup for one of the State's loneliest jobs-their share in the

responsibilities went unacknowledged.

Among these women was Brenda James who, as a Mobile Ranger's wife in the 1970s, voluntarily started a regular newsletter to establish a communication network with all the State's rangers and their families. Called Papa Delta Data-named after the radio call-sign for general all-ranger broadcast-the newsletter kept track of who was where, reproduced articles from environmental journals, gave good botanical and fauna references, and circulated handy bush hints, recipes and other information. With editorial and administrative support from the National Parks Authority, Papa Delta Data was published and distributed guarterly from 1976 until the proclamation of CALM in 1984. It was often used as the basis for national parks brochures. The Jameses retired in 1984, travelled and worked around the State, and now live in Yanchep, where Brenda is a community member of the Yanchep National Park Advisory Committee.

## WOMEN'S WORK

As more and more women around Australia have been able to take up positions as rangers and in other fieldbased jobs in their own right, it has become apparent that field-based work Above left: Susanne Dennings at a malleefowl mound, near Ongerup. Photo – Barbara Madden

Above: Brenda and Jack James look over some of the original Papa Delta Data newsletters that she voluntarily wrote and produced with the help of the then National Parks Public Affairs Officer, John Hunter (right). Photo – Chris Garnett/CALM

is a life-style commitment, beset with difficulties for women seeking balance between paid work and family. Slowly, these barriers are breaking down, as workplace culture continues its slow catch-up to the feminist revolution.

Accompanying that catch-up has been a growing understanding of the way employee diversity and inclusive workplace policies benefit not only women, but the community as a whole. The story of women in conservation has, after all, been one of doing what comes naturally; setting examples, using their fundamental influence to shape the way society deals with the environment. The capability, passion, and potential for community leadership demonstrated by women in the environment have always been there. Their acknowledgement is long overdue.

Tammie Reid's extensive career in forestry has led to her current position as a CALM forester in community education, with particular interests in environmental education and interpretation. She passionately advocates that the task of conserving our natural environment must be based on creating understanding and support, sharing knowledge and encouraging community involvement. She has recently been appointed to the National Parks and Nature Conservation Authority.

Suzanne Curry works as CALM's External Funding Coordinator responsible for the administration of grants and sponsorship. She is also involved in developing CALM's initiatives for the Government Plan for Women 1998–2000. In her spare time, Suzanne's keen interest in natural history and background in botany has led to her co-authoring a significant work on botanist-explorer Allan Cunningham.

Mandy Clews is a qualified health researcher, freelance journalist, and musician who has lived and travelled widely in Western Australia since migrating here from Canada in 1984. She leads a busy life which juggles a young family with a career in health planning, frequent editorial work for *LANDSCOPE*, and weekly rehearsals with a chamber ensemble she co-founded in 1997.

MARGARET KIERATH



Partnership initiatives between government, industry, community groups and CALM are making a major contribution to conservation in Western Australia.



Their continued success will help ensure a thriving environment into the future.



n late spring, the Leda Nature Reserve in Kwinana, a southern suburb of Perth, is at its most profuse. Kangaroo paws (Anigozanthos manglesii) and orchids-cow slips (Caladenia flava), common donkey orchids (Diuris corumbosa), bee orchids (D. laxiflora) and pink fairies (C. latifolia)-are in abundance. Covering 438 hectares and larger than Kings Park, the reserve is recognised for its diverse plant life, including tuart (Eucalyptus gomphocephala) forest and jarrah (E. marginata) and banksia (Banksia attentuata) woodlands. Animals such as the guenda or southern brown bandicoot (Isoodon obesulus fusciventer) and the western brush wallaby (Macropus irma) also find a haven there.

But the apparent vigour masks the fragility of a land at risk. The bushland is under threat from frequent fire, dieback and vehicle damage.

To manage the reserve and to find a balance between its conservation needs and recreational uses, a partnership has been formed between Edison Mission Energy Company, owners of a local power cogeneration plant, the Town of Kwinana and the Department of Conservation and Land Management (CALM). Using ongoing funds from Edison Mission, a committee, with community assistance, helps provide direction on how funds are spent.



Projects have included strategic fencing and gates, seed collection, a botanical survey and publication of a brochure.

## WHY FORM PARTNERSHIPS?

In Western Australia, CALM has the task of managing a vast estate of more than 21 million hectares, comprising an extraordinarily diverse range of land and marine forms, habitats, plants and animals. CALM must balance the different needs of tourism and recreation, land management and landcare, marine



#### Previous page

Main: A CALM officer takes a moment to reflect on the stunning views from Mt Bruce in Karijini National Park, during the assessment of suitable sites for a new trail to access the summit. With the assistance of the Commonwealth Government and industry partner Hamersley Iron, this trail is now completed. Photo - Richard Hammond Insets from top: Gilbert's potaroo. Photo - Jiri Lochman Trevor Walley demonstrates digging for vams at Walvunga National Park. Photo - Dennis Sarson/Lochman Transparencies Common donkey orchid. Photo - Jiri Lochman

Left: Leda Nature Reserve provides a haven for the western brush wallaby (Macopus irma). The support of industry partner Edison Mission assists CALM in managing this reserve. Photo – Wade Hughes/Lochman Transparencies

management, educational activities and the provision of information.

These responsibilities are great, greater than CALM can meet through government funding alone. There is also a heightened community awareness of the need to protect the environment and a growing desire by people from WA and beyond to visit and enjoy the parks, reserves and forests. To that end, CALM looks to conservation partners and sponsors for assistance.

CALM is proud of its many partnerships. Here we acknowledge a number of those projects which represent an indicative sample of the work and activities for which CALM seeks support from the community.

Whatever the magnitude, the contribution—time, products, services or funding—is directed towards clear goals and is of immense value.

## ECOTOURISM—A GROWTH INDUSTRY

Current research has confirmed that ecotourism is an expanding industry; there were more than eight million visitors to the State's parks and reserves last year. CALM is committed to providing facilities that enhance the visitor's experience while minimising

Left: In spring, Western Australia's floral emblem, the red and green kangaroo paw (Anigozanthus manglesii), flowers profusely at Leda Nature Reserve. Photo – Greg Harold



the impact on the environment. Such facilities include visitor centres, shelters and toilets, car parks, picnic and camping areas, interpretation signage and trails.

Partnerships and sponsorships have a major role in helping to provide such assets.

With assistance from the Commonwealth Government and the local mining company Hamersley Iron, such a venture was carried out on WA's second highest mountain, Mt Bruce in Karijini National Park, in the Pilbara Region. The existing walk trail was badly eroded and inaccessible to all but the very fit and agile. It was realigned and replaced with one that provides stunning views and safe walking opportunities, while limiting the environmental impact and being sensitive to the local Aboriginal people.

CALM provided planning, design, materials, transport and supervision, and was responsible for the overall standard of the trail. The Commonwealth Department of Industry, Science and Tourism provided funding through a national ecotourism grant, and the Australian Trust for Conservation Volunteers (ATCV) provided a work force of 59 people, both volunteers and paid personnel. Environment Australia assisted with a grant for Aboriginal people to construct the car park and place bollards at the base of the mountain. Hamersley Iron arranged earthworks for the car park,



constructed the first 250 metres of the walk trail and assisted with design and materials to improve a cliff section of the walk. They later contributed additional funding for maintenance by ATCV.

Inspired by the success of the Mt Bruce walk trail, Hamersley Iron co-sponsored the development of the Weano Recreation Area. Two new lookouts and a day-use area were developed with assistance from Hamersley's Aboriginal Training and Liaison section, Hamersley Exploration, the Commonwealth Government and CALM.

## HELPING CALM'S WILDLIFE EFFORTS

A vital area of CALM's work concerns research, management, rehabilitation of endangered plants *Top:* Assistance from the Commonwealth government and industry partner Hamersley Iron has enhanced visitor facilities in Karijini National Park. Photo – Dennis Sarson/Lochman Transparencies

Above: Educating people through interpretation. This sign, 'Striking the Balance', at Mt Bruce informs people of the challenge in balancing conservation needs and the development of nonrenewable resources. Photo – Richard Hammond

and animals, dieback control and management, feral pest research and management, and ecological community conservation projects.

One particular success story is CALM's partnership with BankWest. Approximately \$20,000 is collected





annually through customer use of the BankWest LANDSCOPE Conservation Visa Card and is allocated to projects relating to endangered species and ecological communities. Over the past two years, CALM has been able to fund many small projects across the State. These include the fencing of Pumpkin Spring, in the Kimberley, to protect the endangered Gouldian finch; the production of colour posters of 29 species of critically endangered plants; the purchase of equipment to assist in monitoring Australia's most endangered native animal. Gilbert's potoroo; and a search for the threatened Lancelin Island skink.

Opportunities can also arise during the course of an organisation's normal business. While carrying out a largescale seismic survey in the Canning



Basin area of the Great Sandy Desert, in liaison with CALM staff, Shell Australia discovered a healthy bilby population. This was particularly exciting news as CALM manages an extensive bilby captive breeding program as part of Western Shield, the feral control and threatened fauna recovery program (see *LANDSCOPE*, Spring 1998). Shell provided financial and logistical support for CALM staff to visit the area and assess the population. Several animals were captured and added to the breeding stock at Peron Peninsula, Shark Bay.

Community groups also assist in wildlife recovery. The malleefowl, a large bird known for building a remarkable incubation mound for its eggs and listed as a vulnerable species, is such an example. A national team has been formed to work towards its recovery. The Goldfields Naturalists' Club is one of the community groups and, with some funding, they combined their efforts with CALM and the World Wide Fund for Nature and Green Corps to assist in a six-month research and survey program at various sites in WA. Much of the work was conducted on CALM-managed lands, and the Group is committed to assisting in the long-term monitoring of the species.

## A VISION FOR THE FUTURE

The success of Western Shield has demonstrated that major, coordinated initiatives can revitalise and enhance nature conservation work. Now in its third year, Western Shield represents the world's biggest campaign against feral predators, to save native animals

*Top left:* Funds from the BankWest *LANDSCOPE* Conservation Visa Card have assisted CALM in protecting the habitat of Pumpkin Spring, a haven for the endangered Gouldian finch. Photo – Hans & Judy Beste/Lochman Transparencies

*Centre left:* A concerted effort between government, conservation groups, community groups and CALM is assisting the conservation of the vulnerable malleefowl (*Leipoa ocellata*). Photo – Sandra McKenzie

Left: During the malleefowl survey, Green Corps team members discovered a small and rather unusual malleefowl mound at Lake Magenta. Photo – Sandra McKenzie and return them to areas where they once thrived. There have been numerous successful species reintroductions. These include the tammar wallaby (Macropus eugenii) to Batalling Forest, the western ring-tail possum (Pseudocherus occidentalis) to Lane Poole Conservation Park, Yalgorup Park and Leschenault National Conservation Park, the malleefowl (Leipoa ocellata) to Francois Peron National Park, and many others (see LANDSCOPE, Spring 1998). Corporate support has been vital to the success of the program. The principal sponsors of Western Shield are Alcoa of Australia, Cable Sands (WA) Pty Ltd and Westralian Sands Ptv Ltd. In addition, there have been numerous significant contributions from a range of corporate and community partners (SPP LANDSCOPE, Winter 1996, Summer 1997-98, Spring 1998, Autumn 1998, Autumn 1999). Recently, the State Government and CALM launched a similar initiative-Western Everlasting -for the conservation of WA's threatened plant communities. Strengthened efforts will be made to control the devastating effects of dieback which are evident across the higher rainfall areas of much of WA's south-west botanical province.

CALM's work in curtailing dieback is being assisted by the Northern Sandplains Dieback Working Party Inc. Founded in 1990, it has made a major contribution to the control of the plant pathogen *Phytophthora* spp. in the region. The vegetation of the northern sandplains, known as kwongan heath, is home to a high number of susceptible plant species and sub-species that are concentrated in small areas.

Past and present members of the working party include RGC Mineral Sands Ltd, Tiwest Joint Venture, CRA Exploration Pty Ltd, Boral Energy Resources, CALM, the Department of Minerals and Energy, Agriculture WA, Main Roads WA and the Western Australian Municipal Association.

This long-term work has resulted in coordinated research and education activities directed towards the general public, government, industry and local communities. Workshops have been conducted, promotional materials produced, policies developed and



implemented and monitoring strategies established.

On another front, Rotary Clubs within the Albany Region, in cooperation with CALM, funded the production of the Dieback Speakers' Kit. Used by community members, CALM officers and members of Rotary Clubs, the kit comes with speech outlines and visual aids, including slides and a video tape. Another project, with the Rotary Club of Albany Port, the Gordon Reid Foundation and CALM, established 20 footwear cleaning stations in the region's parks to help reduce the spread of dieback, in addition to accompanying signage and the production of 10,000 copies of an information booklet.

As well as contributing to the future security of the wildlife of the region, all participants are building up community goodwill and demonstrating environmental 'best practice'.

## LANDCARE AND LAND MANAGEMENT

Landcare and land management cover a diversity of habitats from coastal dunes suffering erosion to inland areas at risk from encroaching salinity. Projects may produce and establish woody plants for land conservation, Acacia, Pityrodia and Thryptomene are typical kwongan heath species in Zuytdorp National Park. Photo – Marie Lochman

rehabilitate land or develop programs to maintain existing sites.

One success story has been the transfer of 198 hectares of wetland to the State for management by CALM. Near the City of Bunbury, the land was formerly owned by mining company Kemerton Silica Sands (KSS). The sensitive wetlands and lakes are a vital addition to CALM-managed lands, as more than two-thirds of lakes on the Swan Coastal Plain have been destroyed or severely degraded. The conservation of the area's genetic diversity has been ensured and KSS will carry out their mining operations in adjacent, less sensitive land. Sons of Gwalia, the parent company of KSS, will also assist CALM, as their own environmental monitoring program had already made a significant contribution to the knowledge of the area. Management guidelines will cover surface and ground water management, fire management and the control of weeds and feral animals. The hand-over demonstrates a clear commitment to the environment by industry, and



demonstrates how multiple land-use can be achieved on a properly managed, cooperative basis. On completion of the mining, KSS will rehabilitate the area, which will also be managed by CALM.

On a much smaller scale, practical contributions to landcare projects have included donations by Kalgoorlie Consolidated Goldmines (who supplied disused conveyor belting for some proposed track stabilisation) and Cockburn Cement (who made donations from their stocks).

Whatever the size and scale of the project, contributions of time, expertise, materials and grants enhance existing programs and launch initiatives that would otherwise not go ahead.

## TACKLING GREENHOUSE GAS EMISSIONS

Earlier this year, CALM entered into a history-making partnership with British Petroleum (BP) to explore the feasibility and management of tree plantations to create carbon sinks as an offset to the company's greenhouse gas emissions. This is the first pilot project of its kind in Australia, and will implement broad-scale tree-planting on maritime pine and landcare species on farmlands in partnership with



Left: Marine management is one facet of CALM's responsibilities where it looks to partners for assistance. Here, scientific research is being conducted in the Jurien Bay waters, the major breeding area of the Australian sea lion.

Below: Support from Australian Geographic will help with researching the feeding behaviour of Australian sea lions. Photos – Eva Boogaard/Lochman Transparencies

farmers—half a million trees have already been planted. A key benefit of the project is its contribution towards slowing the expansion of lands and waterways affected by salinity and maintaining the remnant biodiversity in an already depleted landscape.

### MARINE MANAGEMENT

As with most other programs, marine management is about a balance, a balance between conservation of plants and animals and their habitats, and human use of that environment. Seagrass, coral reefs and mangroves, and large and small marine creatures, fall within the ambit of this responsibility. Social research, marine education and extension are also an integral part of the program.

An ongoing commitment by the Esperance Port Authority provides CALM with exclusive use of a boat to visit and monitor nearby islands. The use of an Authority boatshed is also available as a holding area for injured and sick animals.

A recent CALM initiative, research into the feeding behaviour of WA's two native seal species-the Australian sea lion and the New Zealand fur seal-has enlisted the support of Australian Geographic magazine. The project is extensive, but a critical feature is a portable gas anaesthetic machine. The seals will be captured and restrained for attachment of transmitters and data loggers. The machine is vital to the safety of the animals, and Australian Geographic has made a significant contribution towards its cost. The value, however, will reach beyond the current project; the machine will be a tool in dealing with sick and injured wild seals.

Assistance is also being sought from the Commonwealth Government, the fishing industry and other nongovernment funding agencies and stakeholders.



## ACTIVITY PROGRAMS AND INFORMATION

Environmental educational activity programs play an important part in promoting community awareness and in encouraging people to be involved in experiences that teach about nature.

CALM's Hills Forest Activity Centre and its Aboriginal Tourism, Education and Training Unit, working in collaboration with the Education Department of Western Australia, Healthway and the Aboriginal community, have developed a hands-on, interactive excursion. Initiated in 1996, the program complements Aboriginal Studies curriculum materials being used in the State's secondary schools. The resulting Aboriginal Culture Excursion, the ACE program, was so successful that additional funding was needed to subsidise growing transport costs. Healthway, as part of its 'Respect Yourself, Respect Your Culture' program, agreed to provide such assistance. The program is now being used by Aboriginal people as a training ground for Aboriginal excursion leaders wanting to work in education and tourism.

Another innovative project is the Dryandra Woodland Radio Drive Trail. This spectacular and characteristic wandoo woodland is near the Wheatbelt town of Narrogin. In 1994, CALM received National Forest Ecotourism funding for the development of an interpretative drive trail through the area to explain the ongoing relationship of people to the woodland. To enhance the project further, CALM subsequently



Above left: Noel Nannup, of CALM's Aboriginal Tourism, Education and Training Unit, demonstrates Nyoongar bush skills as part of the Healthwaysponsored ACE Program.

Above: Members of CALM's Aboriginal Tourism, Education and Training Unit with teachers from St Mary's Anglican Girls' School who participated in the Healthway-sponsored ACE Program. Photos – Liz Moore/CALM

Right: Australia's first solar-powered radio drive trail, in the Dryandra Woodland near Narrogin, was developed with the assistance of Advanced Promotions. Photo – Daryl Moncrieff/CALM

acquired the sponsorship of Advanced Promotions, a Perth-based audio promotion company, who donated some of the equipment and expertise to develop Australia's first solar-powered radio trail. Solar transmitters broadcast short, digitally recorded messages, complete with sound effects, from six vantage points along the 25-kilometre trail. Advanced Promotions was excited to be at the forefront of such an innovation and services the equipment when necessary.

# PARTNERSHIPS—A WINNING FORMULA

The benefits of working as partners are broad and personal. There is particular pleasure in exchanging ideas, sharing expertise and developing innovative projects. Whatever the involvement, the goals are the same. Increased community awareness and a shared purpose into the future play a



vital part in building a rich, thriving and secure natural environment. CALM is proud of its many collaborative achievements and, with ongoing commitment from its partners, can be optimistic for the future of nature conservation in Western Australia.

Suzanne Curry is CALM's External Funding Coordinator. She can be contacted on (08) 9334 0567 or email (suzannec@calm.wa.gov.au).

Margaret Kierath is a freelance writer with an interest in the environment.

The authors wish to thank the CALM staff who contributed to this article.

# URBAN ANTICS

## **BIGFOOT TALES**

Winter again. The air is crisp and washed clean of insects and dust.

With no dust and smudges on the recently cleaned sliding glass doors, the crystal clear views of glistening garden foliage are superb except for the 'snail trail' outline of WA left by a nightwandering slug on the exterior of the glass. 'Bother,' I mutter.

The generally mild Mediterranean climate around Perth is ideal for snails and slugs. They don't, however, fancy extreme cold, wind and heavy rain or sunlight and heat. In summer, they are active mainly after a thunderstorm or damp night, but from late autumn on, the occasional shower and cooler weather triggers 'full steam ahead' for feeding, mating, egg-laying and testing the patience of householders and landowners.

Snails and slugs are from the phylum (major division) of the animal kingdom called molluscs. In turn, they are from the largest class of molluscs known as univalves (Latin, meaning 'one shell') or gastropods (Greek, meaning 'belly and foot'). While the two types of animal are similar in structure and biology, snails have an exterior shell of calcium carbonate, covered in a protein coat that gives the colour and pattern, and slugs generally have none.

Terrestrial gastropods move by gliding along on a muscular 'foot'. This muscle constantly secretes mucus, which later dries to form the silvery 'slime trail' that is a clue to their presence. In propelling themselves forward, the muscles of the foot move backward, in a wavelike motion.

During hot dry weather, snails seek hiding places under garden foliage, general debris, fences and cracks, where they aestivate by sealing themselves in their shells with a parchment-like membrane. Slugs can lose 40 per cent of their body weight very quickly, but they compensate by being able to absorb water easily through the foot. Their hiding places are usually minute, seemingly impossible crevices in soil, bricks and plant stems.

The backyards and gardens of the Perth area have more than their fair share of land snails and slugs. Since the arrival of the first European settlers in 1829, we have imported several exotic species, which are those often seen at night demolishing newly planted seedlings or infesting Fido's bowl in search of minute scraps of meat. They also have the annoying habit of getting into alfresco letterboxes and chewing through mail. Any paper products are a tasty source of cellulose and starch, evident by smooth-edged holes rasped in your favourite magazine cover.

By far the most widespread land snail is the exotic common brown garden snail (*Helix aspersa*). This large gastropod (with a shell more than 30 millimetres in diameter) originates from Europe, and is referred to as *escargot* on some restaurant menus. Next most obvious is the white Italian (*Theba pisana*), with a shell usually less than 20 millimetres and often with fine brown concentric lines. It usually comes in plague numbers and needs alkaline sandy soils mainly near the coast.

Also, there is the small, pointed snail (*Cochlicella barbara*) with a greyish-brown conical shell less than 10 millimetres, and a larger relative often found during the day under the broad leaves of lawn thistles or in reticulation sprinkler holes.

Most obvious at night, but usually completely hidden during the day, are various species of slugs. Probably the most common is *Deroceras reticulartum*, a slimy beast about 50 millimetres long, with a voracious appetite. There is one relatively unknown tiny native snail found in our gardens. *Paralaoma caputspinulae* has a disc-like ribbed shell about two millimetres in size and is occasionally found under blades of buffalo lawn.

> At present, it is not known if our fertilizers, pesticides or feral land molluscs, have displaced any native species. It would be nice to think there are still some hiding, waiting to be discovered.

## **BY JOHN HUNTER**

#### **DID YOU KNOW?**

- A univalve has a radula, a horny strip with teeth on its surface to rasp food. Like finger nail growth, as the front edge wears out, it is continually renewed.
- Snails and slugs are hermaphrodites. Both members of a mating couple can lay eggs.
- Common garden snails excavate a small hole into moist ground several times a year and deposit 20-120 spherical pearl-white eggs, each 4mm in diameter. They hatch in 2-4 weeks.

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A magnificent rivergum at Burrup Peninsula. Photo – Chris Garnett



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