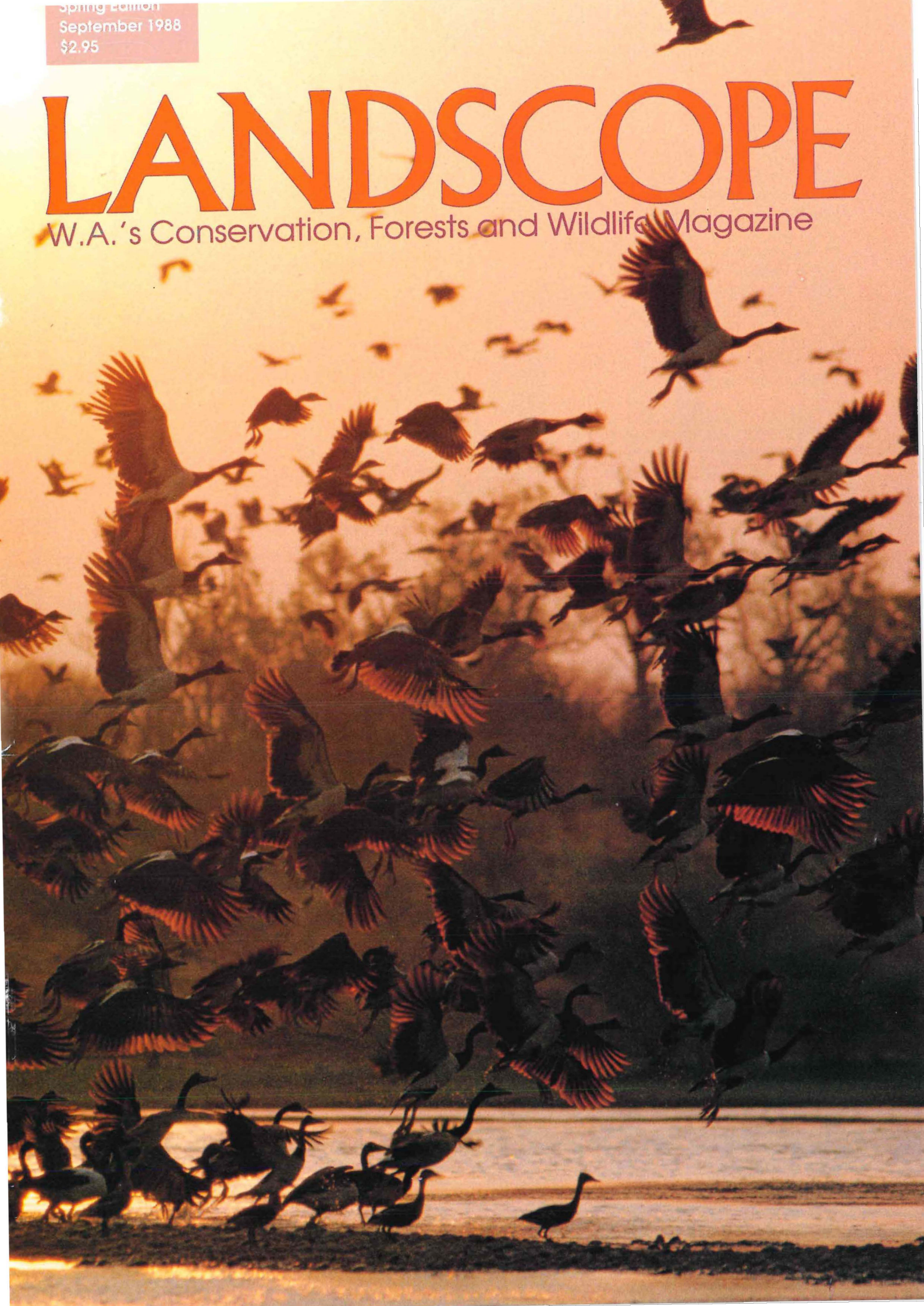


Spring Edition
September 1988
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LANDSCOPE

W.A.'s Conservation, Forests and Wildlife Magazine



LANDSCOPE

EDITORIAL

In W.A. the concept of marine conservation reserves was firmly established in 1984 when the CALM Act was passed, with provision for Marine Parks and Marine Nature Reserves, vested in the National Parks and Nature Conservation Authority.

Since 1984 two major Marine Parks have been declared in W.A: Marmion and Ningaloo.

This is a new field in W.A., and there are no local precedents to guide us in resolving the many management issues which have emerged.

A first consideration has been that fishing is already controlled under the Fisheries Act. It would be foolish for CALM to attempt to establish itself as a fisheries management agency. A policy decision has been made that any fisheries in Marine Parks will be regulated under the Fisheries Act.

A more philosophical problem has been that many citizens, although generally sympathetic to the conservation cause, are unaccustomed to the idea of having parks and reserves in the sea. The idea that the sea is a public common where anything and everything goes is still well entrenched in public attitudes. Yet there are many terrible examples around the world where coastal environments and their resources have been devastated by excessive and improper use. In W.A. we have not reached that point.

W.A. can be proud of its fisheries management record, based on the principle of sustainable use for posterity. Development of a marine parks and reserves system along our coast is another essential part of the overall objective. It is to be hoped, then, that our first initiatives in this direction will receive public support.

Volume 4, No.1
Spring Edition/September 1988

PINES

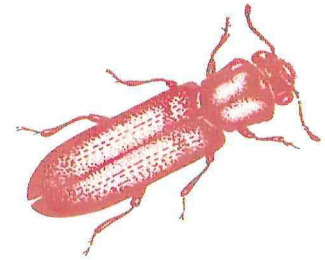


How can less than four per cent of the State's area supply us with all our timber needs, and save the hardwood forests at the same time?
Details on **page 28**.

WALL OF MOUTHS



*It's a fish-eat-coral world, but what do the coral eat? Find out on **page 32**.*



BORERS

*Now you **can** be sure there are no borers in the door. Well, if they are there, at least you'll know what to call them after reading the article on **page 42**.*

TROUBLED WATERS



*Does the very word pollution make you feel powerless? Discover what you can do to help the wildlife victims on **page 20**.*

FOREST RENEWAL



*What is the connection between the poets' of the First World War and W.A.'s forests? Find out on **page 56**.*



JEWEL OF THE KIMBERLEY

What do you mean frog? In my home I am a prince. After all, Prince Regent is the only mainland reserve where all of the original animal species remain. Meet the rest of them on **page 47**.

HILLS' BELLES



When Perth looks out its backdoor in spring the Hills are ablaze with colour. Your field guide to some of our glorious wildflowers starts on **page 4**.

ATTENTION ADULTS!

Sick of taking the anklebiters to the same old national parks and camping spots? Put them to work for you. If they enter the kids' competition on **page 63** they could win two beautiful books on all the best picnic and camping spots between Perth and Eucla.

GATHER NO MOSS



The trouble with lichen is that up until recently it wasn't protected flora. Now lichen and their relatives - mosses, liverworts and algae - have joined the rest of the State's flora. See **page 54**.

RIGHT ON TRACK



Is a high-tech wilderness trek a contradiction in terms? Find out how 4WDs and conservation can co-exist peacefully on **page 12**.

Cover Photo



Magpie Geese take off from the Ord River.

Photo: Richard Woldendorp.

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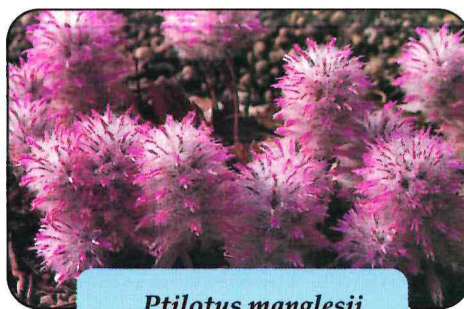
Hills' Belles

Over 800 species of flowering plants can be found in the Hills that are the backdrop to Perth - the Darling Scarp and Range. That is more than half the total number of flowering plants occurring in the entire United Kingdom. So much for the cottage garden!

Wildflower aficionados, John Marshall and Brian Tullis, from the Darling Range Branch of the W.A. Wildflower Society, give you a guided tour of some of the more interesting and beautiful Hills' Belles.

W.A.'s natural garden, the native bush, is unparalleled in spring. The growth and flowering, which begins with the coming of the rains in April, offers many a delight and surprise for the winter bushwalker. Water from the winter rains, and the increasing warmth, turn the quietly attractive bush garden of July into a mass of colour, a vernal spectacular. Over 250 species flower in September and October.

The show persists into November and December, but as surely as the soils dry out ahead of the summer heat, the garden becomes subdued, and finally, by March, desperate for moisture. By then, five to six months can have passed without significant rains. Yet, for the keen-eyed, flowering gems are to be found through to the end of the cycle.



Ptilotus manglesii

The great richness of plants in this region is due to the great variety of plant habitats on the Scarp. Slopes, gentle and steep, face west, south, north and east. The weathered soils of the Range have been pared down by erosion. They range from 50 m deep to exposed rock outcrops. This variation in soil depth is a vital determinant of the different plant habitats. Broadly, there are four such habitats: the forested parts of the Range and uplands on the deepest soils; the sparsely-treed slopes on shallower soils; the very

shallow soils around rock outcrops; and the seepage areas and streamsides, dependent on water draining into them from upslope.

A visit to the Hills early in the year, before the breaking rains, reveals one of its great spectacles: the flowering of the marri (*Eucalyptus calophylla*). Marri flowers from February to April, giving life-sustaining nectar for birds and wildlife at a time of year when pickings are sparse. The trees often appear snow-capped, contrasting strangely with the summer heat (see *Landscape*, Winter 1988).

Within six days of a summer shower, there's another surprise. Masses of pink matted triggerplant, *Stylidium repens*, appear; one of the very few triggerplants to flower outside springtime.

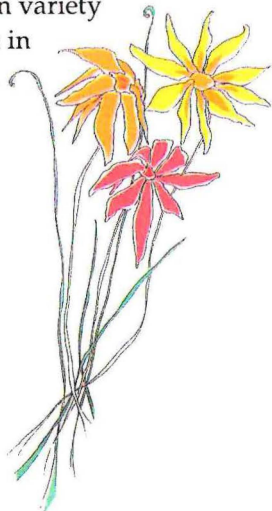


Drosera stolonifera

Even before the rains in April-May, parrot bush (*Dryandra sessilis*), with its prickly, blue-green leaves and pale yellow flowers, may be spotted beginning its long flowering season. And as the rains come, those several species which have waited in readiness to flower suddenly bloom. Two are from the daisy family, the Asteraceae: *Olearia paucidentata* and *Pithocarpa corymbulosa*. But the early starters really belong to the Southern Hemisphere heaths - the Epacridaceae. *Astrolomas*, *Andersonias*, *Styphelia*, *Leucopogons* range from cushion plants with small, pointed leaves, to medium, upright shrubs over a metre in height. They surprise with the variety of colours of their tubular flowers: red and black; blue and pink; cream; and white.

At Easter the slender grass trees, *Kingia australis*, are in flower. Closely related, but without blackened trunks, are the mat rushes, *Lomandras*, which are especially well represented in the Hills. These small tussocks of tough, grasslike leaves at ground-level bear curious and varied flowers.

On recently-burnt slopes, more obvious than ever amidst the blackened stems, the white flowers of ground-hugging rosettes of sundews (*Drosera* spp.) appear. These insectivorous plants trap insects with their sticky, glandular hairs. *Droseras* abound in variety and form in the Hills.



Styphelia tenuiflora
(above).
Astroloma foliosum
(below).





Hovea pungens (above).
Kingia australis (left)
Hibbertia amplexicaulis (bottom left).

By June, the most commonly represented family of all, the peas (Papilionaceae or Fabaceae) begin to make a contribution. There are over 80 species in this family, including Hovea, Oxylobium and Daviesia. By this time, too, the closely-related wattles (Mimosaceae) have made an appearance. The rich yellow flowers belong to *Acacia teretifolia*, the pale flowers to *A. obovata*, while in the forest, *A. urophylla* bears almost white flowers. Later, the slope species will be followed by the lemon-yellow pom-poms of *A. nervosa*. The stream banks turn yellow with the ribbon wattle, *A. alata*, with its curious 'leafy' winged stems. Unlike the tree-forming wattles to be found in suburban gardens, introduced from Eastern Australia, these native species are medium to small shrubs.



Prominent among the yellow-flowered shrubs are the Hibbertias, or guinea flowers. Particularly widespread is the buttercup bush, *Hibbertia amplexicaulis*, although over a dozen species in all are to be found in the Hills.

By mid-winter, more orchids have appeared; the greenhoods (*Pterostylis* spp.), with their several representatives - the dwarf and banded greenhoods; and the bird and jug orchids. Donkey orchids (*Diuris longifolia*) come out in July and continue, almost overlapping with the bee orchid (*D. laxiflora*) in late spring.

Up till now, the flowers in the bush have been for the searcher, the learner and the curious. From August onwards the numbers become overwhelming, making learning daunting, but invoking sheer wonder.

The woody shrubs, mainly in the banksia and eucalypt families (Proteaceae and Myrtaceae) are beginning to make their presence felt. Colours span a wide range. The yellow of *Lambertia multiflora*, the pinks of *Isopogon formosus*,

Hypocalymma robustum and *Melaleuca scabra*, and the creamy whites of Hakeas and Grevilleas add to the reds of the hairy jugflower, *Adenanthos barbigerus*, which has been in flower for most of the year, *Grevillea bipinnatifida*, one of the first to flower after fire, *G. wilsonii*, a speciality of the Range, and *Calothamnus* spp., the one-sided bottlebrushes.

Featherflowers are perhaps the most exquisite contribution of the eucalypt family with *Verticordia acerosa* (yellow) and *V. huegelii* (creamy-white then pink) the most commonly encountered of the six Hills' species.

Other less well-known families are also represented, including the blue-white flowers of the woody violet, *Hybanthus floribundus*; the pink, drooping, open bells of *Tetralathea hirsuta*; and the greeny-yellow flowers of false boronia, *Phyllanthus calycinus*. Boronias, with their four-petalled flowers in pinks and blues, contrast with closely related pepper-and-salt, *Eriostemon spicatus*, with its erect spikes of five-petalled, lilac flowers.

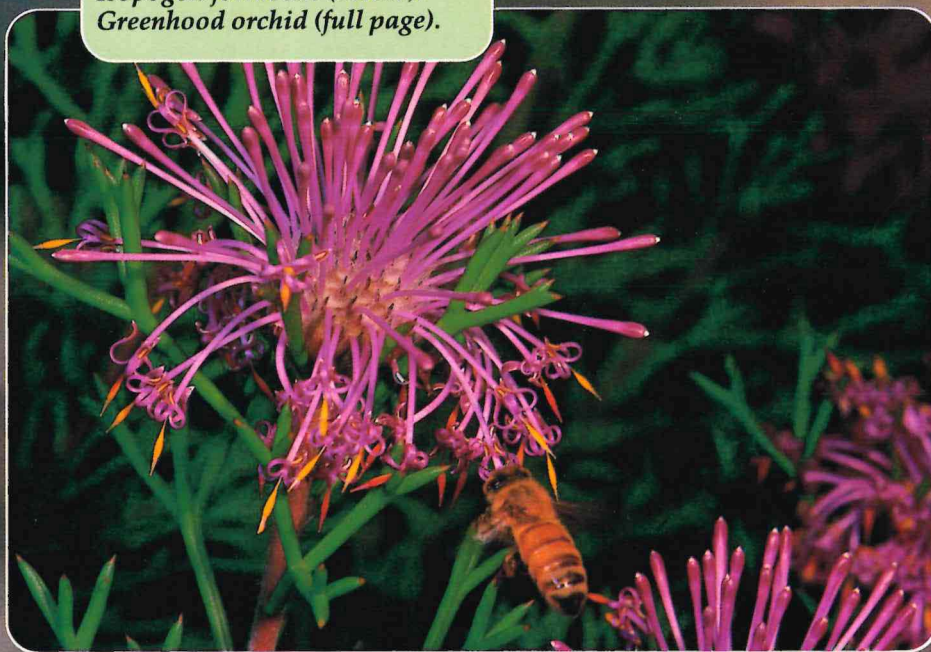


Phyllanthus calycinus
(above left).
Eriostemon spicatus
(above).
Lambertia multiflora
(below).





Verticordia huegelii (top left).
Diuris laxiflora (above left).
Tetratheca hirsuta (top right).
Isopogon formosus (below).
Greenhood orchid (full page).





Leschenaultia biloba (above).
Gompholobium polymorphum
 (below).
Scaevola striata (inset).



Among the smaller shrubs, from July onwards the characteristic sky-blue of *Leschenaultia biloba*, the emblem of the Hills suburb of Kalamunda, takes pride of place. Others include the deep blues of *Dampiera linearis*, *D. alata*, and, in October, *Goodenia caerulea*, and the purples and whites of the *Scaevolas* (four species). The closely-related *Lobelia* family is represented by several species, and most reliably seen as the dainty *Lobelia alata* which flowers year-round on the stream banks.

The pea family includes the scrambling *Kennedias*, of which the coral pea, *Kennedia coccinea*, with its improbable combination of cerise and orange, is the most celebrated. The flame orange of the flame pea, *Chorizema dicksonii*; the bronze-orange of more *Daviesias*; the large, yellow or orange, granny bonnets of *Gompholobium polymorphum* add to the colour-patchwork of the slope shrublands.

Colour and shape now blaze from every direction with many of the most exquisite coming from lilies and orchids. The pale, sky-blue of the morning iris, *Orthrosanthus laxus*, to be found in the forest and woodlands near the Scarp edge, gives way, later in the season, to the dark, royal blue of false blind grass, *Agrostocrinum scabrum*. Topping slender stalks alongside the morning iris are the white flower heads of milkmaids *Burchardia multiflora*, with its more robust relative to be found on slope seepages. Blues among the orchids range from the shortly-stalked, single-flowered blue china orchid (*Caladenia gemmata*) on the inhospitable ironstone gravels and exposed slopes through the progressively taller blue-beard and silky blue orchids (also *Caladenias*) to the majestic queen and scented sun orchids (*Thelymitra crinita* and *T. nuda*) with several large flowers clustered along stalks to half a



Stylidium amoenum
(above).
Bickley Valley
(below).

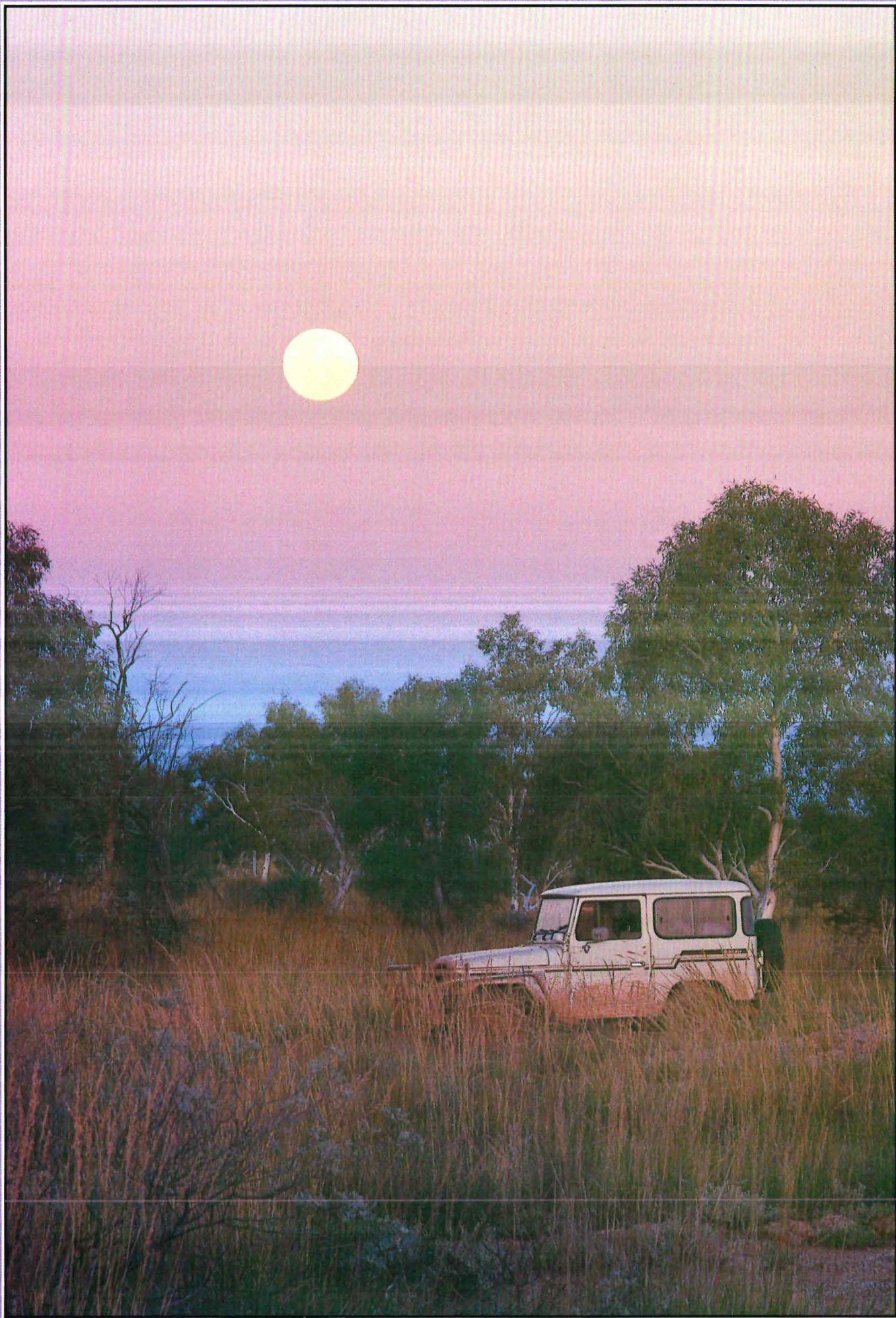
metre tall. Also on tall stalks, over a metre tall and especially prominent after recent fire, are clustered the hundreds of flowers of leek orchids, *Prasophyllums*. Observed closely, these are all found to be majestic white spider orchids, *Caladenia longicauda*, well remembered of the bush of yesteryear, with their pointed upper, and trailing lower flower parts extending some 8 cm.

October is the peak month for flowers in the Hills, and adding greatly to the number are the triggerplants (*Stylidium*). Though many are small, they are conspicuous *en masse* when in flower. Their identification is certain: two pairs of colourful petals spread from the flower centre. These may spread upwards and downwards, as in the large, pink flowers of the Queen triggerplant (*Stylidium affine*) with its grasslike leaves in tussocks, and flowers 2 cm

across. Or they may spread to the sides of the flower centre as in the flowers borne in crowded spikes of the pink fountain, lovely and butterfly triggerplants (*S. brunonianum*, *S. amoenum* and *S. hispidum*). Whatever the display of petals, it is the bringing together of male and female parts of the flower onto the single, touch-sensitive column that associates triggerplants as a group. When 'untriggered', or set, the column is bent back, largely out of sight, behind the petal pairs. But the lightest touch on a warm day at the centre of the flower - by insect or small twig - brings the column swiftly over. The purpose is to ensure pollination, the transfer of pollen from one flower to the stigma of another. This is achieved by the pollen at the end of the column being dabbed, at the end of trigger-action, on part of the insect responsible. Self-pollination is frequently avoided because the pollen and stigma of the one column are not ready at the same time. And so, as the insect visits another flower, this time with the stigma receptive, cross-pollination is achieved by the trigger-action resulting in pollen being picked up by the stigma. Two final aspects of triggerplants: Western Australia is by far the richest place in the world for these plants which belong to the largely Southern Hemisphere family, the Stylidiaceae. And, when studied, the combination of size of flower (and hence, size of insect it will support) and length of column is such that the pollen of each of over 100 species is practically assured of a unique spot on its carrier. This fact alone is almost as remarkable as the richness of the wildflowers of the Hills itself!



A book on identification of the Wildflowers of the Hills is in preparation by the authors of this article and enquiries are welcome to the Darling Range Branch of the Wildflower Society of Western Australia, P.O. Box 64, Nedlands, W.A. 6009.



Right On Track

by Kylie Byfield



Mark True

Four-wheel-drivers pick their way through a blanket of flowering *Verticordias* near Eneabba (above).

W.A. has some wild and wonderful country - and every year more and more people are discovering that the best way to see it is to pack up the four-wheel-drive and head bush for a dose of adventure.

They grind their way across some of the State's roughest terrain to sleep below a blanket of stars. They huddle around an open fire sipping a steaming cup of boiled billy tea. They walk, talk and soak up nature's beauty before heading home, exhausted.

That's what four-wheel-driving is all about - getting a buzz from getting back to nature.

WAYNE Schmidt, manager of CALM's Recreation Branch, says most four-wheel-drivers want to get away and find opportunities that are testing.

'Those opportunities are there and they will remain as long as the drivers are responsible. In the Eastern States, four-wheel-drives are banned in many areas, but in W.A., if the public continues to do the right thing, the chances of them being locked out are minimised.

'The users have a duty of care - an obligation - to do the right thing as far as the environment is concerned and CALM has received strong support from the growing number of four-wheel-drive clubs in getting this message across.

'Most people with a four-wheel-drive don't want to go "bush-bashing" anyway. They have, in most cases, invested upwards of \$35,000 in a vehicle and don't want to wreck it. The clubs provide a mechanism for ensuring their members do the right thing.'

'The clubs achieve this by adopting a code of ethics,' says Steve Wilke, vice-chairman of the W.A. Association of Four-Wheel-Drive Clubs and chairman of its land use sub-committee.

'There are about 30 clubs in W.A. today, and all of them have a code of ethics,' he said. 'Many of them have adopted a 12-point Code produced by the Australian National Four-Wheel-Drive Council. By adopting such a code the clubs aim to maximise their enjoyment while minimising their impact on the environment.

'Four-wheel-drives can still get to places which are inaccessible to two-wheel-drive vehicles and they don't need to stray from existing roads or tracks to get there.

'And that doesn't mean you have to stay in a caravan park. We travel with friends in convoy, pitch



Les James

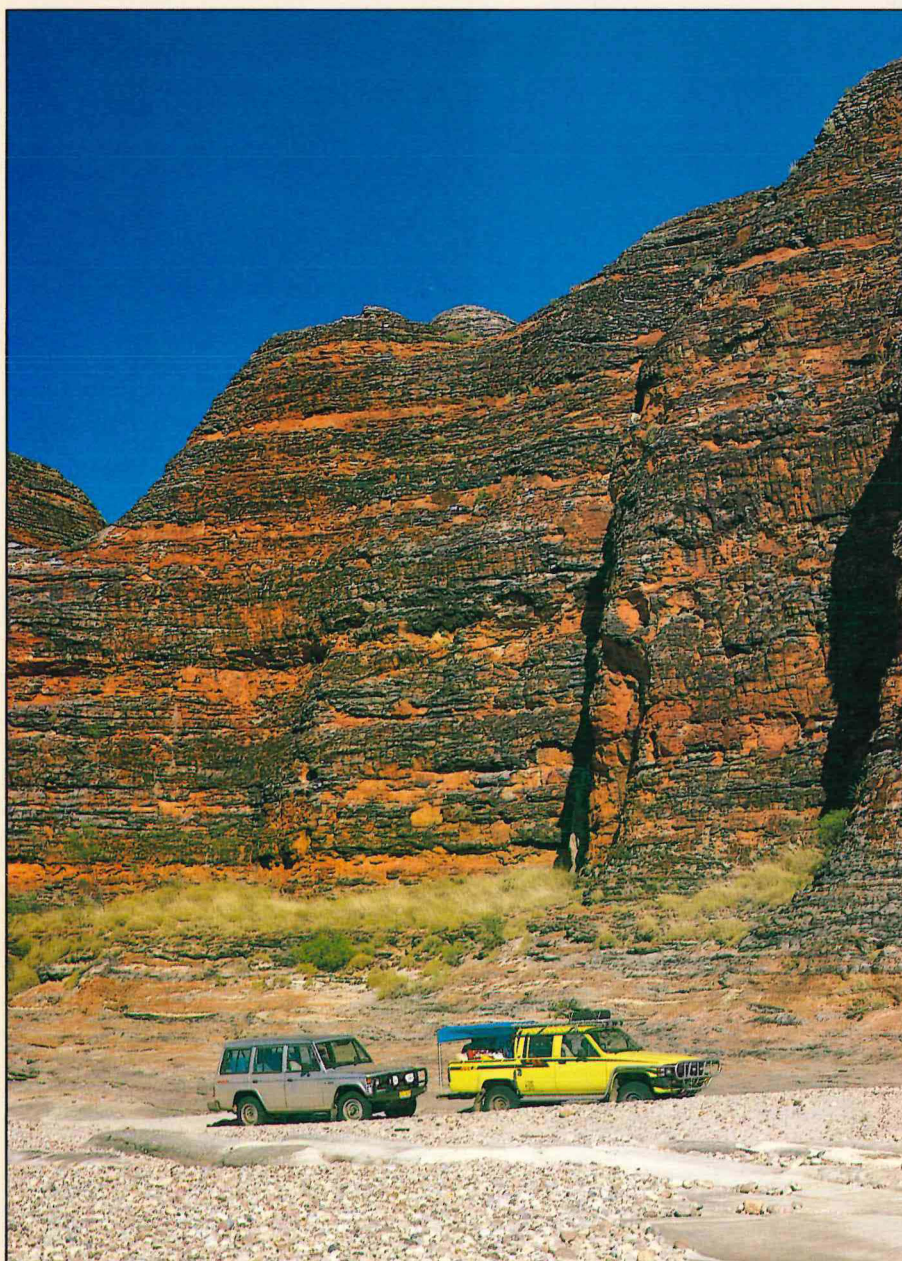
It's slow going along a steep forest track in the Darling Ranges (above), while four-wheel-drivers take to the open road along the northern section of the Canning Stock Route in the Kimberley (below).



Les James



The track to Port Warrender, Mitchell Plateau (above). Picanninny Gorge in the Bungle Bungle area is restricted to hiking, but thoughtless four-wheel-drivers can spoil it for the rest (below).



our tents, boil a billy and sit around a campfire chatting under the stars. It's so refreshing - that's how we get our buzz rather than bashing expensive vehicles.'

But while the clubs are doing the right thing, they are concerned about the irresponsible minority who continue to 'bush bash' and destroy not only the environment, but the reputation of all four-wheel-drivers.

'They believe they have a right to go where they like off-road and, lacking any environmental ethics, they tend to see the environment as a challenge rather than something to be enjoyed, appreciated and respected,' says Mr Wilke.

'The results can be quite devastating and, unfortunately, the general public tends to lump all four-wheel-drivers into the same category. However, the legitimate four-wheel-drive club movement is working hard to overcome this problem by encouraging others to join clubs or to at least embrace a code of ethics.'

Although 'bush bashing' is a term likely to offend most of today's four-wheel-drivers it is still a major problem. CALM is all too familiar with the lasting scars left on the landscape by irresponsible four-wheel-drivers or trail bike riders.

One of the greatest sins of irresponsible four-wheel-driving is that it spreads dieback and other diseases. The vehicle tyres which carry these diseases can also destroy vegetation, leading to erosion of the soil by wind and water. With heavy traffic, soil becomes compacted, preventing plants from regenerating and in some cases, water which can't penetrate the soil runs off into other areas, sometimes causing floods during heavy rainfall. Four-wheel-drives can also disturb wildlife or destroy its natural habitat.



Enthusiasts learn about angles of approach and departure during one of the RAC's four-wheel-drive courses (left).

Les James

Clubs

Four-wheel-drive clubs are nothing new in W.A. In fact, some of the State's oldest clubs are more than 20 years old. Today, there are about 30 clubs in W.A. based in both metropolitan and country regions. Of these, 23 belong to the W.A. Association of Four-Wheel-Drive Clubs, which is itself affiliated with the Australian National Four-Wheel-Drive Council. Clubs range in size from 10 to more than 100 members and most cater for families.

The structure of clubs also varies. Some cater for four-wheel-drives from one particular manufacturer while others allow all types of all-wheel-drive vehicles. All clubs have a constitution, an elected executive and many have become incorporated bodies. They all adopt a code of ethics and meet regularly (usually monthly).

Touring is the main club activity and trips range from short, one-day tours (less than 200km) to weekend jaunts (200-1000km) and extended trips (more than 1000km).

For more information, contact the W.A. Association of Four-Wheel-Drive Clubs, C/- Sportsmens Association, Stancliffe Street, Mount Lawley 6050

Then there is the damage inflicted by the drivers themselves. As more people gain access to previously inaccessible areas, the risk of fire increases along with vandalism and littering.

It's hardly surprising, then, that CALM is concerned - after all, managing and caring for the environment is its prime responsibility. But far from condemning four-wheel-drives, CALM actually encourages their responsible use. This, too, is not so surprising when viewed in light of the Department's policy that the environment is there for the public to enjoy.

So what has emerged in recent years is something of a cooperative arrangement, says Frank Batini, manager of CALM's Environmental Protection Branch.

'The four-wheel-drivers help us and we help them,' Mr Batini said.

It's an arrangement which seems to be working.

For their part, the drivers are doing much to help by simply staying on existing roads or tracks. This minimises damage to plants and wildlife and helps CALM contain erosion. They also reduce the threat of fire and join the fight against dieback by complying with fire and quarantine regulations.

So what is CALM's end of the bargain in this cooperative deal? Is it to place unnecessary restrictions on four-wheel-drivers - restrictions which sometimes prevent them from escaping to some of the State's most isolated yet most attractive areas?

Not so, argues Frank Batini. Although there are restrictions, they are imposed for two very good

reasons: to protect environmentally sensitive areas and to protect the public.

'Four-wheel-drives are allowed in areas where they will have the least environmental impact but in some places, such as disease-risk areas and nature reserves, CALM has either limited or prohibited four-wheel-drive access,' Mr Batini said.

'CALM doesn't want to take a big brother approach and have to enforce the rules. We would prefer four-wheel-drivers and four-wheel-drive clubs to be self-policing.'

The responsible four-wheel-driver is usually the first to support conservation. After all, they have seen some of the most beautiful and remote parts of W.A., and they are very likely to want to look after our unique environment.

Though seeing the issue from different perspectives, both Wayne Schmidt and Steve Wilke strongly advocate membership of four-wheel-drive clubs as the best way to encourage responsible four-wheel-driving.

'Clubs have a lot to offer. Not only do they provide social interaction with people who have similar interests, it is also safer to travel with a group, particularly in remote areas. The clubs also run driver education programmes, host guest speakers, conduct first-aid, bush survival and navigation courses and offer instruction in search and rescue techniques.

This is where the cooperative arrangement comes into play again. Officers from CALM, and other government bodies such as the Environmental Protection Authority and the Water Authority, have been called upon to address four-wheel-drive club meetings. CALM also provides training for the public in outback safety and bushcraft.



Fuel supplies can be few and far between in the remote outback and modern petrol pumps can sometimes be hard to find (above).

By doing these things they are, in a sense, upholding their end of the bargain. But this is not where CALM's cooperative role begins and ends, as Wayne Schmidt explains.

'It is very important that four-wheel-drivers invest time in planning their trip - particularly when conditions can change so quickly,' he says.

'This is where CALM can be an enormous help. The Department can provide up-to-date information about almost any region in the State no matter how remote it is. Say, for example, four-wheel-drivers are planning a trip to the south coast. They could drive hundreds of kilometres only to find the roads have been washed out by rain or are closed to prevent the spread of dieback. For the cost of one long-distance phone call, they could have found out what local conditions were and either abandoned the trip or planned an alternative.

Tips For Trips

Planning and careful preparation is the key to safe and enjoyable four-wheel-driving say Les James and Neil Baldwin of West Coast Four-Wheel-Drive.

And they should know - they run four-wheel-drive training courses for a variety of government bodies and other organisations.

Les says four-wheel-drivers should start a checklist of what to take and things to do before they leave. This list can then easily be added to or up-dated.

Here's a few tips to start with:

The Essentials

- First-aid kit
- Fire extinguishers
- Spare water (4.5 litres per person per day minimum)
- Petrol engine ignition tune-up kit
- Petrol and diesel fuel filters
- Spare radiator and heater hoses
- Spare fan belts (make sure they're the right size)
- Safety triangles
- Tow rope (with shackles)
- Leather gloves
- Puncture repair kit
- Jack and jack base plate(s)
- Ground sheet
- Spare tyre with extra tube (take 2 when travelling to remote areas)

- Basic tool kit to suit your vehicle
- Torch/trouble light
- Small round-mouth shovel
- Survival kit

The survival kit should be able to satisfy your needs for water, shelter, warmth and food. Apart from food and water, include items such as a bandage, a candle, a cigarette lighter (for lighting fires), medication (such as pain-relieving, diarrhoea and vitamin tablets), bandaids, twine and fish hooks, a whistle, a signal mirror, a knife, nylon cord, wire, aluminium foil, a compass, a survival blanket, pencil and paper, a hacksaw blade, a needle and thread, a can opener, a small torch, insect repellent and some plastic tape.



Marie Lochman

Getting back to nature at Bob's Crossing in the Lane-Poole Reserve.

'We strongly urge all four-wheel-drivers to contact CALM's district offices or local rangers before embarking on any trip.'

The W.A. Association of Four-Wheel-Drive Clubs makes a similar recommendation. 'It's in the four-wheel-drivers' own interest,' says Steve Wilke. 'That way they can be sure there will be no hitches.'

So the cooperative arrangement really does work - and it's not hard to understand why. CALM, for its part, wants people to enjoy the environment but not to damage it in the process. The four-wheel-drive clubs, on the other hand, want continued access to some of W.A.'s most fascinating and beautiful areas and don't want to jeopardise the good relationship they currently have with CALM.

'This relationship is important because CALM lands afford some of the best opportunities in this State for touring, camping, bushwalking, photography and nature appreciation,' says Steve Wilke.

And that, after all, is what four-wheel-driving is all about - getting a buzz from getting back to nature.

Preparation Plan

Decide where you want to go and buy a general map of the area to help you plan your trip.

Consider the distance you plan to travel, the sort of terrain you will cover, and the time you have available. Allow some extra time for unforeseen circumstances or simply so you can look around.

Plan alternative routes in case your original route is inaccessible.

Buy more detailed maps of the areas which do not have established roads. (These are available from CALM or the Department of Land Administration.)

Start making enquiries about conditions and restrictions in the area you plan to cover. Find out where you can camp, what food and water sources are available en route, which places are accessible by vehicle and whether your route crosses private lands.

In some cases, you will need a permit to cross Aboriginal lands. This usually takes about six weeks to get. If you will cross pastoral stations, get permission from the owner or manager. Because stations are often very isolated, it is also courteous to offer to pick things up from the nearest town for them.

Take a first-aid, and survival course before setting off.

If you are travelling to very remote areas, make sure you have high-frequency and C.B. radios.

Do a bit of research to learn about the area you will travel through (its history, plant and animal life, etc.)

Give your vehicle a thorough check. This includes wheels and tyres (don't forget the spares); fittings such as the fire extinguisher, tool kit and first-aid kit; fuel, lubricants and coolant; the battery; the engine (make sure all gauges and lights work along with the windscreen wipers, indicators and horn); and finally, brakes and steering.

Make sure you have all the supplies you need to be totally self-sufficient. Carry plenty of extra food and water.

Try to avoid using a roof rack. If it is a must, carry no more than 100 kg on the rack and never carry fuel on the roof.

Finally, when travelling to remote areas, advise police and at least two friends or relatives of your departure date, proposed destination, the routes and alternative routes you plan to take, and your estimated time of arrival. Notify them of your arrival once you get there.

Broome Birds

Ten years ago, an expedition to plot known bird species in Australia discovered rare, migratory waders on the north-west coast between Broome and Port Hedland. The recently established Wader Studies Program of the RAOU formed an expedition in 1981 to investigate. It was immediately evident that this stretch of coastline held one of the ten largest concentrations of waders in the world, with the mudflats and the mangroves providing an extensive, sheltered feeding ground for the birds.

Naturally, participants of the Wader Studies Program had questions about migratory patterns, but the answers would require prolonged observation. Broome seemed the ideal site for an observatory and the idea gradually took shape under the guidance of Doug Watkins, Chairman of the Management Committee of Eyre Observatory, and Grant Pearson from the wetlands unit of the Department of Conservation and Land Management.

A grant of two-and-a-half hectares of land near Crab Creek from CALM, and two transportable buildings from Lord McAlpine have provided the basis of the Fall Point Observatory, which now needs staff and equipment. All RAOU bird observatories must be self-supporting and are funded by providing catered accommodation for visitors, but before it reaches that stage volunteers and more money for facilities are needed.



The Welcome Swallow Hirundo neoxena is well known for its peaceful coexistence with humans, often using man-made structures as a base for its



Jiri Lochman

own nest. Stables, sheds, bridges and garages are frequented, but some pairs have more avant-garde tastes in decor. This pair decided on the bush toilet at Poison Creek in Cape Arid National Park (left).

So, even if you are a model visitor of national parks, you can find yourself unwittingly disturbing our precious wildlife.

A juvenile Welcome Swallow ventures further afield (above).

Parks Upgrade

W.A.'s national parks will set a new standard in public facilities and services following a \$6.5 million funding boost from the State Government.

Conservation and Land Management Minister Barry Hodge said the funds, to be injected over the next three years, will help CALM fulfil its charter.

'The Government recognises that it has a huge task in correcting past neglect and providing even basic facilities for the State's 56 national parks and two marine parks,' Mr Hodge said.

'But with the formation of CALM three years ago, and a funding commitment such as this, we are well on the way to protecting and

preserving these parks for future generations.'

That is what the CALM plan is all about. By merging the former Forests Department with the National Parks Authority and the wildlife section of the Fisheries and Wildlife Department, the government brought three bodies with similar goals under one umbrella.

The recent \$6.5m funds boost is evidence that the vision is being realised. Now, money can be channelled into public facilities and services.

The three-year, State-wide parks improvement plan involves immediate upgrading of park facilities and information services to encourage a greater appreciation of these most precious resources.

Robert Kairi Davies



Troubled Waters

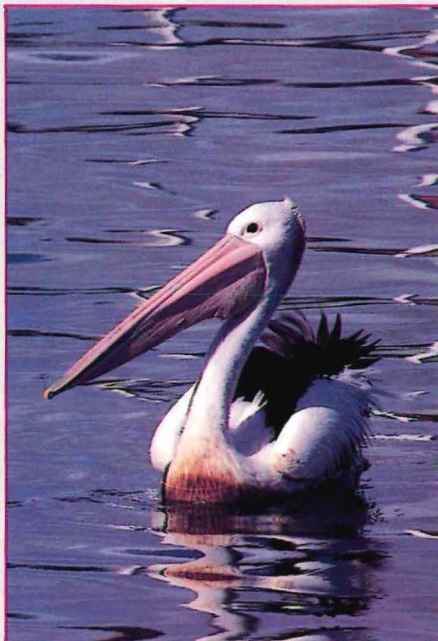
The old expression 'pour oil on troubled waters' took on a sinister irony when the *Torrey Canyon* oil spill befouled the beaches of England and France in 1967. Closer to home, the *Korean Star* ran aground 30 km south of Ningaloo Reef in March 1988, and a derailment at Pinjarra in July 1988 resulted in the discharge of diesel into a drain leading to the Peel Inlet.

Neither of these local incidents were environmental catastrophes, but they sound a clear warning. How well prepared are we to cope with the threat of oil and other pollution? Liana Christensen investigates.

YOU are driving home from work in the pouring rain when suddenly the driver of the truck in the left-hand lane brakes. He skids, loses control and the truck tips its contents into the middle of a suburban intersection. You thought you noticed one of those little signs on the back warning about hazardous chemicals. What now?

Another possibility: perhaps you love to go running on the beach just after dawn, when there is nobody else to share the pure solitude. What if you got there to find the sand stained black, and the oily heaps of seaweed littered with dead and dying birds? What would you do? Cry? Ignore it?

Nobody likes to think about such a possibility, but, fortunately, Federal and State authorities have not taken a head-in-the-sand approach to potential pollution crises. If you were the first person to discover such a disaster, it is comforting to know that a phone call to the appropriate authority (see box) could mobilise an impressive array of helpers ranging from the Defence Department to volunteer wildlife rescue groups.



Oil polluted pelican.

Federally, the responsibility for pollution control rests with the Department of Transport and Communications. They have prepared a National Plan to Combat Pollution of the Sea by Oil. This plan is designed to mesh with State and local contingency plans, and gives clear guidelines about which authority is responsible for what aspect of control. It lists appropriate tactical responses, and

also details the locations of stockpiles of necessary equipment. In a real emergency, the Defence Department can be called upon to shift personnel and equipment to combat the threat as swiftly and efficiently as possible.

Within W.A., the major authority dealing with pollution is the Environmental Protection Authority, but the Department of Marine and Harbours is in charge of any operations within harbours and ports under their control. The Fremantle Port Authority oversees shipping movement within Fremantle, and stores special equipment for the containment and cleaning up of oil spills. Depending on the location and nature of the hazard, the Fire Brigade, the State Emergency Service, the Police and the Water Authority may also be involved.

With so many groups involved, it is essential that sound organisational structures and chains of command are in place ahead of time, because in a crisis situation you have to react quickly to complex problems. The Department of Conservation and Land Management (CALM) becomes involved whenever there

Kwinana industrial estate.



Wade Hughes

is a danger to wildlife, or if the pollution threatens a national park, marine park, nature reserve or State forest.

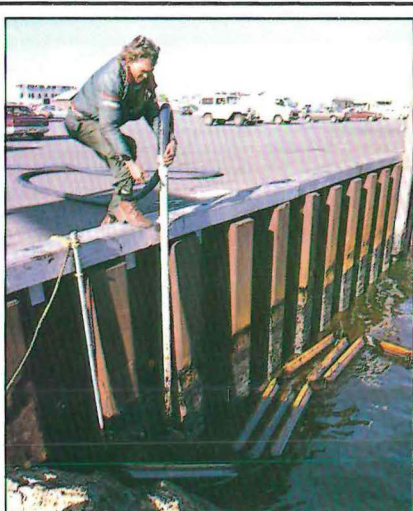
In order to be well-prepared, CALM liaises with the State Committee for Combating Marine Oil Pollution, and is a member of the State Counter Disaster Advisory Committee. In an emergency we may advise on the special protection localities, identify specific wildlife concerns, gather intelligence, monitor things such as oil spill movement or the movement of a chemical through a drainage system, and carry out clean-up procedures on CALM estate. We also contact volunteer groups to assist with wildlife rescue and rehabilitation or clean-up.

Interestingly, an extensive history of dealing with wildfires means the Department has a ready-made internal framework enabling swift mobilisation and a flexible, efficient response to environmental threats. 'Large fire organisation' principles and practices are often used in response to pollution crises. A good example is the use of fire spotting aircraft to monitor the rate and direction of an oil spill spread.

Once the alarm is raised, what can actually be done? Remedial measures depend upon the type of hazard, and whether the problem is chronic or acute. Whoever is first alerted, which might be anybody from the police to a regional radio station, should ensure the appropriate authorities are contacted

An urban road accident involving a truck full of herbicide, for example, will require a different combination of experts than an oil spill in Cockburn Sound.

It is essential to verify and assess the accuracy of any reports. It is common knowledge that eyewitness accounts can be notoriously unreliable. The recent



Suction of spilled oil from Fremantle Harbour. Jiri Lochman

IN AN EMERGENCY...

Oil pollution of sea and/or inland waterway.

Marine and Harbours State Oil Pollution Combat Committee: Captain Spencer, w. 335 0888, a/h 364 4949.

Captain David Oliver, w. 335 0888, a/h 528 2584.

Fremantle Port Authority: 24 hour number 430 4911, a/h 4304962.

Commonwealth Department of Transport: w. 323 1700, a/h Captain Clark, 383 8554.

Land emergencies involving oil, chemical or gas.

Fire Brigade/Police: 000.

Environmental Protection Authority: w. 222 7000, a/h 008 018 800.

If there is any threat to wildlife, national park or marine park, nature reserve or State forest: Department of Conservation and Land Management: 364 0733, a/h 401 8183.

When reporting an emergency, the most vital information is location, followed by the nature of the emergency. You should also give your name and a contact number.

derailment at Pinjarra, for instance, yielded several conflicting stories, including a totally fallacious claim that there was a vehicle trapped under the upturned wagons! (In much the same way, rumours ran rife during the Augusta whale rescue of August, 1986).

Top priority is, of course, given to any potential threat to human life. Next it must be decided whether or not there is a serious threat to the environment. E.P.A. officers will make such decisions, with advice from CALM on wildlife or environmentally sensitive areas under their protection. Information on hazardous chemicals is available from the E.P.A.'s chemists, and Chemistry Centre (W.A.). The Fire Brigade is the equal any of authority in the world in its knowledge of how to deal with hazardous substances. It has the most comprehensive data base. The Fremantle Port Authority has access to two computer programs: 'Harwell Chemdata' which provides information on 65 000 chemicals, and 'Toxichem' which details 17 000 chemicals in use in Australia.

The following is an excerpt from a wildlife officer's report after an incident in February 1987 when a factory fire in Welshpool led to the suspected pollution of Wilson Park Wetland:

..I alerted key members of the Waterbird Volunteer Group (Fauna Rehabilitation Foundation) to the problem and proceeded to Wilson Park, a tidal wetland on the Canning River, where I spoke to police officers. I was informed that officers of the Waterways Commission had installed oil containment booms across the drain (where it runs into the wetland) to prevent the spread of oil into the wetland itself. I was then requested to contact Police Chief Inspector Barry Clay (emergency controller) at the factory fire site. As it was nearly dark,

Cleaning Up Our Own Backyard



Robert Karr-Davies



Old-fashioned cyanide tailings pond (above).

The Seven Mile Waste-Oil Pits at Karratha (left) and one of its victims (below) - a Red-Necked Avocet.

S. Vellacott/Courtesy E.P.A.



S. Vellacott/Courtesy E.P.A.

As well as accidents and emergencies, there have been some chronic problems for wildlife with things such as oil dumping pits and the cyanide pits used in the goldmining industry.

A recent example was the 80% death rate among waders (birds) affected by oil at the Seven Mile Waste Oil Pits at Karratha. (This problem has now been dealt with). Birds and animals can mistake oil and cyanide pits for stretches of water. It is a tragic error. Cyanide, particularly, means an agonising death, as the bird or animal bleeds internally and externally.

In the past there has been mass mortality of Budgerygahs, waders, kangaroos, birds of prey and other species. Today, most waste pits are designed to avoid environmental problems. Appropriate measures include: covering them, making them smaller and much less attractive to birds and animals by removing trees which offer roosting and cover; fencing; and raising the levy banks.

Environmental awareness has increased substantially over the last twenty years, and many industries have changed their approach to environmental issues (sometimes voluntarily; sometimes due to increased penalties for contravening laws).

There are now very stringent environmental guidelines. Complex conditions are attached to exploratory oil leases, for instance. Environmental impact statements must be prepared prior to work commencing, and there must be contingency plans covering possible emergencies such as a blow out on an oil rig.

Industry and conservation are not always incompatible. Barrow Island, for example, is an A-class nature reserve. It is also an oilfield. With careful planning and enormous care both can continue to comfortably coexist.

an inspection of the wetland was not undertaken.

At approximately 20:00 hours I conversed with Police Chief Inspector Clay who informed me that there was the possibility that dangerous chemicals may have polluted the water used to douse the fire and that this run off water was flowing through storm water drains into the open drain discharging into Wilson Park.

Water samples had been taken to Chemistry Centre (W.A.) for analysis. I was warned by Mr Clay not to allow anyone into the Wilson Park Wetland to recover affected waterfowl until the result of the analysis was known, as rumour had it that PVC pipes dissolved when water from the drains was pumped through them. (People living adjacent to the drain pump water from it for irrigation purposes). Other unconfirmed information indicated that a number of Long Neck Tortoises had died in the open drain.

Although this incident proved to be very minor, and had no detrimental effects on the environment, it does serve to illustrate several key points. A selection of different authorities was involved. Most importantly, a control centre had been established, which facilitated communication. CALM was notified because of a possible threat to wildlife, and, in turn, notified volunteer groups. Rumours abounded - dissolved PVC pipes and dead Long Neck Tortoises proved to be figments of someone's overactive imagination. Nonetheless, quite correctly, steps were taken to ensure humans weren't put at risk until chemical analysis proved the rumours unfounded.

Oil spills are the other type of acute pollution problem. The two accidental causes of marine oil pollution are: big tankers carrying crude oil can be ripped open on a reef, as happened with the *Korean*

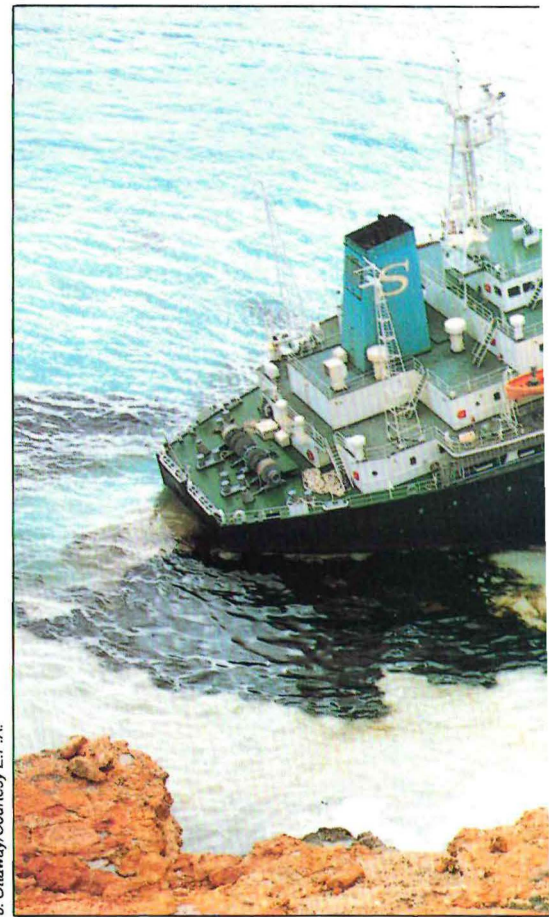
The wreck of the Korean Star.

Star off Carnarvon, or in collision with another ship; and human error - a wrong valve may be opened, releasing oil. Some tankers, mainly in the Japanese fleet, still wash their tanks out at sea by sluicing them with heated seawater and pumping the resulting mess back into the ocean. Fortunately, most tankers now use a system where waste oil is loaded in such a way it can be taken back to refineries and re-used.

Whatever the cause, however, the effects of an oil spill can be disastrous. It all depends upon the location of the spill, the type of oil, and the weather conditions. A spill of diesel in the open ocean far from any area of particular environmental sensitivity may be no big deal, unless it is a fishing ground for seabirds. Diesel evaporates rapidly, particularly when emulsified by wave action in rough conditions. A major spill in an environmentally sensitive area like Cockburn Sound, however, could be catastrophic.

People tend to think immediately of the visible effect on waterbirds and the shoreline, but there are many other hidden victims and secondary effects. Beneath the surface of Cockburn Sound, for instance, there are seagrass beds, fish nurseries, many marine vertebrates, such as dolphins and sealions, and invertebrates, such as shellfish and starfish. It's hard to imagine what to do with a 150-200 kg sealion covered in crude oil. It would be difficult to catch, let alone treat.

There are also several island nature reserves which are breeding grounds for birds, some of them uncommon on the coast, such as Fairy Penguins on Penguin Island.



J. Ottaway/Courtesy E.P.A.

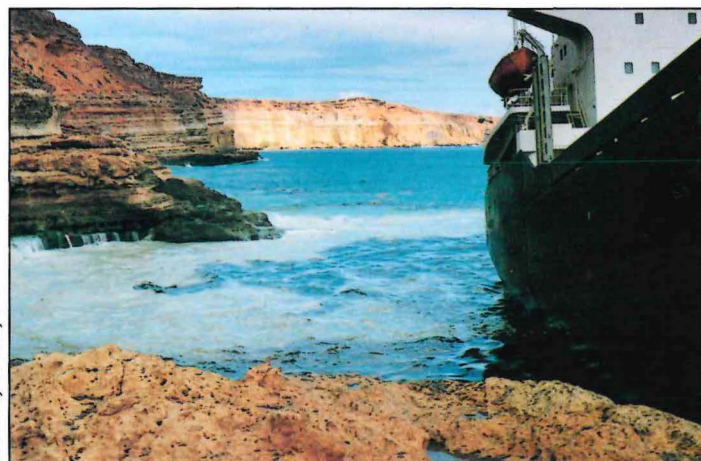
Fairy Penguins enter and leave the water by night, and would have no chance of distinguishing oil in the blackness.

Oil destroys the waterproofing of birds' plumage, causing loss of insulation, decreased feeding efficiency and eventual starvation. In birds and animals toxins are absorbed through the skin, which may become red, inflamed and burnt. It also burns the eyes. The waterbirds and vertebrates suffer not only from being covered with oil but also from ingesting it. They may ingest oil in several different ways: by preening or grooming, drinking polluted water, or eating a food source which is already contaminated. Once ingested, oil will cause gut inflammation, gut ulceration and absorption of toxins.

The response to oil spills is based upon informed decisions about the extent of the environmental threat. If action is deemed necessary then several steps will be taken. Once the flow of oil has been stemmed, a



J. Ottaway/Courtesy E.P.A.



W.A.N.



plane may be taken up to monitor the size and movement of the spill. Then booms, which are large, orange, inflatable 'sausages', can be used to contain the slick or prevent it travelling in a certain direction. The oil can be skimmed with special equipment, or absorbed by sorbents such as straw. In some circumstances dispersant chemicals may be used, but these must be of low toxicity as approved by the State Combat Committee, because dispersants may do worse damage than the original spill. The use of dispersants on oil slicks requires prior approval from the on-scene co-ordinator. If necessary, volunteers may be called upon to assist with wildlife rehabilitation and beach clean ups.

CALM averages only one or two pollution 'incidents' per year. Trusting to luck does not suffice, however, and it is reassuring to know that all the right organisation and equipment is in place to avert the worst effects of any future crisis (see box, page 22).

Jiri Lochman



Oil from the *Korean Star* (top).

Volunteers arrive to clean up Penguin Island (above).

Oil containment booms being launched from Fremantle Harbour (below).

What More Can I Do?

There is certainly a role for the concerned individual, especially when it comes to helping wildlife. You need to be more than just well-meaning, however, because the wrong treatment of affected fauna is often worse than no treatment at all. It is also essential that any voluntary actions do not conflict with the plan of the on-scene co-ordinator. The most practical thing to do, therefore, is join one of the volunteer rescue groups which are contacted in an emergency. Then you will be kept informed of the most up-to-date methods, and there will be improved communication between all participants in the operation.

Sue Smith of the W.A. Native Bird Hospital has had over ten years' experience as a volunteer, and she initiated and coordinates a Wildlife Carers List. She also runs a Summer School course at the University of W.A. on the 'Care of Sick and Injured and Orphaned Wildlife'. If you are interested in being of assistance contact Sue Smith on (09) 295 1588.

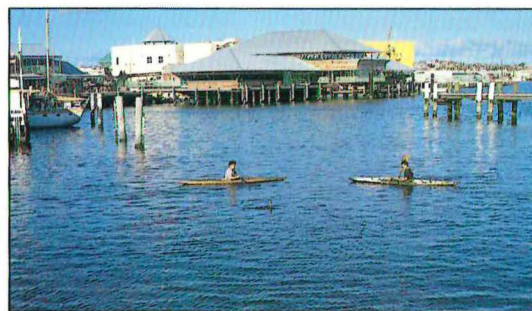
The Waterbird Conservation Group also has extensive experience in the transport, care and rehabilitation of waterbirds. Contact Joan Payne on 397 6380 or Jean Canaway on 384 1564.

If you live in the South-west FAWNA (Fostering and Assistance for Wildlife Needing Assistance) have an excellent record for helping fauna. If you wish to join them contact Rita Watts on (097) 522 258.

The Fauna Rehabilitation Foundation acts as an umbrella group for these and similar groups. For further information ring 249 3434.



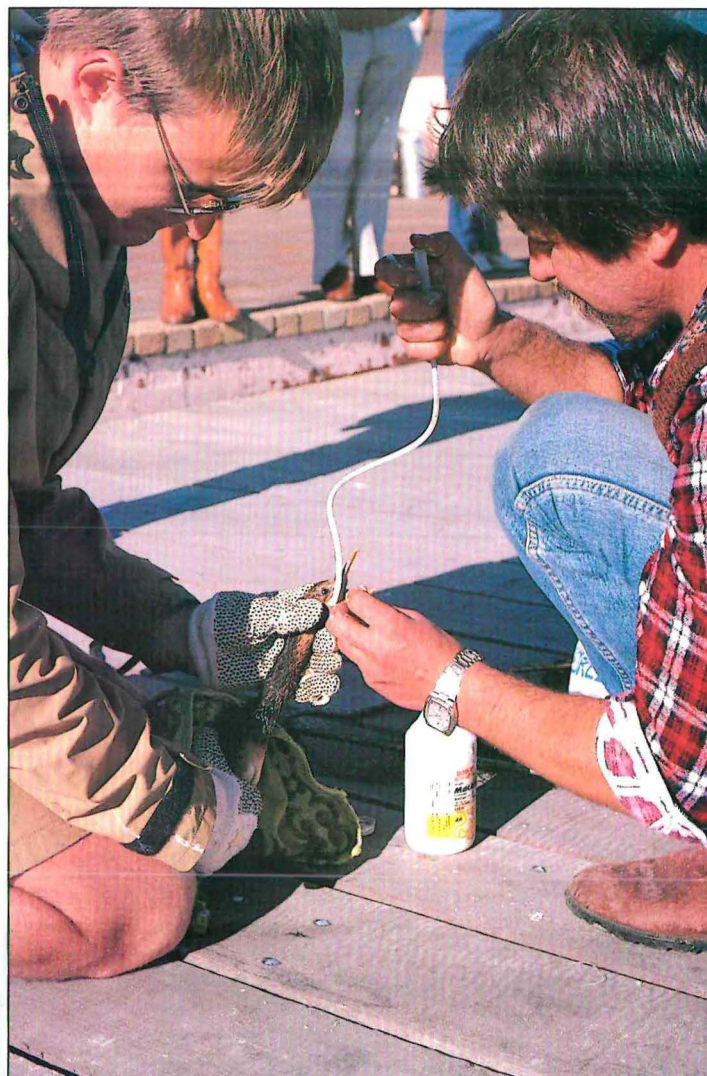
S. Vellacott/Courtesy E.P.A.



Jiri Lochman

The price of progress (above).

Members of the Waterbird Conservation Group set out to rescue a cormorant (left) and treat it (below).



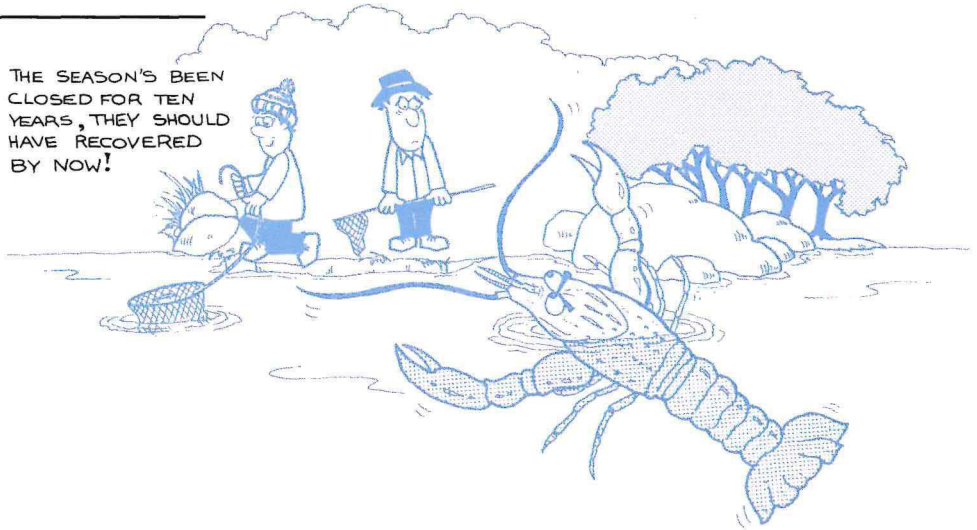
Jiri Lochman

Urban Antics

Marron Glace

By Andrew Cribb

THE SEASON'S BEEN
CLOSED FOR TEN
YEARS, THEY SHOULD
HAVE RECOVERED
BY NOW!



Muttering darkly two shadowed figures stumbled through the evening bush, burdened like smugglers with boxes, poles and a variety of other unrecognisable implements.

An enthusiastic anthropologist might have noted that the figure at the rear end of this strange caravan was the most heavily laden. Bales of wire and netting, and several billy cans were slung across its back, in one hand swung a flickering gas lamp, in the other an enormous esky.

'Bill, Hey Billlll, wait up.'

The first figure was rapidly disappearing into a dense thicket of waterbush, loaded down with a pole, a torch and a strong whiff of something indescribable.

Recognise the scene? No? O.K., we'll run the next few frames.

As the first figure struggled through the dense undergrowth, showering its follower with the entire morning's rainfall, the second slipped, and careering down a muddy slope with a strangled yell, came to rest at the water's edge.

'Keep it down, Jim, you'll scare the little blighters off,' bellowed the first figure.

Here a series of foot-long shadows scurried away from the bank, barely creating a ripple in the dark, glistening water. This was a top secret spot. A spot visited once a year, and never more often.

Bill and Jim were members of a kind of secret society. A society so secret in fact, that the cells often consisted of only two people, or a small, family group.

The society's rituals often involved scraping something very dead off the side of the road, and carrying the remains long distances through the bush at nightfall.

There the participants would soak the rotten offering in the nearest river or dam, light a small, sacrificial fire, and pour the odd libation to celebrate life and the freedom of wild places.

The sites were usually State forest and national parks, and, you've guessed it, Bill and Jim were marroners. The secret society they belonged to had its own set of ethics, amongst which was preserving the marron breeding stock, and the preference for big rather than small.

In 1988, this age-old ritual is in danger of dying out, the end result of several dry seasons, and too many greedy people chasing too few marron.

Between 1976 and 1987, there was a dramatic fall, from 13 to 9, in the number of legal-sized marron caught per trip.

The season was closed completely during the summer of 1987/88 to give the marron population some chance of recovering. But whatever rules the government might introduce will mean little unless West Australians adopt a fundamentally less spoilt attitude.

Take a stroll along the shores of any dam or river during the marron season and see the litter of tiny pink shells left by the cacker catchers, busy scalping next year's legal-sized stock.

Wouldn't you rather snare half a dozen decent-sized marron, fresh out of the water, cook them in an old billy with the smell of woodsmoke in the air and the sun sinking over the tops of jarrah trees, serenaded by a chorus of banjo frogs, soothed by your chosen beverage, and come back next year, and the year after, to do the same thing?

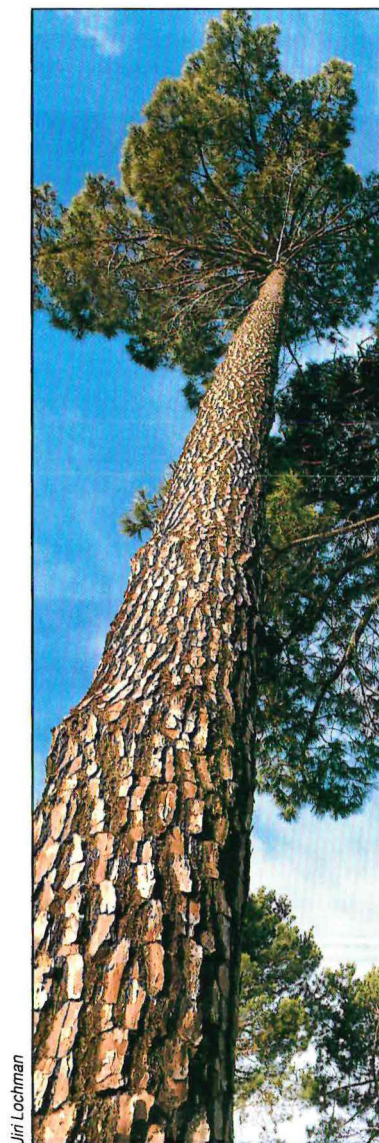
P.S. A museum officer named McCulloch first recorded the use of the common name 'marron' in 1914. He postulated that it was derived from the French word 'marron' meaning chestnut, and drew the analogy with a hard, spiny shell containing white flesh.

Whoever heard of Sandgropers using French? If any readers have a more authentic source for the name write to the Editor, Landscape, 50 Hayman Road, Como, 6152

For licences or any other enquiries, phone Department of Fisheries (09) 325 5988.

Australians abroad find nostalgic reminders of home in the khaki green of a eucalypt forest in such exotic locations as India, Brazil, East Africa, California and Spain, while in W.A., descendants of northern Europeans picnic beneath stands of pine, relating fairy tales of wolves and cruel stepmothers to their Australian born children.

Although soothing to the migratory psyche, this change in the original order is obviously not simply to ward off pangs of homesickness. Rather, it is to ensure a balanced supply of valuable softwoods and hardwoods in domestic and world markets. Don Spriggins gives the full story.



Jiri Lochman



Pines for form...

PINES - the

In W.A. all the native commercial timber comes from eucalypts, which are hardwoods. Introduced pine provides an alternative, softwood timber. Karri and jarrah timbers have often been used for purposes to which softwoods would have been equally or better suited. To counter this the recently released timber strategy encourages the use of hardwoods such as jarrah in visible, high value products such as furniture and panelling for home and overseas markets.

Sturdy timbers such as jarrah and karri have traditionally been used for all our wood needs. One difficulty in continuing this approach - which is not desirable - is whilst there are millions of trees in the karri and jarrah forests resulting from past regeneration of cut over areas, the trees are generally below current milling size. They need time to grow. The great attraction of pine is its

ability to produce sawlog sized trees in 30-40 years compared with the 100 years it takes jarrah or karri to reach that size.

There is also great potential to generate valuable export income through pine. The timber import bill for Australia is about \$1.7 billion per year (W.A.'s share is about \$27 million) so it makes good economic sense to grow most of our needs, provided the cost of producing is competitive. As the world supply of quality hardwoods is decreasing, it also makes economic sense to use pine to replace hardwoods in house framing, beams and general building construction where, whatever timber is used, it is frequently covered with wall cladding. Once treated with chemical preservatives, pine also makes excellent electricity poles and railway sleepers, which will guarantee continued demand.



function...

and farming

soft option

Why not simply import pine from the Eastern States and New Zealand? Currently this would be possible, but W.A. grown pine will become more competitive with imports in the future. This is due to a combination of the lower value of the Australian dollar and the planned construction of highly efficient pine sawmills which will use larger logs, making locally grown pine timber cheaper to produce.

Pine forests become productive early in their career. They are initially planted with over 1 000 seedlings per hectare which ensures that trees grow straight and tall and there are enough to give a good selection in the final crop of about 150 trees. By age 12 a first thinning is required to remove some of the trees to allow the remaining trees room to grow on to produce sawlogs.

Material from the first thinning is suitable for making particleboard, paper or fencing. The amount of first thinning carried out is restricted to available markets and, up until the construction of a particleboard plant at Dardanup by Wesfi in 1976, little commercial first thinning occurred in the South-west. Stands stagnated and drought death of trees was common. Ten years of production of particleboard at Dardanup has now allowed most State plantations to be thinned, but there are some private forests which need attention. CALM recently proposed a system of providing a contract service to harvest and sell logs from private pine forests if the owner so wishes. About 100 000 cubic metres of sawlogs and 200 000 cubic metres of small particleboard logs are produced each year from Departmental pine forests. Cultivation of pine forests further

benefits the economy as sawmills and processing centres employ about 400 people full time. In the forests, another 100 people are involved in harvesting and haulage operations. Direct return to the State from the sale of pine timber is \$9.8 million per year.

Pine forests generate employment. Recently, three new pine milling contracts were awarded, which will result in construction over the next few years of three major pine sawmills costing over \$40 million. These will be at Mundijong and two other locations in the South-west. As well as creating employment during the construction phase, the new mills and associated logging are expected to provide 500 jobs when they are operational. These three new mills will generate a return to the community by way of royalties of about \$100 million over a ten year period. The current major pine mill at Bunbury operated by Westralian Forest Industries currently employs 80 people, but this will rise as intake progressively increases.

By early next century, as the existing forests mature, it is expected that pine sawlog availability will have risen from 100 000 to 400 000 cubic metres per year. The plan is to continue planting 2 000 h/a per year of *Pinus radiata* until the early part of the twenty-first century. Planting targets will be 1 000 ha near Albany with 500 ha in both the Central and Southern Forest Regions.

If this can be completed, approximately 100 000 ha of pine forest will have been established. This will have the capacity to provide 0.8 million cubic metres of sawn timber per year in perpetuity, which is very close to the current demand for sawn timber in W.A. All this from a forest which would only constitute 3.75% of the total area of the South-west!



Cliff Winfield

Pines create employment.



Courtesy Westfi

Pine is a beautiful as well as practical timber.

Hardwoods and Softwoods - What's in a Name?

Trees can be classified as either Gymnosperms or Angiosperms.

Gymnosperms, the more ancient in evolutionary development, produce uncovered seeds, usually in cone-like structures, hence a major portion of the trees classified as gymnosperms are called conifers. Gymnosperms are described as softwoods by botanists. This term has no relation to the softness of the wood, and confusion often results

because carpenters and timber merchants frequently use the term to describe timbers which are easy to work with, but which are not necessarily softwoods in the botanical sense.

Angiosperms are flowering plants whose seeds are formed inside a ripening fruit. They are subdivided into monocotyledons, which include the palms and bamboos, and dicotyledons, to which the term hardwood is applied.



Cliff Winfield

Where it all begins: the pine nursery at Nannup.

A scheme called Softwood Share Farming was introduced in 1986. This system allows farmers to grow pines in partnership with CALM. Participants are paid an annuity and a proportion of the final crop return. They are also encouraged to undertake paid development work in the plantation, such as pruning and firebreak construction.

Response to the scheme has been encouraging. Since 1987, 2 500 ha has been established under the scheme, and it is hoped from now on up to 80% of the annual target of 2 000 ha per year can be achieved by sharefarming.

Pine stands in agroforestry are very open compared to traditional forest stands and agricultural activities such as cattle grazing takes place beneath the trees. An excellent example of this can be seen on the South West Highway, at Balingup, where cattle commonly graze under the pine canopy.

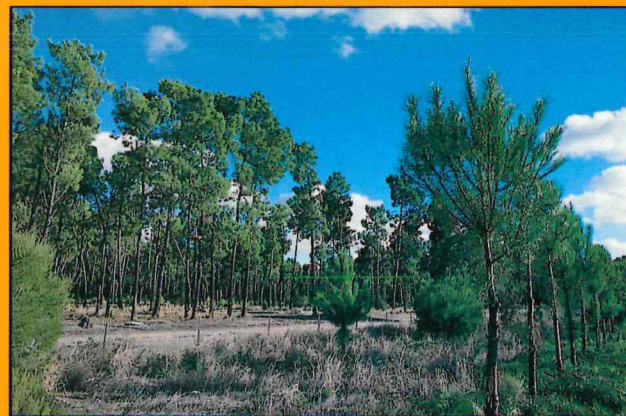
But the grazing cattle don't necessarily have the pines to themselves. Some West Australians have already discovered the joys of picnicking on a soft bed of pine needles, or have used the forests for orienteering, horse riding and car rallies. Each year thousands of West Australians sample the northern European flavour of the mature forests at Nanga Mill and Baden Powell Water Spout in the Lane Poole Reserve or go bushwalking and picnicking in the Gnanagara pine forest north of Perth. Just as the Australian abroad souvenirs gumnuts to tuck nostalgically in a back pack, we may forage the forest floor for edible toadstools and fungi to grace our dinner tables!

Pine Variety

Over 80% of the world's timber supplies come from softwood trees such as pine, oregon or spruce; few native softwood species grow in Australia. In W.A. the only native softwood capable of yielding commercial timber is the callitris or cypress pine which grows in the Kimberleys, the Murchison, the Goldfields and on Rottnest Island. Although yielding fine timber, it is a very slow growing tree and uneconomical on a commercial basis. Consequently, pine forests in W.A. have been based on two species originating from the Northern Hemisphere, *Pinus radiata* and *Pinus pinaster*.

The native home of *Pinus radiata* (Monterey pine) is restricted to three small isolated forests on the Californian coast and a grove of trees on Guadalupe Island off the coast of Mexico, where it is an unimportant tree. But just as eucalypts have often performed better overseas than in their homeland, *Pinus radiata* has displayed remarkable growth rates when transplanted to New Zealand, Chile and Australia. In recognition of this, its botanical name for many years was *Pinus insignis* meaning the 'remarkable pine'.

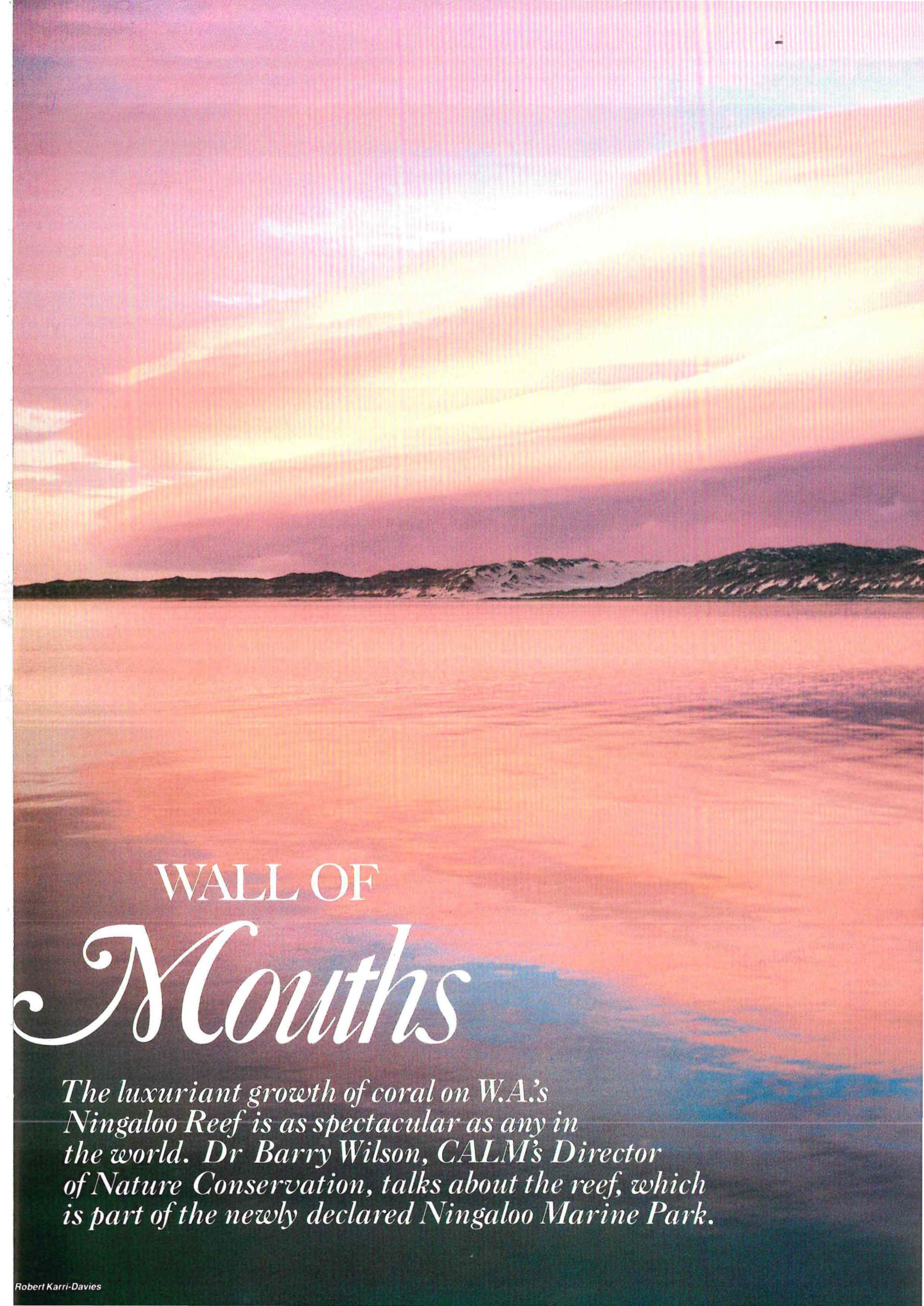
In the Eastern States, *Pinus radiata* grows well on a range of sites, but in W.A. it requires an annual rainfall of about 700 mm a year, and deep, reasonably fertile soils or regular fertiliser dressing.



Marie Lochman

The pine plantation at Gnanagara.

The second pine, *Pinus pinaster* (maritime pine) is outstanding in its ability to grow well on the lower rainfall and poor sandy soils of the Swan Coastal Plain. It occurs naturally over a wide area of Southern Europe. Of the several varieties known, the most successful in W.A. comes from the forest of Leiria in Portugal. The forest of Leiria, created by King Denis who reigned from 1279 to 1325 A.D., has been part of the royal estate and subject to regulation and management since its creation. During its lifetime much of it has passed through several growth cycles from seedling through to large size trees.



WALL OF *Mouths*

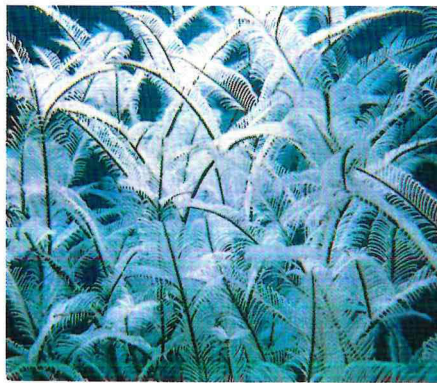
The luxuriant growth of coral on W.A.'s Ningaloo Reef is as spectacular as any in the world. Dr Barry Wilson, CALM's Director of Nature Conservation, talks about the reef, which is part of the newly declared Ningaloo Marine Park.



Ningaloo Reef stretches down the coast along the western side of the Cape Range Peninsula and southwards to latitude 23°34'S, forming a ragged line of coral. For most of its 260 km length it lies a little distance offshore as a barrier reef protecting a shallow lagoon.

At certain places in the oceans of our blue planet there are 'hot-spots' where marine life is particularly abundant through the coincidence of favourable physical conditions. The Ningaloo coral reef is one of these.

The edge of the continental shelf is unusually close to land in this region, located just a few kilometres from the front edge of the reef. Mighty ocean swells spend their force on the reef-edge before spreading in foamy sheets over the shallow reef-flat and pouring into the lagoon behind. The coral reef



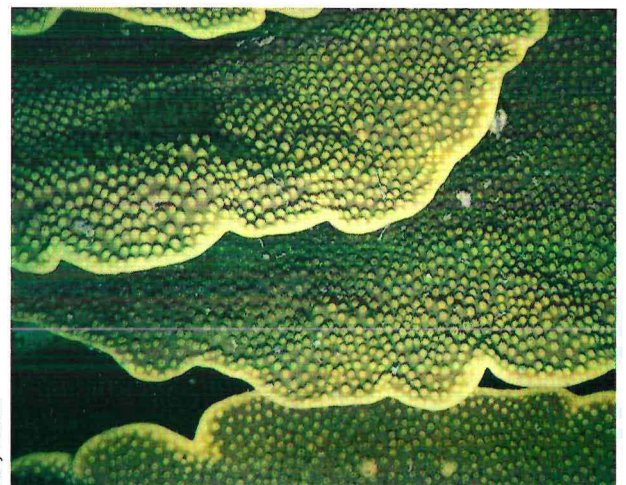
owes its existence to this constant flow of clear, warm, oceanic water.

Sunlit surface ocean water seems clear but microscopic examination will show that it contains countless numbers of planktonic organisms, both plants and animals. The water flowing over Ningaloo Reef carries a never-ending supply of these tiny edible creatures. Corals and many other coral-reef animals are primarily 'suspension feeders' -

they trap plankton as the water flows over them. The reef may be regarded as a giant energy trap, a 'wall of mouths' capturing and concentrating energy produced in the surface waters of the eastern Indian Ocean.

Many corals also maintain a culture of microscopic green algae, called zooxanthellae, in their skin tissue. During sunlit hours these symbionts photosynthesize and produce supplementary nutrients for the host corals. On the whole, the reef and lagoon are like a human city whose citizens are dependent upon food supplies grown elsewhere and transported in. Only a small portion of the system's driving energy is generated by photosynthesis on the spot.

From this concentration of ocean energy, trapped by the



plankton-eaters, the complex coral-reef ecosystem is built with a trophic chain which leads all the way up to the giant predatory tiger sharks - and man.

The coral wall forms a solid rampart protecting a sheltered lagoon from the powerful and temperamental forces of the open ocean. As well as forming an energy trap, the wall creates a system of habitats, including the high wave-action zone of the reef-front, the intertidal reef-flat zone which becomes exposed to air and sun at low tide, the sheltered back-reef edge, and the quiet lagoon. Variable physical structures provide a range of habitats for the large diversity of species which characterise coral-reef ecosystems.

Nature has endowed Ningaloo Reef with an exceptional concentration of marine life and a sheltered and

safe lagoon. It has become a popular fishing, diving and recreation spot. Given the outstanding scenic and wilderness quality of this land-seascape it is no surprise that Ningaloo Reef has been declared as W.A.'s premier marine park.



Neil Wehlack

The modern Ningaloo Reef came into existence several thousand years ago when the sea rose to its present level after the last Pleistocene ice-age. Originally pioneer corals settled on rocky ridges of the sea-floor, and the reef we see today is built from the accumulated remains of successive generations of corals and other creatures with limey skeletons. The living corals of the reef grow on the structure left by earlier generations.

Most sexually mature corals release eggs and sperm into the water at a single, annual spawning time. While they drift with the currents, the eggs are fertilised and begin to divide and grow, eventually becoming tiny swimming larvae called planulae. When they have reached the appropriate development stage they find a suitable hard place on the sea-bed to settle, fasten themselves, and



Eva Boogaard

The coral *Galaxea* has relatively large polyps, each one separate and raised above the surface of the colony (above).

Fireweed. These delicate fronds are not plants but colonial hydroids. The polyps have stinging cells which may cause unpleasant rashes on the skin of an unwary diver (top left).

Staghorn and plate corals (far left).

One of many kinds of starfish which live on the reef (above left).

The hard coral grows in colonies with petal-like plates (left).

A fan-like gorgonian colony growing on an underwater cave wall where constant water flow brings a regular supply of plankton to feed the polyps (top right).

Ningaloo Reef: a winding wall of coral mouths (right).



Robert Garvey

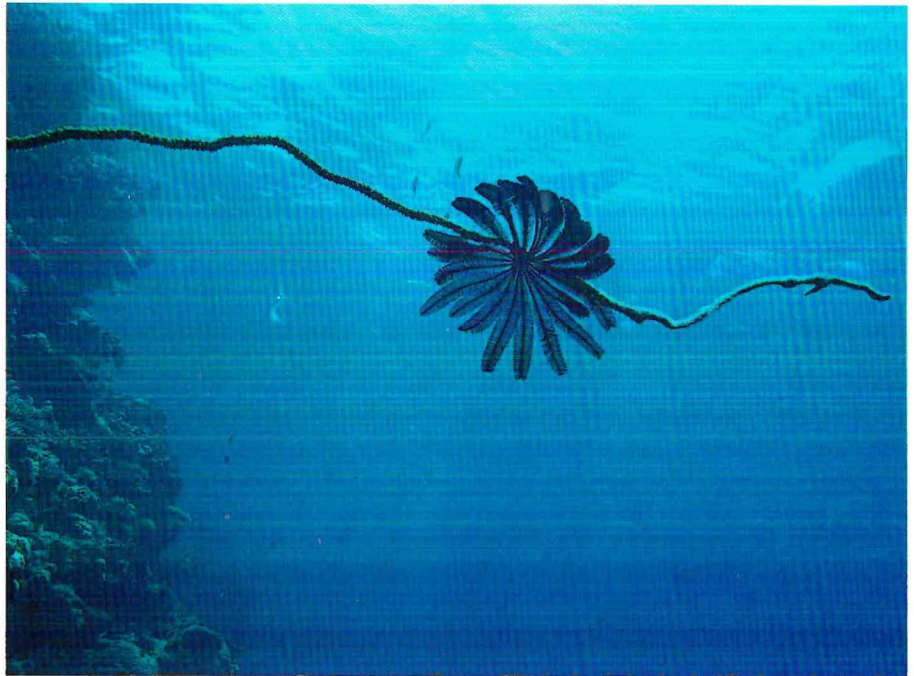
transform into sedentary polyps stiffened and supported by a secreted skeleton of hard lime.

A few corals remain as single polyps in adult life, but the majority divide asexually to form colonies. Once established the colonies grow by this process of division. Some of the very large massive colonies may be centuries old and consist of thousands of individual but interconnected polyps, each one a genetic replica of the original single ancestor. When some of the polyps are killed or eaten they may be replaced by asexual growth of survivors of the colony. But if the entire colony is killed then replacement must be by settlement of a new larva, sexually produced by a parent coral elsewhere. The degree to which isolated coral reefs are dependent on occasional replenishment from other reefs is one of the important issues of current coral reef research.

The shape and fine structure of coral colonies seem infinitely varied. There are branching, flower-like, and encrusting forms, delicate fern-like colonies, and huge massive domes. Individual polyps may be pin-head sized or the size of a fist. They may be separate or merged together.

Ningaloo Reef is built by about 220 species of coral belonging to at least

Neil Wehlack



John Butler



A many-armed feather-star on a gorgonid soft-coral (above).

A gorgonid fan-coral (left).

A Butterfly Fish feeds on polyps of a living coral (above right).

A Clown Fish shelters among tentacle of a large, fleshy anemone, protected by the anemone's stinging cells (right).

Cape Range National Park

The magnificent Cape Range National Park abuts the northern portion of the new marine park. See *Landscape* Autumn Edition, 1987.

A management plan for Cape Range National Park was approved, after public input, in 1987, and a draft management plan for the State waters part of Ningaloo Marine Park was issued for public comment in June 1988.

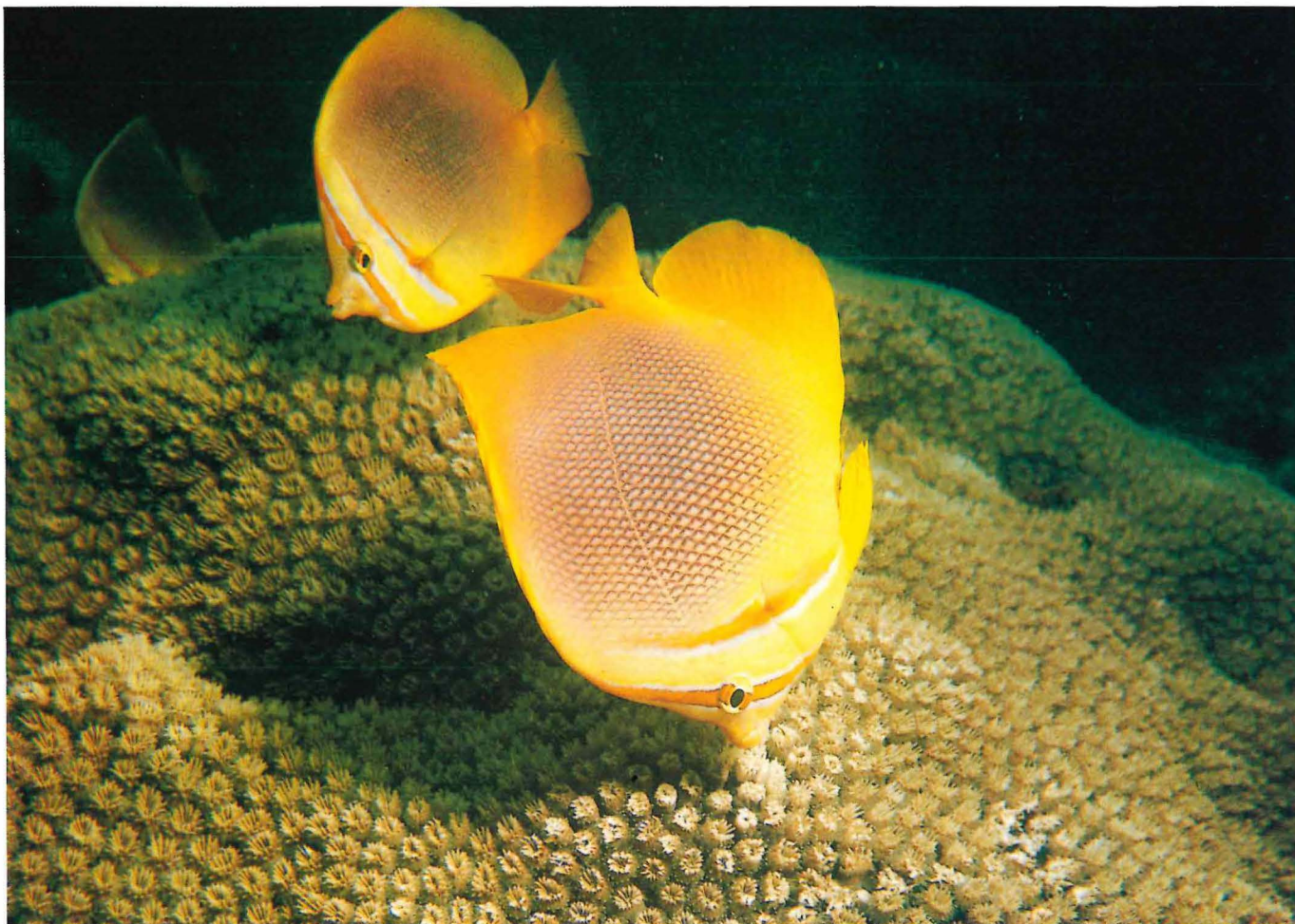
Robert Garvey



The Cape Range Sturt Pea lacks the black throat typical of this plant elsewhere.

A draft management plan for the Commonwealth portion of the marine park is in preparation by the Australian National Parks and Wildlife Service.

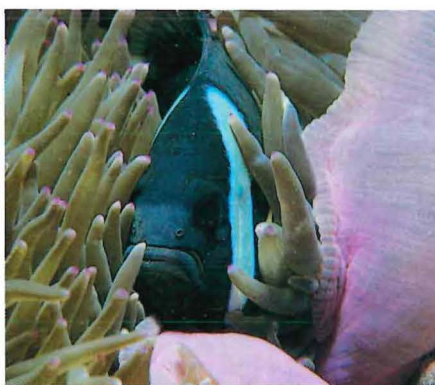
Eventually all three plans will be integrated, and the three areas managed as a single park by the W.A. Department of Conservation and Land Management on behalf of both State and Commonwealth Governments.



54 genera. The naturalist may find them as varied and as beautiful as the wildflowers of our southern forests.

For sheer visual splendour there are few ecosystems which can match a rich coral reef like Ningaloo. The variety of form and colour of the corals themselves provide the spectacular background. But the structural and biological habitat they create is the basis for a colourful community of great complexity.

Many of the reef invertebrates are plankton-feeders like the corals, and they position themselves where there is a strong flow of plankton-bearing water, enhancing the energy-trapping capacity of the coral wall. Other invertebrates are detrital feeders living on the organic waste of the ecosystem, herbivores feeding on plants,



John Butler

parasites or predators. Some kinds of invertebrates and fish eat living coral.

People often ask how Ningaloo Reef compares with other coral reefs, the Great Barrier Reef for example. In underwater spectacle, the average visitor will see little difference. As on all reefs there are places where coral growth is poor and others where it is luxuriant, with the attendant multitudes of

colourful fish and other creatures which one expects to see on a rich coral reef. The luxuriant areas at Ningaloo are just as spectacular as you would see anywhere, and they are unusually accessible.

Almost all the coral species at Ningaloo are widespread throughout the tropical Indian and Western Pacific Oceans. This is true for most of the fishes, molluscs and other reef animals also, although in these groups there are some species peculiar to the W.A. coast.

The number of species of coral and other creatures present on the Ningaloo Reef is less than at some other reefs further north and on Queensland's Great Barrier Reef, perhaps because of the relatively simple physical structure of Ningaloo Reef and the smaller range of habitats. However, only the experts who count the species will notice that.

Managing For Posterity

Ningaloo Marine Park is a multiple-use marine reserve. It has been declared under both Commonwealth legislation (the offshore areas) and Western Australian legislation (the inshore areas under State jurisdiction).

The prime objective of management is to protect the natural values of the reef and marine environment for posterity, while providing for reasonable use, including public recreation and enjoyment, tourism, and commercial fishing.

Recreational use is concentrated mainly along the shore, the reef and the lagoon. It includes recreational fishing as well as passive activities like diving, swimming, sailing, beach-combing and camping on the shore. All of these activities take advantage of the wildness and naturalness of the marine environment and the wonders of the coral reef environment in particular.

Because of the accessibility of Ningaloo Reef from the shore there are unparalleled opportunities in this park for nature appreciation programs. With the assistance of a generous grant from the Australian Bicentennial Authority a visitor centre has been built at Milyering close to the shore within the Cape Range National Park. This centre is intended as a focus for tours and the educational programs for both the marine park and the adjacent terrestrial environment.

The majority of visitors are accommodated in the towns of Exmouth and Coral Bay and enter the park on a day-use basis. Guided shore tours, dive tours, and coral-viewing boat



Robert Garvey

The Milyering Bicentennial Visitor Centre (left).

At Yardle Creek visitors may canoe in quiet waters behind the sand-bar, with the lagoon and coral reef beyond (below).

Coral-viewing boats operate from Coral Bay and Exmouth (centre).

Fishing from the shore is a fine way to relax and provide a camp meal (bottom).



Cliff Winfield

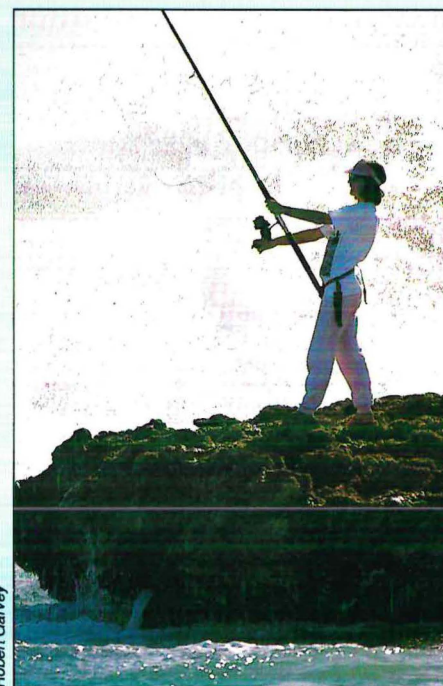


Robert Garvey

trips are available, and there is no doubt that these activities will develop and contribute significantly to the tourism industry of the region. However, camping in remote corners along the shore is traditional on this stretch of coast and the management program will ensure that it may continue. Preservation of the wilderness atmosphere of much of the coast is an important management objective.

A wide range of fish species are sought by recreational fishermen in this marine park. There is no evidence that current fishing pressure has had any significant effect on the fish populations. However, the resource is not infinite and care must be taken that future increase in fishing pressure does not cause diminution of the stocks.

Fisheries Act Regulations apply in the marine park. Visitors are expected to adhere to the prescribed bag limits so that recreational fishing may be sustained indefinitely for everyone. The principle adopted for recreational fishing in the park is that visitors should catch



Robert Garvey



Gerry Allen



A school of Bat Fish (above).

This Spangled Emperor is not destined for the frying-pan. He gets a free meal instead (left).

only what they can eat on a day-by-day basis.

Beyond the reef, where it is unlikely to have significant effect on recreational users, the existing level of commercial fishing is to continue, under the control of the Department of Fisheries. Here also, the management objective is to ensure that the fishery is sustainable and that there is no detrimental effect on the environmental values of the park.

The paramount management strategy for the marine park is to ensure that the reef itself remains perpetually in good condition. The secondary strategy is to ensure that users of the park do not impinge upon each other's activities to the point of conflict.

Zoning the marine park for different uses is the means by

which these strategies are put into effect. Potentially conflicting uses will be spatially separated into different zones. In Ningaloo Marine Park three principal zone categories will be recognised.

Sanctuary zones -

are total protection areas where visitors may 'look but not touch'. They serve as special observation areas; reference areas for scientific studies, particularly as monitoring sites for study of long term changes; and as reproductive replenishment zones, providing recruits to nearby depleted reef communities in the event of excessive use.

Some sanctuary zones are designated so that visitors may experience coral and reef fish communities which have not

been subject to human exploitation.

Recreation zones -

exclude commercial fishing but generally permit recreational fishing providing amateur fishing regulations are followed. Within these zones, potentially conflicting recreational activities such as spear-fishing and fish-watching may be also spatially separated.

General use zones -

provide for commercial fishing, as well as other uses. The bulk of the park is zoned for general use.

Providing a recreational amenity is one of the prime reasons for reserving and managing this marine park. Nevertheless, of paramount importance is that this wonderful natural feature, W.A.'s biggest coral reef be protected for posterity.

wild places,

Many will recall the glossy, glove-box sized hand book, 'Beating About the Bush', which informed Perth nature lovers of the natural haunts accessible for day trips from the city. Now the Department of Conservation and Land Management has produced a companion discovery book, in a similar format, called 'Wild Places, Quiet Places' which takes the reader through the south-west corner of the State from Bunbury to distant Eucla.

Divided into five geographical sections, the descriptive text begins with the jarrah forests between Dwellingup and Bunbury. Photographs of the forests, catchments, rivers and dams of the region show the camper or tourist the charms of the fertile environment, and a camping code on each page provides a quick assessment of local recreation and facilities.

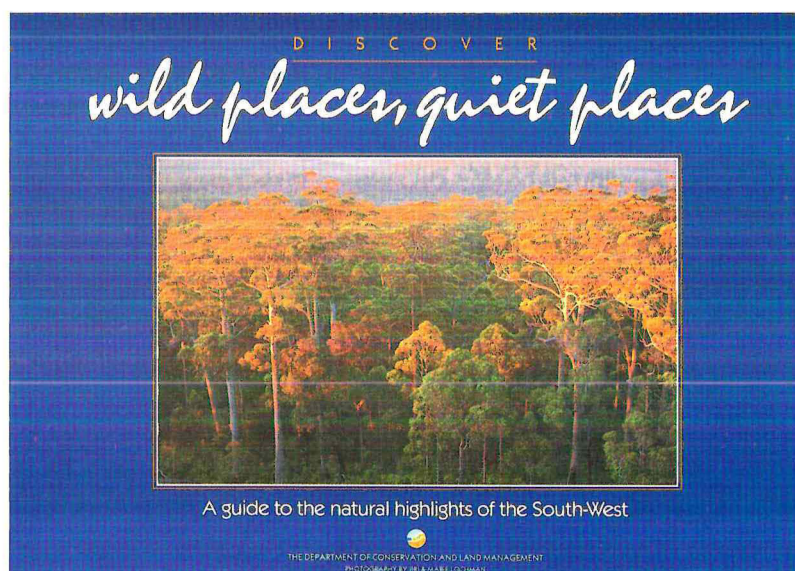
The remaining sections are in the same pattern. Busselton to Augusta, the limestone coast, is popular for its surf, caves, parks and forests. The national parks from Manjimup to Walpole

include the most magnificent karri forests in the State, and the mountains and seaciffs of Denmark and Albany cover an impressive, rugged coastline. The final chapter is devoted to the little explored reaches between Bremer Bay and Eucla, a stretch of almost undisturbed country with extensive national parks.

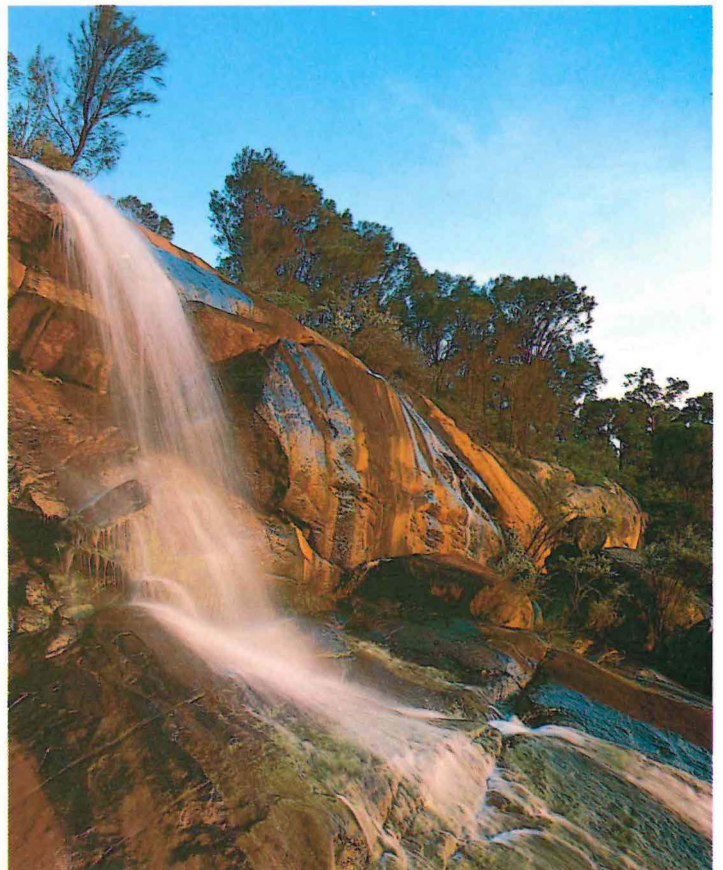
The book is well written and comprehensive. It includes keys for the identification of wildlife and vegetation, camping etiquette, detailed maps and survival information.

The many photographs reveal the lovely scenery of the South-west and also show many of the outdoor activities that can be enjoyed, such as following walk trails or caving.

Visually the book is a tribute to the work of Jiri and Marie Lochman and, besides being a pre-requisite for planning a tour, it would make a lovely gift for those unable to visit the South-west or those preferring to read and view in their own homes.



quiet places



Everybody knows about termites, but what about the other species of wood-eating insects? Dr Ian Abbott, leader of CALM's Entomology Research Program, tells you what they are, and what to do about...

MORE BORING INSECTS

WOOD-EATING insects have a bad image because some species damage wood (such as karri trees, floorboards, furniture) of value to sawmillers or householders. Nevertheless, these insects are simply doing what they have done for millions of years - helping to decay unhealthy trees and to break down dead wood in forests and woodland. In doing so, they return nutrients to the soil. Subterranean termites also mix and improve the structure of soil.

During the past 20 years, some 80 species of insects have been recorded in association with wood in south-western Australia. Most of these produce well-defined tunnels within wood, and are known as 'borers'. The only exception are termites, which do not produce clearly defined tunnels.

Eight of these wood-eating species are accidental introductions, and, not surprisingly, six of these are associated with pine wood.

Healthy living trees can defend themselves against wood-eating

insects because wood contains phenols or resins toxic to insects. When a tree experiences prolonged moisture stress, however, or is damaged by mechanical injury or fire, wood-eating insects may colonise the tree following the disruption of its chemical defences. Healthy trees are often immune to termite infestation, in contrast to the seasoned timber derived from them.

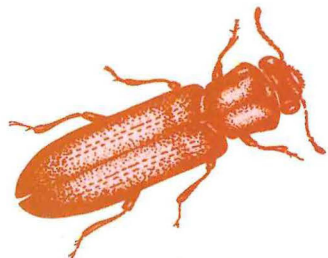
Adult female borers either tunnel into wood to lay their eggs or remain on the surface and pierce the wood with an ovipositor. The larvae that hatch remain within the wood and digest the sugars in the wood consumed. Undigested wood is often known as 'borer dust' or 'frass', and may fill the tunnel behind the larva. Once maximum size is attained, the larva transforms into a non-feeding stage (pupa), after which the adult insect emerges. (Termites in contrast do not live such a solitary life and have a different type of life history - see 'Quiet Achievers', *Landscape*, Winter Edition, 1988).

When you see signs of wood-eating insects, don't panic and assume

that the floor or ceiling is about to collapse. With a better grasp of basic facts you can confidently attempt your own diagnosis. Examine carefully the damaged wood, and then with the help of Table 1 (p.44) identify the insect species responsible.

- * Determine if the wood sample is from a living tree/freshly felled log, or of partly moist/partly dry wood, or of dry seasoned wood.
- * Determine if the wood is a hardwood (e.g. eucalypt) or softwood (e.g. pine).
- * Determine the part of the wood eaten - cambium; sapwood; heartwood.
- * Measure the diameter of any 'exit holes' (from which adults have left the wood) or of the tunnels.
- * Rub a sample of frass between your fingers and note the texture - is it gritty or smooth like flour?
- * Compare any adult insects found with the photographs and drawings in this article.

The insects which should most concern householders are those infesting drying wood or dry seasoned wood. They can re-infest wood already damaged, and over a period of time virtually destroy it. These species are *Lyctus brunneus*, *Anobium punctatum*, *Ernobius mollis*, and termites. The three beetle species will honeycomb parts of timber with their larval tunnels.



Lyctus brunneus Lyctidae (above).
Average length 5 mm.

The frass of *Lyctus* has a fine flour-like texture, whereas that of *Anobium* and *Ernobius* is gritty. *Ernobius* is unlike *Anobium* in that it requires the presence of pine bark on seasoned pine before it will infest. Therefore, *Ernobius* will not be a problem if pine timber with small pieces of bark attached are avoided. CALM records indicate that *Anobium punctatum* is extremely uncommon in south-western Australia.

Lyctus is widespread, but will not cause problems if resistant hardwoods (e.g. jarrah, old growth karri) or susceptible hardwoods from which all sapwood has been removed are used. Insecticide treatment of timber in use which is infested by these borers is difficult and rarely effective.

In south-western Australia the termite species present require more moisture than is available in air-dried wood; this additional moisture is usually obtained from soil. These subterranean termites, as they are known, destroy wood by infesting it from the ground or from other timber already in contact. These species can be prevented from gaining entry to buildings if the soil beneath is treated with poison and if timber naturally resistant or treated with preservative is used.

IPS GRANDICOLLIS -

an American beetle living in Western Australian pine plantations for over 40 years.

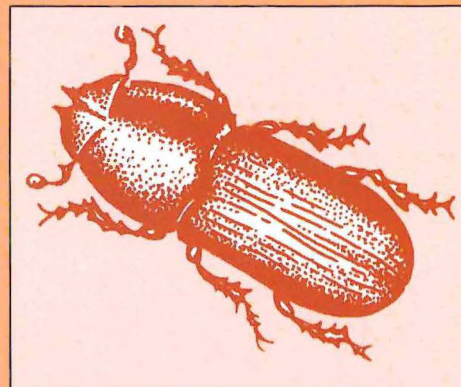
These small beetles (4mm long) can be readily found under the bark of infested pine trees or logging debris in plantations. Two types of attack can occur. In a breeding attack, usually in logs or slash, the male first tunnels through the bark and makes a chamber in the cambium into which the female is attracted. After mating, the female tunnels farther within the cambium and lays eggs. The larvae, hatched from the eggs, feed in the cambium but their tunnels, which resemble an engraving, do not degrade the wood.

A blue stain fungus is introduced by the adult beetle into the cambium and spreads to the sapwood. If there is enough fungus, the water conducting system of the tree is disrupted, causing browning of the tree crown and sometimes death of the tree.

In a feeding attack, which occurs when beetle populations are large, trees may be killed after being infested by adult beetles of either sex. Both bark and sapwood are heavily damaged along the upper bole and branches. The tree is then ring-barked by the insects.

Pine trees that have experienced drought, competition from adjacent trees, damage from lightning or fire are prone to infestation by *Ips*.

Departmental records indicate that *Ips* had been present in the south-western plantations for 20-30 years before becoming a problem in March 1970, and again in 1973, 1980, and since 1986 particularly in the Blackwood Valley. These outbreaks reflect severe winter droughts which are predicted to worsen during the next 50 years.



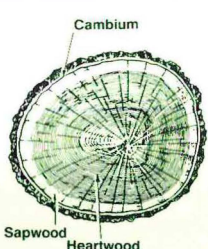
Mature *Ips* beetle (above).

Fortunately, a program of importing parasitoid and predator species of *Ips* from North America to South Australia began in 1981 (with the approval of the Australian Plant Quarantine Service). One of these species is now definitely established there. In 1984 controlled releases of three of these species were made in Gngangara plantation. In May 1988 Dr David Morgan, former forest entomologist at the Waite Institute in South Australia and consultant to the Woods and Forests Department there, visited the Gngangara release site and found that *Roptrocercus xylophagorum*, a parasitic wasp, had established. This species was also found to have established in plantations in the Blackwood Valley.

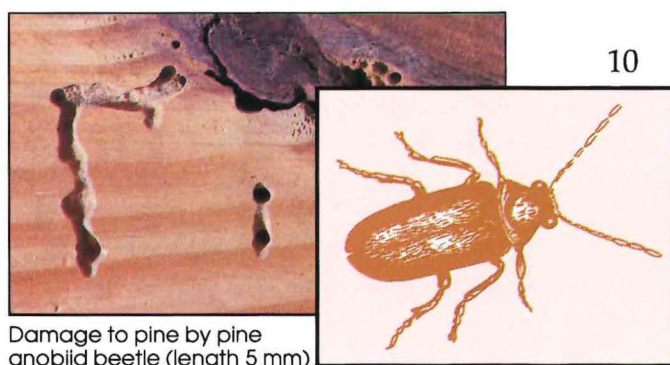
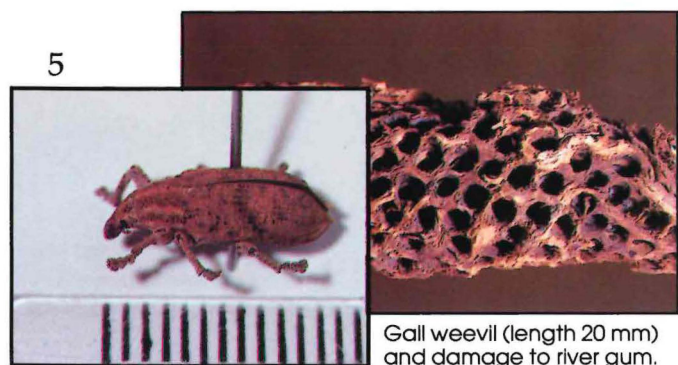
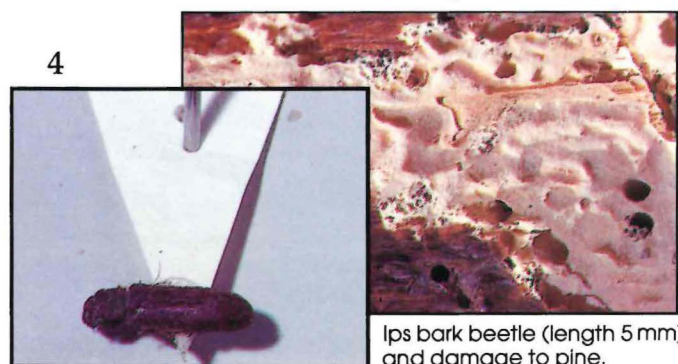
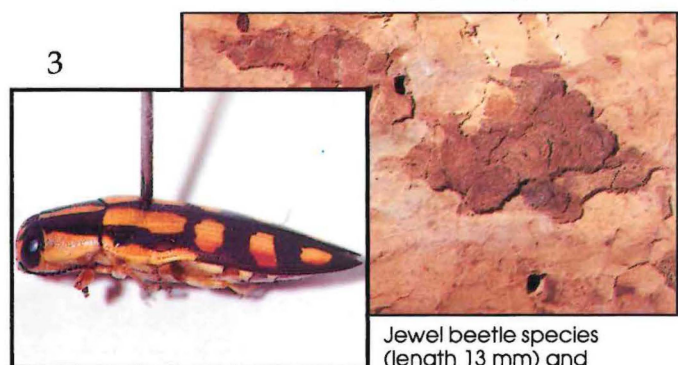
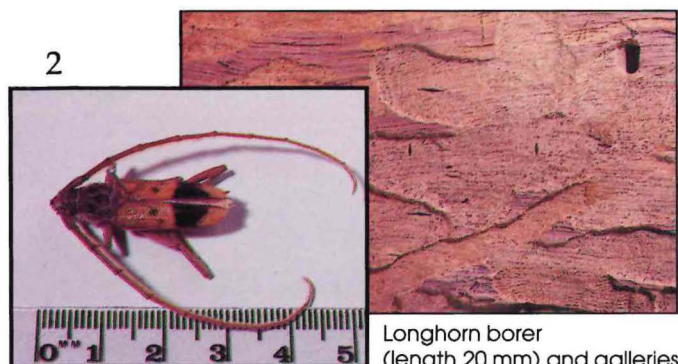
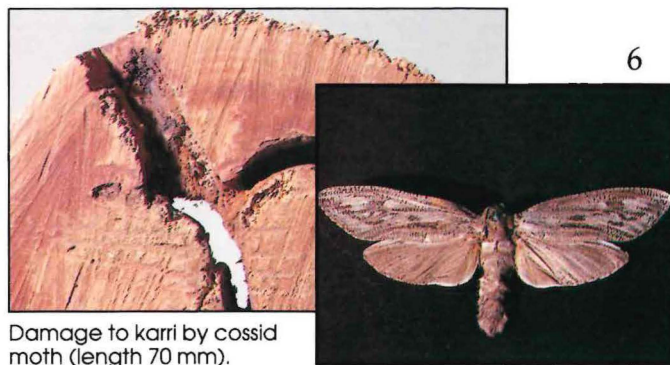
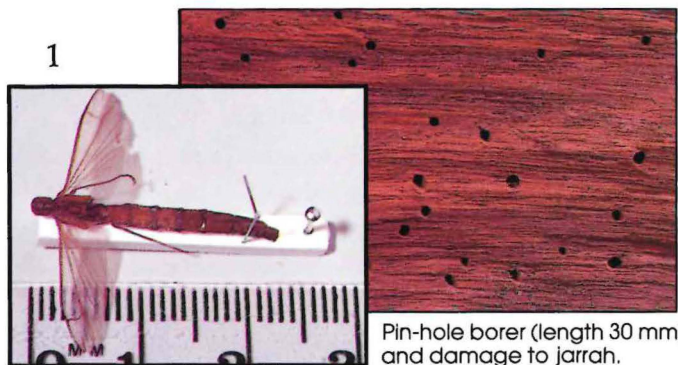
Dr Morgan also arranged for a fourth species, the predatory beetle *Temnochila virescens*, to be released in the Pinjar and Ferndale plantations. CALM plans to accelerate releases of these beneficial insects in other plantations during the next few years. The benefits should take about 10 years to become evident.

Using beneficial (parasitic or predatory) insects to minimise damage by a pest insect is known as biological control. After intensive testing to ensure there are no undesirable side-effects, it is a method far safer and more cost-effective than resorting to spraying trees with insecticides.

TABLE 1
DIAGNOSIS OF INSECT DAMAGE TO WOOD IN SOUTH-WESTERN AUSTRALIA

	INSECT SPECIES/GROUP	TYPE OF WOOD INFESTED	PART OF WOOD INFESTED	DIMENSION OF EXIT HOLES(MM)	INJURIOUS PART OF LIFE CYCLE
PESTS OF LIVING TREE, FRESHLY-FELLED LOG OR GREEN TIMBER 	1 Pinhole borer <i>Atractocerus kreuslerae</i>	Hardwood	Cambium Sapwood Heartwood	< 1	Larva
	2 Longhorn borer <i>Phoracantha</i> , <i>Tryphocaria</i> spp.	Hardwood	Cambium Sapwood Heartwood	8-12 x 4	Larva
	3 Cypress Jewel beetle <i>Diadoxus erythrus</i>	Softwood	Cambium Sapwood	3 x 2	Larva
	4 Ips bark beetle* <i>Ips grandicollis</i>	Softwood	Cambium	2	Adult Larva
	Ambrosia beetle <i>Xyleborus saxeseni</i>	Softwood	Sapwood	< 1	Adult
	5 Gregarious Gall weevil <i>Strongylorhinus ochraceus</i>	Hardwood	Cambium Sapwood Heartwood	7	Larva
	6 Cossid moth <i>Xyleutes</i> sp.	Hardwood	Sapwood Heartwood	25 x 15	Larva
	Termites	Hardwood Softwood	Sapwood Heartwood	-	Worker
PESTS OF MOIST AND PARTLY DRY WOOD	7 Xyloryctid moth <i>Cryptophaga unipunctata</i>	Hardwood	Sapwood Heartwood	5	Larva
	Auger beetle <i>Bostrychopsis jesuita</i>	Hardwood	Sapwood	3-6	Adult Larva
	Termites	Hardwood Softwood	Sapwood Heartwood	-	Worker
PESTS OF DRY SEASONED WOOD	8 Powder post beetle <i>Lyctus brunneus</i> *	Hardwood	Sapwood	1-2	Larva
	9 Furniture beetle <i>Anobium punctatum</i> *	Softwood (Hardwood rarely)	Sapwood Heartwood	1.5-2	Larva
	10 Pine Anobiid beetle <i>Ernobius mollis</i> *	Softwood	Sapwood Heartwood	1.5-2	Larva
	Termites	Hardwood Softwood	Sapwood Heartwood	-	Worker

☆: Introduced



Wood Wasp (*Sirex noctilio*)

This wasp has been accidentally introduced from Europe to New Zealand and from there to Tasmania, Victoria, South Australia and New South Wales. Occasionally, it has been intercepted on ships arriving at Fremantle, but surveys of pine plantations carried out in the 1960s and in 1986-7 have failed to find it in W.A.

During oviposition the female introduces the spores of a wood-rotting fungus on which its larvae feed. This fungus spreads through the cambial layer and ringbarks and kills the pine tree.

Fortunately, effective ways of controlling *Sirex* have been found, so if it did establish in south-western Australia nematodes and parasitic wasps could be quickly introduced from eastern Australia as counter measures.



Pine stand in Blackwood Valley - drought affected and infested by Ips bark beetle.

Larvae, adult female and adult male wood wasp (length of female 30 mm).

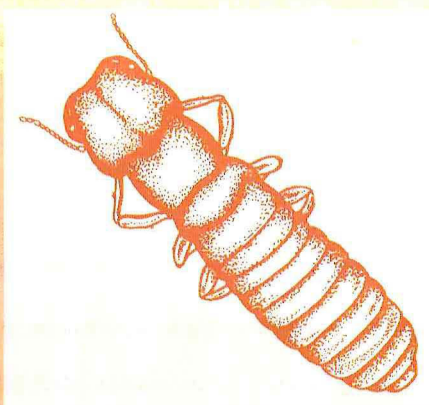


Dennis Haugen

West Indian Drywood Termite (*Cryptotermes brevis*)

This species, the world's most destructive drywood termite, has been accidentally introduced to Queensland and New South Wales. It can enter wood directly from the air (in contrast to subterranean termites), and its small colonies can easily be transported in single items of furniture and crates. They can tolerate relatively low moisture conditions for lengthy periods and obtain their water from the wood in which they feed.

Once established, drywood termites are very expensive to control (in contrast to subterranean termites): fumigation is the only effective option. Although W.A. has one native species of drywood termite, this species is not known to be a pest.



Cryptotermes brevis, soldier (length 6 mm).

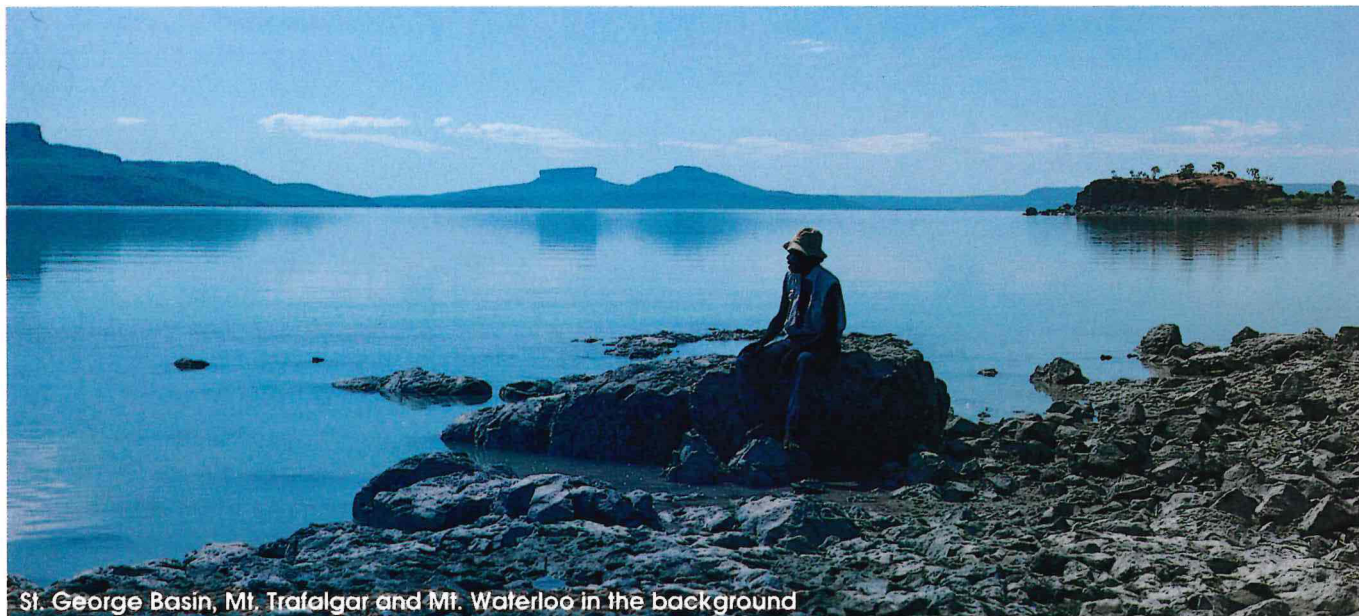


Hylotrupes bajulus (length 15 mm).

European House Borer (*Hylotrupes bajulus*)

In Europe this longhorn borer was originally an inhabitant of forest but is now a common domestic pest. It was accidentally introduced to eastern Australia in the 1950s, but all known infestations were destroyed by fumigation. This borer has the reputation of being the world's most destructive pest of seasoned softwood. The damage superficially resembles that caused by *Lyctus* in hardwood in that the sapwood is completely powdered beneath a thin veneer of apparently sound wood. When this species infests a roof, the first sign of its presence is the collapse of the infested structure.

W.A. relies on the vigilance of the quarantine authorities to keep this State free of these pests.



St. George Basin, Mt. Trafalgar and Mt. Waterloo in the background



Andrew Burbidge

Aboriginal cave paintings



Jiri Lochman

Yellow-throated Miner



Marie Lochman

Marbled Velvet Gecko

PRINCE REGENT

JEWEL OF THE KIMBERLEY

by
Andrew Burbidge
Chris Done
and
Barry Wilson

The Prince Regent Nature Reserve is a wonder of natural history covering 633 825 hectares of rugged sandstone and volcanic country in the State's highest rainfall area. Located in the north-west Kimberley, it is one of Australia's most remote places. Once, remoteness was a barrier to people and very few visited the region after the original Aboriginal occupants (Worara tribe) moved to European settlements in the 1930s. Now, however, the remoteness has become an attraction.



OVER the past ten years a thriving charter boat industry has developed in this part of W.A. It has been estimated that there were between 50 and 100 boat visits to the Regent in 1986, and 1987 saw the first voyages of the 'Kimberley Explorer', a luxury catamaran carrying 32 passengers and 10 crew. One of the features of any boat trip along the Kimberley coast is a visit to St George Basin to see Mount Trafalgar and Mount Waterloo, and to the Prince Regent River to view King Cascade.

A nature reserve is a place people may visit, but facilities are not provided and human activity should not adversely affect the biological values. Clearly, with the increase in visits to the Prince Regent Nature Reserve some control now needs to be exercised over the area.

Present control is via a permit system. The Reserve is declared a 'prohibited area' under the CALM Act, and a permit is required to visit it. Notice is required because of the Department's agreement with the Mowanjumb Aboriginal Community. Few permits have been issued, but now many private yachts are including the Prince Regent on their itinerary during coastal cruises, and most do not realise the area's status and do not have a permit.

The Prince Regent gained some notoriety early in 1987 when an American tourist was attacked and killed there by a Saltwater Crocodile. The private launch on

Deep freshwater pool in the Roe River; home of freshwater crocodiles, turtles and fish (top).

St. George Basin from the summit of Mt Trafalgar. Rainforest below the cliff (left).

King Cascade (right).





which this party was travelling did not have a permit to enter the Reserve, and therefore had not been given advisory information on the crocodiles, and how to take precautions to prevent attack. If there had been a field station in the Reserve things might have been different.

As well as controlling permit use there are other management problems. As with much of the CALM estate in the Kimberley, two of the management issues in the Prince Regent Reserve are the control of feral animals and the reimposition of an appropriate fire regime.

Feral animals known to already occur in at least part of the Reserve are donkeys, cattle and cats. The last are thought to be widespread, but cattle and donkeys have not yet penetrated many areas, and it is essential they be contained to ensure that damage is minimised.

In other parts of the Kimberley, cattle and donkeys have been observed to cause massive erosion, and cattle in particular have opened up the ecologically important patches of rainforest, allowing invasion by annual grass species and subsequent burning from wildfire. These rainforests contain many fire sensitive species, and



Cattle-caused erosion to Blyxa Creek, a tributary of the Prince Regent.

their size and diversity is reduced by recurring fires.

During Aboriginal occupation of the area, fire is thought to have been far more frequent, but on a much smaller scale than is now the case. Fire was used by Aborigines for hunting as well as for facilitating movement throughout the area. Much of this burning would have taken place early in the dry season when a combination of cool temperatures, high humidities and partially cured fuels would allow the fires to go out at night. This mosaic of recently burnt areas and low fuel loads would have

limited the extent of wildfires later in the season.

The cessation of Aboriginal burning practices has resulted in fuel loads building up and, inevitably, extensive fires of great intensity, mainly late in the dry season. Many dead trees and areas of 'fire weed' invasion bear testimony to this change. Such a fire pattern is self-perpetuating, as the destruction of the trees and the subsequent regrowth of annual grasses and short-lived perennials (such as some *Acacia* species) give a rapid fuel build up capable of carrying a fire on an almost annual basis.

Long ago when sea-level was lower and the present-day NW Kimberley coastal islands were part of the mainland, ancestors of the Worara people asked their northern neighbours, the Wannambal tribe, to share with them a piece of their high country. It was agreed and a certain high, flat-topped mountain was split in half. The Wannambal people kept one half and it now stands in the sea, known by Europeans as Montlivet Island. Help was sought from some fishes and crustaceans who wriggled under the other half. They lifted it onto their backs and, with buckling knees,

carried it down a road they had made, far south into Worara country. But they had trouble getting out from under where they parked it. They couldn't get it straight and so it remains now with a tilt to the south. Also, when they emerged it was discovered they they were all squashed almost flat by the weight they had borne; their offspring, the rays, shovel-nosed sharks and crabs, remain that way today. The Waroora people call the mountain 'Widulgup' which means 'split in half'. They are very proud of it even though it tilts a little bit and is not finished. **David Mowljarli**

The use of satellite imagery will allow monitoring and establishment of a more accurate fire history and should assist with establishment of a more appropriate fire regime. Aerial ignition of strategically placed, early dry season fires began on a trial basis in 1988.

As a first step towards developing a management presence in the Prince Regent Nature Reserve, a team from CALM and Mowanjum visited the area in June 1987. The three authors were accompanied by Sam and Maurice Umbergai, Yerticle Maru and Charles Oobagooma, Worara men from the Mowanjum community, and Dr Patricia Vinnicombe of the W.A. Museum's Department of Aboriginal Sites. The team travelled to the area in the charter boat 'Wave Spirit', and while in the Reserve surveyed and visited some areas by helicopter.

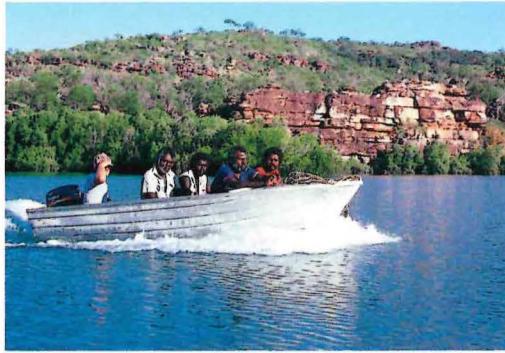
The aims of the expedition were twofold: to select an area where a field station could be built and to liaise with the Worora people with a view to using their knowledge of the country and involving them in management of the area.

A follow-up visit in June 1988 allowed more detailed examination of the site by a consulting engineer. Various options are being considered for the construction and servicing of the field station, but the selection of a suitable site was the most important decision made.

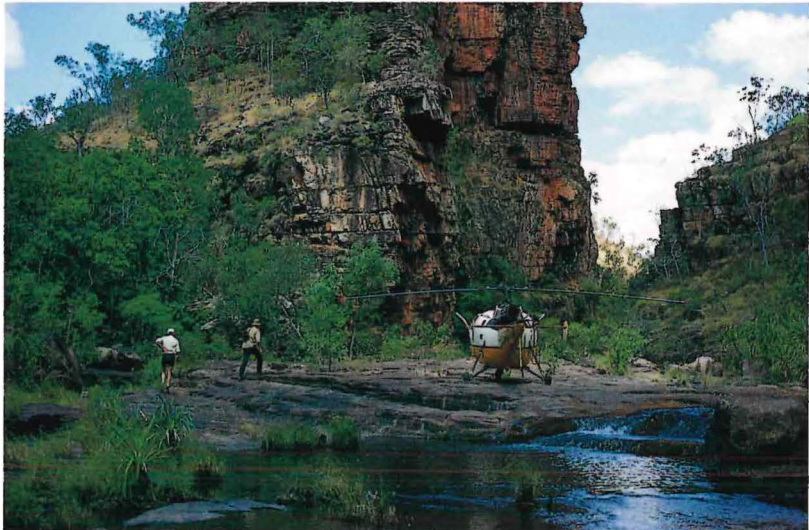
Aborigines from the Mowanjum Community with Barry Wilson in a tidal tributary of the Prince Regent (top).

Pitta Gorge: Pitta Creek, a tributary of the Prince Regent flows through the gorge. Access to the rugged north-west Kimberley is difficult (centre).

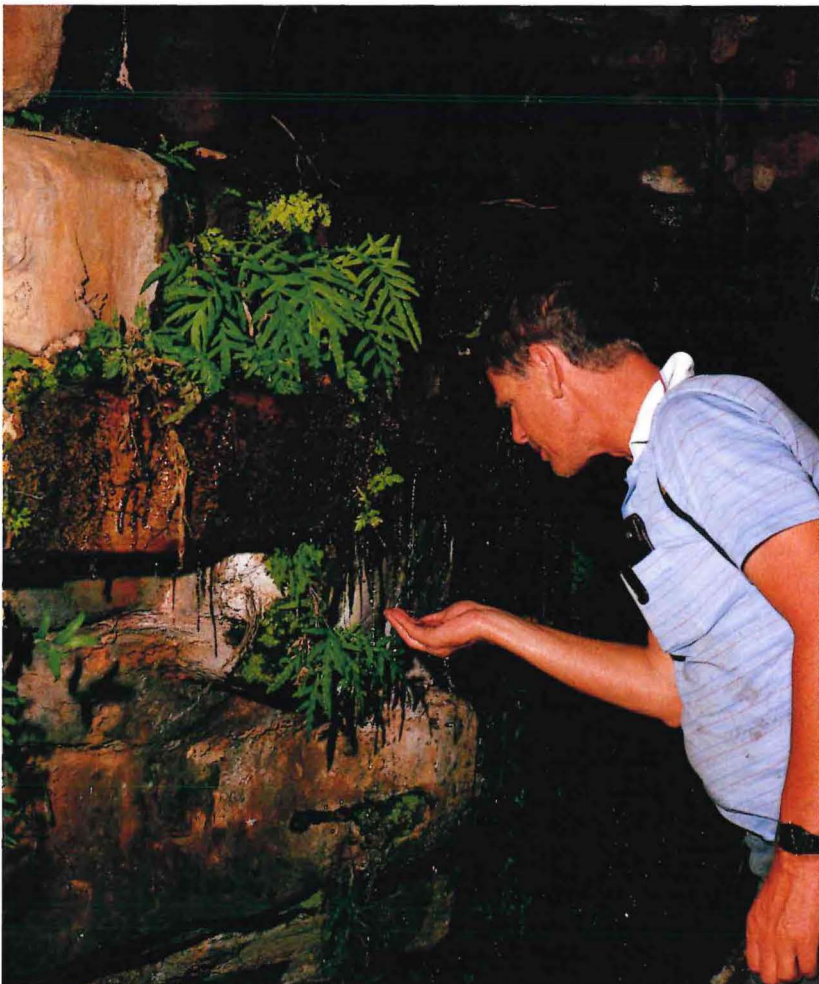
Co-author Andrew Burbidge drinks from a fern-clad seepage (right).



Andrew Burbidge



Barry Wilson



Barry Wilson

The Prince Regent Nature Reserve includes significant areas of the three main geological sequences of the north-west Kimberley, and protects many areas of scenic grandeur.

An ecological survey conducted in 1974 revealed a biological richness in the area, and further studies in 1987 and 1988 during the rainforest surveys have added considerably to our knowledge. The Reserve area contains over half the mammals and half of the bird species found in the whole Kimberley region, and more than 502 species of plants were located in the 1974 survey.

The north Kimberley is the only place in W.A. where the mammal fauna has not declined since European settlement. Thus the Prince Regent Nature Reserve is the only mainland conservation reserve in the State with an intact fauna. The Reserve also supports a major population of the Saltwater Crocodile, and counts in 1977/8 and 1986 showed that crocodile populations are recovering more rapidly there than elsewhere in the Kimberley.

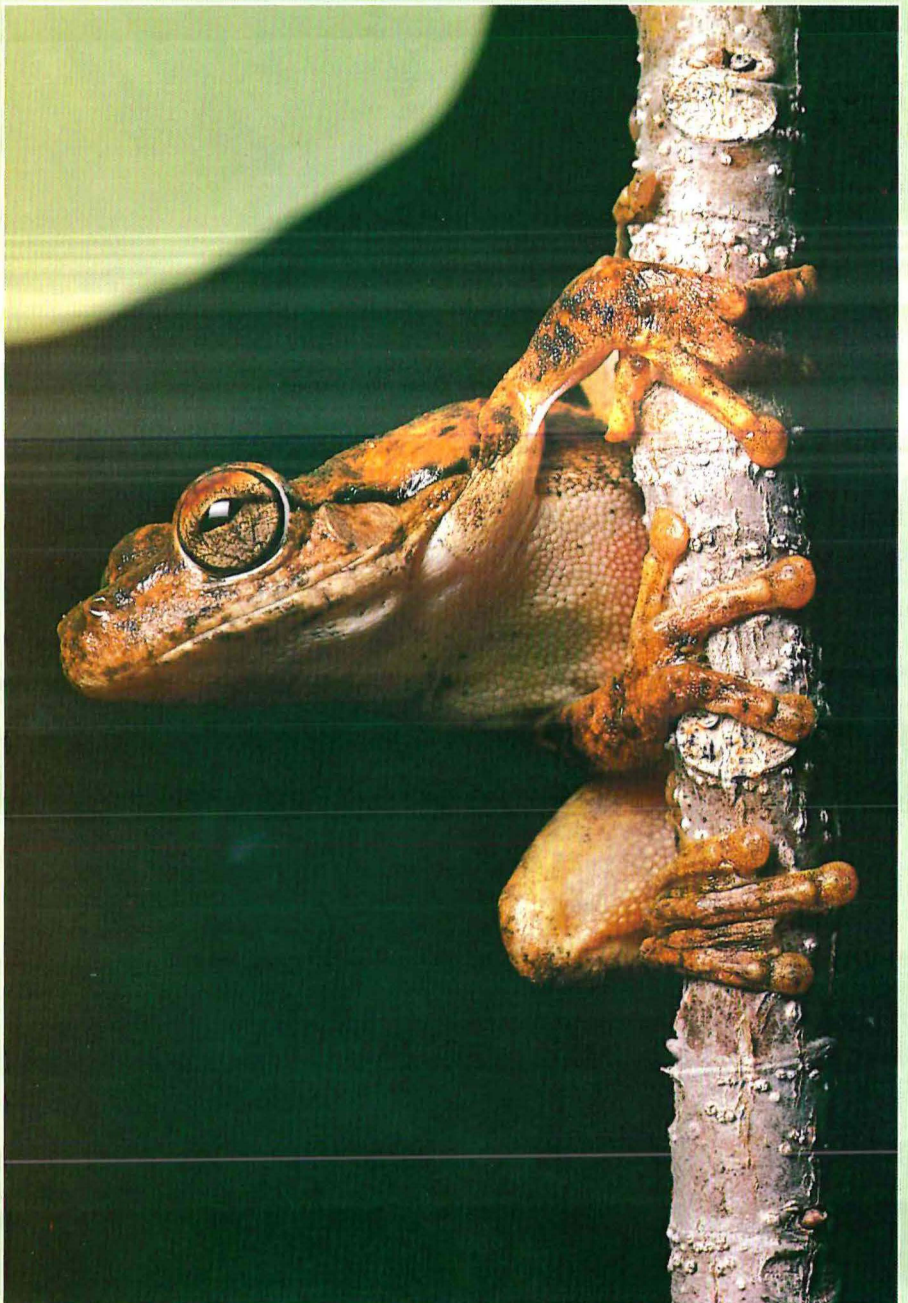
Proposals to enlarge the Reserve by declaring St George Basin and Prince Frederick Harbour marine reserves, and adding the small section of the Prince River catchment not already in the Reserve, received endorsement by the Environmental Protection Authority in 1978. Recently, CALM re-submitted these proposals to the Kimberley Region Planning Study, together with a recommendation that the area be declared a national park.

The smallest wallaby, *Petrogale burbidgei*, known to Wunumpal Aborigines as 'Monjon'. This species occurs only in the Reserve and nearby country (top).

Roth's Tree Frog, *Litoria rothii*; plentiful along freshwater creeks all year round (right).



Jiri Lochman



Jiri Lochman

The extremely rugged nature of the terrain along most of the coastline, cost, and the sensitivity of sandstone areas to damage restricted consideration to areas of volcanic rock. The site finally selected is near the base of Mount Waterloo, so the field station has been nicknamed 'Waterloo Station' pending the selection of a suitable Worara name.

During examination of the site on foot we were fascinated to find signs of previous occupants - it had been used by Aborigines as a camping ground, and there were also European artifacts: pieces of rusting corrugated iron, crumbling stone walls and a small dam. Clearly, others also thought 'Waterloo Station' a good place to live.

Much of the materials to construct and support the base will be brought in by sea, so a suitable barge landing is essential. The team selected two sites, one adjacent to Mount Waterloo and another on



Jiri Lochman

Northern Native Cat (*Dasyurus hallucatus*).

Rothsay Water a few kilometres to the north; the latter gives immediate access to a site selected for airstrip construction. Sea planes are becoming a feature of the Kimberley, and may be used for immediate or emergency access until an airstrip and ground access can be built.

The Worora men on the expedition strongly favoured the construction of a station and are looking forward

to participating in management of the area. Further negotiations are continuing with the Mowanjumb community.

Now the whole operation needs to be funded. A request for funds has already been made to the Commonwealth Government as part of the National Rainforest Conservation Program and matching funds are being sought from the W.A. Government.

Approaches are also being made to the private sector for assistance. A field station in this remote place would be of benefit to various organisations and would be extremely valuable during search and rescue operations.

If all goes well, construction will commence in the dry season of 1990. It is to be hoped that the plans come to fruition, as the overwhelming impression of the Prince Regent Nature Reserve is that of a place unspoiled by modern man, but needing care to see it stays that way.

The south-east cliff face of Mt. Trafalgar, with rainforest at its base.



Norm McKenzie



Jiri Lochman



Steve Hopper

A moss microcommunity on limestone rock at Rottnest (above).

Ganoderma resinaceum growing on wood (top).

Marchanta sp., a liverwort, from West Cape Howe. Liverworts are usually found in moist, shady locations on rocks or soil (full page).

Gather No Moss

Mosses, liverworts, fungi, lichens and algae have now been elevated to the status of 'protected flora.' CALM botanist David Coates gives the details.

Protection of species diversity is an important part of CALM's work, and this applies especially to the State's flora, which is exceptionally rich in localised and rare endemic species.

Up until now only vascular plants (that is the ferns and flowering plants) have been classified protected. Following a recommendation from the National Parks and Nature Conservation Authority and approval by the Minister for Conservation and Land Management, Barry Hodge MLA, non-vascular plants have also been declared as protected flora under the Wildlife Conservation Act. Being protected flora means they cannot be taken from any Crown land without a licence from CALM.

The non-vascular plants consist of the Bryophytes (mosses and liverworts) and the Thallophytes (algae, fungi and lichens). Many of the species in these groups are relatively inconspicuous, although they constitute a very important and valuable component of this State's flora. Approximately 200 species of Bryophytes, 194 species of lichens and 300 species of macrofungi are now classified as protected flora. While most Bryophyte and Thallophyte species are thought to be widespread, their conservation status is yet to be documented in detail. Some species are poorly collected and may be rare.

Mosses, liverworts and lichens frequently form diverse communities on granite rocks through the south-west of W.A. The mosses and liverworts have a simple form, small size, and are considered to be quite unrelated to our generally more conspicuous vascular plants. Lichens are of particular interest because they are composed of an alga (green or blue green) and a fungus, and are classified according to their fungus component. The macro-fungi show

Steve Hopper



Cladia sp. - a lichen on granite near Jackson Rock east of Hyden.

a spectacular array of fruiting bodies of all shapes and sizes. The fruits appear after the first winter rains.

This declaration of the non-vascular plants may mean the licensing of contractors, or individuals, for the removal of moss and lichen covered rock from vacant Crown land, and licensing the farming of salt lake algae for carotenes. Picking the common field mushroom, *Agaricus campestris* (a macro-fungus), is still legal because it is regarded as an introduced species. Although it is unlikely that the wildflower industry will harvest endemic Bryophytes or Thallophytes, commercial pickers will now be required to hold a Commercial Purposes Licence, or, in the case of

private landowners, a Commercial Producers Licence should they wish to do so.

The status of 'Protected Flora', which now covers virtually every native plant species in the State, should not be confused with the category of 'Declared Rare Flora'. Plants in this latter category are those which are rare, endangered, or in need of special protection. Nobody, not even research scientists, can take or damage any part of the plant without permission from the Minister. The Declared Rare Flora list currently contains 226 species. A special colour publication with photographs of all our Declared Rare species will be produced early next year.

C REBUILDING THE CATHEDRAL

Growing and caring for new forests established after timber cutting is one of CALM's most important tasks. Roger Underwood (a forester in the south-west of W.A. for over 25 years) explores the philosophy and history of forest restoration.

My literature studies as a high school student included novels and poems written by soldiers in the First World War. From these, I carried grim images of the battle-scarred countryside of France and Belgium in my imagination, until I visited France for the first time in 1978.

I was on a study tour with a group of international foresters when, by train, we crossed the fields of Verdun - the great battleground of 1915. I did not expect to see a desolate landscape of mud, shell-holes and shattered forest, but what I did see that summer afternoon astonished me.

It was now a soft, productive and beautiful rural landscape, with rolling fields of crop and pasture, fine woodlands of oak and beech and avenues of elm and poplar. The formerly mutilated countryside had been remade!

Later that year I spent time with the district forester at the Forest of Dean near the English and Welsh border. He was embroiled in controversy over the preservation of old-growth oak at the time. As a forester from W.A.'s karri country, I knew something about such controversies, but there was a difference between the English forest and ours.

The Dean oak forests had been clearfelled and regrown several times since forest records started

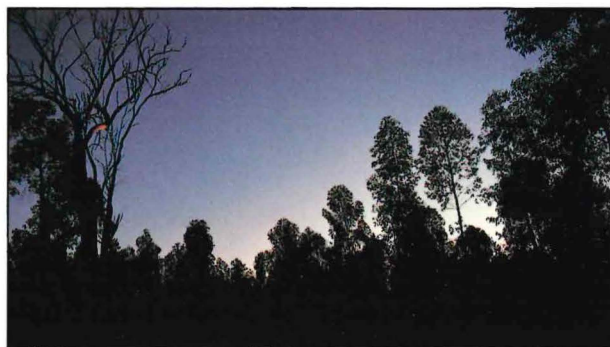
in Roman times about 2 000 years ago. The 'old-growth' oak stands at the centre of the present controversy were only 150 years old, having been replanted in the wake of widescale fellings for shipbuilding during the Napoleonic wars.

One final experience from my European trip was central to forming a lasting philosophy on forestry. During my European tour, I visited some of the world's great cathedrals. They all had three things in common: they were inspirational, they were man-made, and construction had taken a long time - often hundreds of years. I wondered if humans had the genius, vision, determination and technical skills to build cathedrals of stone and timber, whether they could build a forest?

I believe the Department of Conservation and Land Management, and the foresters whose main job is to regrow new forests, can do this. A major reason for my confidence is knowledge of the successes we have had already, and the growth of W.A.'s new forests which have developed after past harvest and regeneration.

Here are stories about four of them which I know well: the Eastern Goldfields' eucalypt woodlands, the jarrah forests along the Hotham Valley Line, the Treen Brook karri forest, and the Julimar wandoo forest.

by Roger Underwood
General Manager of CALM



Jiri Lochman

THE GOLDFIELDS' EUCALYPT WOODLANDS

The forests of the arid and semi-arid Eastern Goldfields are outstanding for the splendour and variety of tree species and their height and vigour in such a dry area. Most people don't realise that huge sections of this thriving inland forest are regrowth, which arose in the wake of clearfelling in the late 19th and early 20th centuries. The timber, which was hauled in on narrow gauge railways called woodlines, provided fuel for the mining industry and towns in the Goldfields.

W.A.'s first forest ranger was posted to Coolgardie in the late

1890s, when some of the State's first forest reserves were created in the Goldfields. Mining began in the early 1890s. The logging operations in the Goldfields lasted 65 years, and an area of over 3.4 million ha was clearfelled.

There was little planned regeneration of the cut over forests along the woodlines due to a lack of staff and funds.

Fortunately, the mature trees of these forests flower and carry seed nearly every year. In a healthy forest this seed normally feeds insects, but if the forest is burnt in a

wildfire or felled for timber, the seeds germinate prolifically. So a new forest now grows in the Goldfields, replacing the one cutover.

Some of these regenerated forests are now nearly 100 years old, and only a trained eye can distinguish between these and virgin stands in forest reserves. The Eastern Goldfields region in WA has a very harsh climate: sparse irregular rainfall, baking summers, and freezing winters. It is a miracle that such an environment produced naturally such a wonderful forest in the first place. Deeply reassuring is the way these forests coped with an almost total exploitation for their timber resources. A new forest again clothes the rocky hills and vast plains.

Today, with no demand for steam engine fuel at the mines, the forests are thinned in some places for domestic firewood, mine props and posts and rails. However, they are mainly managed for collection of seed to be sent to buyers in other arid countries, beekeeping, recreation and as a wildlife refuge.



Cliff Winfield

Magnificent salmon gums, one of the Goldfields' most beautiful trees.

THE JARRAH FORESTS OF THE HOTHAM VALLEY LINE

In an arc north-east, east and south-east of Dwellingup are 'the crown jewels of the jarrah forest'. The key factors contributing to forest excellence are all present: fertile soils, high rainfall, a resilient and dominating tree species with strong, durable timber, and abundant wildlife.

A huge section of the area was proposed as a Flora and Fauna Reserve back around the turn of the century, but the political climate at the time was not right for such a move. Instead, the Hotham Valley railway line was built through the forest, from Pinjarra to Boddington, in 1910.

Along the railway, a series of small timber towns sprang up. Each town had a sawmill, settlement, mill workers and bush crews, and was at the end of a network of timber tramways stretching into the forest. Along these lines, logs were hauled to the mills by steam locomotives. The timber was used in Perth, in the Goldfields and for wharves, or was exported all over the world.

As well as the men milling timber, an army of sleeper-cutters worked through the bush. Usually they formed the 'advance guard', selecting the best and straightest trees. The railway sleepers were hewn direct from the log and carted by horse and dray to the railhead. This was at the time when the W.A. wheatbelt was being opened up, and jarrah sleepers were needed in their millions to take railways into the new agricultural districts.

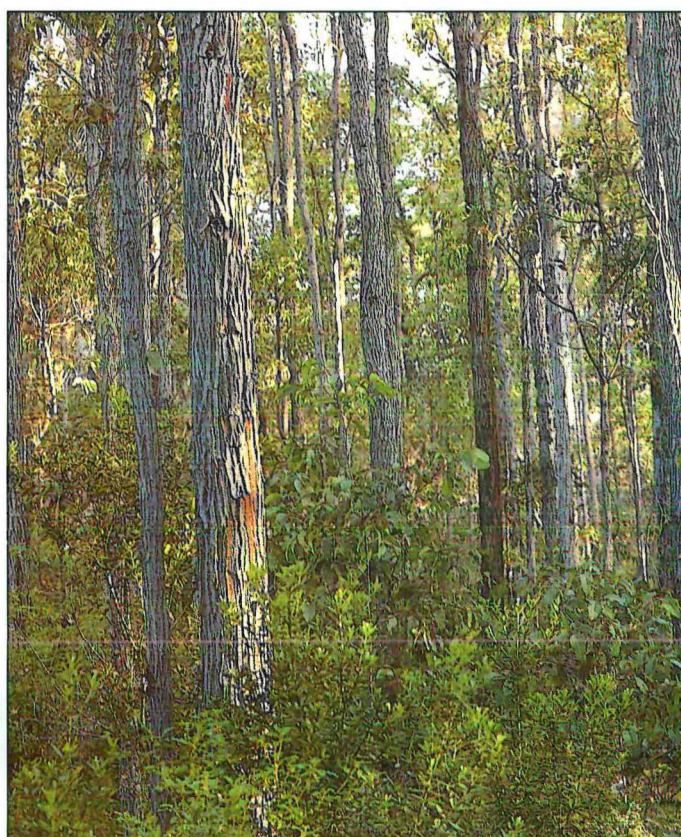
In the early days, there was virtually no government supervision of the industry. However, forestry

planning and protection commenced in the 1920s, and its influence was soon felt. Until then, only the worst trees, or unwanted timbers like marri, were left standing. The bush was clean cut over hundreds of square kilometres. After the 1920s planned regeneration began.

The Hotham Valley's jarrah forests, like the Goldfields' eucalypts and the wandoo, survived. Natural regeneration was just as successful after timber cutting as it would have been after fire or storm.

The Great Depression of the 1930s helped. Many mills were forced to close and a pool of workers became available to help foresters carry out essential fire protection, thinning and regeneration work.

By the 1950s, a superb new forest had replaced the old one. The only remaining timber town in the area is Dwellingup. Part of this forest is now in the Lane Poole Conservation and Recreation Reserve, and is enjoyed by thousands of visitors each year. Prime jarrah timber is growing on the rest.



Another successful before-and-after story. Ten years after clearfelling (above) and thriving today (right).

Jiri Lochman

TREEN BROOK

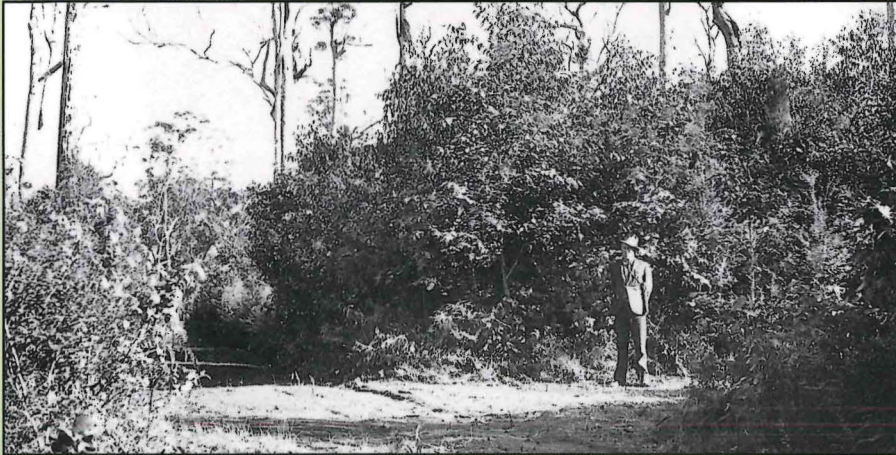
Of the many regenerated karri forests in the south-west, Treen Brook is perhaps my favourite. This forest, straddling the main road south of Pemberton, escaped conversion to farmland in the Group Settlement Scheme in the

1920s, but became a prime source of timber for the Pemberton mill in the 1930s. A few small areas of mixed karri-marri and pure marri were retained, but the remainder was clearfelled. Only seed trees were left in the cutover forest.

The forest could not be regenerated immediately, as karri trees regenerate differently from the annually seeding eucalypts, or species like jarrah. Karri produces seed infrequently, and the dense undergrowth and mature trees must be cleared away before the seed can germinate. Karri regenerates naturally only when a hot fire coincides with a seed year, which may occur only once every 5-7 years. In 1936/37 the whole forest flowered. The following year, foresters ran controlled fires through the cut over stands, seed fell onto the ashbeds and regeneration followed.

The new Treen Brook Forest is now 50 years old. The young trees are already over 60 m high. One section of the forest has been added to the neighbouring Warren National Park. Here, old logging tracks have become popular scenic drives and walks and clear streams are favoured for trout fishing. There are no signs of the old timber camps, the horse and bullock yards have gone long ago, and even the snig tracks and log landings, where the soil was churned to mud, have disappeared, reclaimed by the new forest.

It may be another 50 years or more before the new Treen Brook forest is as grand as the virgin forest it replaced, but the cathedral is being rebuilt!



The beginnings of a new forest - Treen Brook regrowth 50 years ago (above).

Treen Brook today - well on its way to cathedral-like grandeur (left).

Cliff Winfield

THE JULIMAR

The wandoo (white gum) forest is one of W.A.'s most attractive and interesting, although not much of it is left today. Wandoo country was popular with early settlers, especially the open woodlands which were easily cleared and pastured. The best of the remaining wandoo country today is found in the Helena and Darkin River catchments and north-east of Perth between Bindoon and Toodyay in the Julimar Forest.

The Julimar has a remarkable history. In the early part of the century, almost half of it was taken up as farmland. However, most of these farms failed to survive the Depression of the 1930s, were abandoned, and reverted to Crown land. A short time later, the then Forests Department was able to convert the Crown land to State forest. Within a decade, a new forest was growing on the abandoned farms.

Julimar State Forest - wandoo regrowth after logging in the 1960s.

Then came the second part of the Julimar story. Between 1950-70, the forests not cleared for agriculture were cutover to supply logs to the region's sawmilling and woodchipping industries. I worked as a forester in this area in the early 1960s, marking seed trees and regenerating cut over stands. After regeneration work on the cut over stands, the seed trees were kept as an important source of nectar for beekeepers and a refuge for wildlife.

In the wake of this timber cutting and regeneration treatment, a second new forest grew in the Julimar. Today, old stumps still remain where felling took place, although these are disappearing as termites and occasional fires take their toll. The forest, recently nominated as a conservation park, is rich in wildlife (particularly birds and mammals) and continues to be a prime resource for beekeepers and a popular spot for visitors.



To many people, the idea of felling trees or cutting timber out of forests is an emotional and distressing one. To these people, the forest is a cathedral and is irreplaceable. They believe that to fell it is to destroy it - what was once a thing of value and beauty becomes forever a wasteland.

It is true that immediately after a clearfelling logging operation the landscape appears devastated. It is also a fact that in some parts of the world wastelands can develop after timber cutting in forests. But this has never happened in Western Australian forests, and should never happen if the community and its agencies are determined on reconstruction. The history of the First World War battlefields shows that even the most shattered landscape can be rebuilt, and, as illustrated in this story, W.A.'s experience already provides reason for optimism.

Trees are living things in the forest community and, like any other living thing, they experience birth, growth, competition for resources, sickness,

accidents and death. Luckily, our eucalypt forests are tough and resilient. They can cope with the transitory effects of timber harvest, particularly with modern forestry management. For example, road and stream zones are now retained to better protect each area's aesthetic, wildlife and water resource value; fire control is far more sophisticated; and a comprehensive reserve system has been put in place to preserve large areas of virgin forest.

While conservation is the major concern for W.A.'s forest managers, productivity and the beauty of the forest landscape is also of concern. Our job is to care for our natural heritage, in reserves and parks as well as to regenerate and rebuild following disturbance or harvest. These are long term and complex tasks and there are, no doubt, many refinements still to be made. Nevertheless, the success of our regeneration and restoration work to date is very reassuring. To the foresters in CALM, as to forest lovers everywhere, the new forests are a source of pride, and a vision for the future.

ENDANGERED!

by Dr. Andrew Burbidge



Bert & Babs Wells

GOLDEN BANDICOOT

Isoodon auratus

The Golden Bandicoot once occurred throughout the northern half of W.A., the whole of the Northern Territory, the northern part of South Australia, and possibly parts of Queensland and New South Wales. It has disappeared from almost all of its mainland range, and exists only in near-coastal areas of the north Kimberley from the Yampi Peninsula north to Prince Regent Nature Reserve.

Fortunately, it also occurs on three Western Australian islands - Barrow and Middle Islands (Pilbara) and Augustus Island (Kimberley). Black Rats (*Rattus rattus*) have become established on Middle Island leading to concern about the long-term viability of the population there.

The Golden Bandicoot once occurred on Hermite Island, in the Monte Bellos, but the introduction of cats led to its extinction well before the islands were used for the

testing of nuclear weapons in the 1950s.

Golden Bandicoots once lived in a wide variety of habitats, including sandplains, dunefields, and stony country. They sheltered in a grass-lined nest in a shallow scrape, usually under a spinifex hummock or amongst tussock grass. They are very well-known to Aborigines, and were an important Aboriginal food item. I have spoken to Pintupi Aborigines from the Gibson and Great Sandy Deserts who remember eating Golden Bandicoots as recently as 15 to 20 years ago (see 'Vanishing Desert Dwellers', *Landscape*, Winter 1987).

Very little is known about the biology or ecology of Golden Bandicoots and studying them in the wild would be very difficult because of the remote, rugged areas that they now inhabit. A practical alternative is to observe captive animals and compare them with the closely-related and better-studied

Brown Bandicoot (or Quenda) of the South-west.

The first step towards study of the mainland form of the Golden Bandicoot was taken recently. During the recent CALM rainforest survey three animals, two females and a male, were caught. After capture the animals travelled to the base camp at Mt Hart Station by helicopter, then by light aircraft to Derby and then by jet to Alice Springs via Darwin. At last report they were doing well. Alice Springs was chosen as the site for captive breeding because it is within the former distribution of the species, and the Conservation Commission of the Northern Territory is a partner with CALM in the project.

If we can get the Golden Bandicoot to breed successfully, additional animals will need to be captured from the wild so that inbreeding is prevented. In the long term, plans are being developed to re-establish Golden Bandicoots.

LETTERS

Going Bats!

In your interesting article on bats in the latest issue of *Landscape* I thought some of the items on fruit bat problems might be solved by an observation I made on the grey-headed fruit bats of Sydney. I have also been puzzled by the ability of these bats to thrive in huge numbers in regions where blossom and fruit are in short supply. In our suburb I heard fruit bats in a poplar tree and in the morning found thousands of chewed fragments of the growing leaves of this introduced tree. It is therefore quite possible that, like the sugar gliders which tap the sap of tree trunks, fruit bats do not always wait for the blossoms to provide nectar and pollen but obtain it earlier by tapping the sugars being prepared by the plant in its green tissues. By eating young leaves from some kinds of plants the bats could survive lean times.

It might also explain why they are found in country lacking blossoms.

Regards
Vincent Serventy

Sad about Wrapping

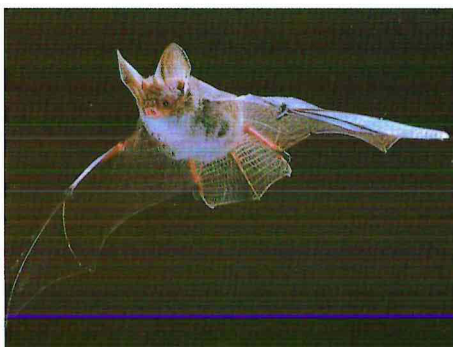
I have subscribed to *Landscape* for two issues now, and I have been impressed with the format, the articles and the professionalism displayed.

How disturbing, then, to see that a publication concerned with conservation arrives covered in hazardous waste!

Plastic is not biodegradable, it emits poisonous gases when burned and in its various forms presents a hazard to animals in the environment. How much more sensible to wrap the magazine in paper. Paper is recyclable and timber is renewable, unlike oil.

Plastic is very hard to dispose of thoughtfully, putting it in a rubbish bin is not enough.

C. Myers, Narembeen



Quiet Achievers

Your item on termites by Tess Williams in the Winter '88 *Landscape* was very interesting.

I'd like to offer a few observations on *Mastotermes darwiniensis*, the voracious giant termite which will even eat through to untreated heartwood in treated hardwood sleepers.

The species is found across northern Australia, the Pilbara being their southern limit of distribution in W.A.

In the Kimberley the species is not only a serious problem for wooden buildings, fences etc. but stories abound of its appetite for rubber (don't leave your car in one place for too long) and plastic (trickle irrigation pipes are a delicate morsel) and almost all kinds of woody plants are fair game. Treated pine poles seem to fare relatively well probably because chemicals penetrate almost right through.

The species is the bane of gardeners and horticulturalists who on some soil types can lose a high proportion of their plantings. Heavy clay soils however do not appear to attract 'Masto' to any great extent.

Methods of control are under investigation. Whilst short term protection can be given from particular colonies 'Masto' seems to be able to find a chink in most protective measures in time.

C. Done.
Kimberley

Fat of the Land

Having read Louise Burch's article 'Urban Antics' in the Winter 1988 edition of *Landscape*, I felt stirred to add a few words about attracting birds to one's urban garden.

We decided some time ago to reduce our cholesterol intake by not eating the fat-laden skin from chickens. Perhaps selfishly, we offered the finely-sliced skin (cooked!) as well as other fat-meat trimmings to a family of magpies who use our garden as a bug-hunting ground. The offer was so enthusiastically taken up that the male will now take food from our hands, although the females have enough caution to restrict their feeding from a regular plastic plate.

The point of this note, however, is that other garden birds have decided to jump on the bandwagon and we are slightly surprised to watch Singing Honeyeaters and both Laughing and Spotted Turtledoves also feeding on the fat. Does anybody know if this is just urban opportunism or are those three species naturally omnivorous?



Evan Biggs, Mt Pleasant

Hill-billies? No way!

The next time Sydneysiders tell me stories about the hill-billies out in Western Australia, I'll jam my copy of your publication in their faces. I am now wondering what sort of publication the conservation folks of New South Wales put out.

I have read more than half my copy and am both pleased and impressed. I am particularly pleased with your focus on the general public. It caused the following thought: have I spent my twelve-and-a-half years in Australia on the wrong side of the continent? I am hoping you will not follow letter-writer Martin Van Bueren's recommendation to make *Landscape* more of a technical journal.

Erik M. Windus, Woodford, N.S.W.

North-west views

Thank-you for allowing me some space on your 'letters' page, Winter Edition. Am I right in assuming my letter was responsible for the theme of your editorial of the Winter Edition?

Both my husband and I are serious about conservation and we also enjoy the Pilbara as tourists. We feel if you want to become more technical in your approach this must be balanced by pertinent information and photographs to attract the tourist sector.

e.g. 1. The ways in which the ordinary person can help stop the immediate destruction of the environment and wildlife.

2. Why national parks are established and what they are protecting and why.

The above points are some of what you cover now in your magazine, and they should not be forsaken for the technical issues. Sometimes after listening to radio programmes such as 'Earthworm' and 'The Science Show' I feel like slitting my throat, but your magazine gives me hope because I can see you *doing* something.

Publications for the home gardener seem few and far between, and as it is recommended (and we prefer) to plant natives indigenous to the area for the encouragement of native birds and insects and, not the least, conservation of water, would it be possible for you to publish an article which deals with the plants and management of an arid type native garden in the Pilbara?

One last point. Re M.A. Lewis' letter in the Winter Edition. I disagree. Is it assumed the 'unruly and antisocial' do not own dogs and would not want to bring theirs along to the national park as well? Save us! And as a mother of young children I know that if there is a 'turd' around my children will bring it back on their shoe. However, I think I am missing the point, because aren't dogs banned in order to protect wildlife?

S.D. Worrall-Hart, Newman

Competition

National parks mean different things to different people. Some go to see the animals, some go to see the flowers. Others go just to enjoy some sunshine and fresh air.

If you are a school student, here's your chance to tell us what you think - and you could win a great prize, too. All you have to do is tell us, in less than 200 words, what W.A.'s national parks mean to you.

Entries will be divided into two categories: one for primary school students (Years 1-7), the other for high school students (Years 8-12). The best entry in

each category will win a set of two beautiful books, *Beating about the Bush* and *Wild Places*, *Quiet Places* which will give them a chance to visit all the best parks and places around Perth and south-east to Eucla.

Entries must be received by November 4, 1988. Don't forget to write your name, age and address on the back of the envelope and on top of your entry. Send your entry to:

The Editor
Landscape
50 Hayman Road
COMO W.A. 6152

Filling the gap

I have recently arrived in Perth from New Zealand where I have been involved in environmental issues as a professional advisory officer, government consultant and personal advocate for almost fifteen years. During my time I have contributed to and edited many environmental magazines and journals, but I have to admit that your *Landscape* is on a far superior level. Well done!

In the Winter 1988 edition your editorial asks readers for their views on whether *Landscape* should be more general or more technical in nature. My view is the former - very much so. There are lots of technical magazines and learned journals for those seeking detailed knowledge. My cursory overview of the environmental scene here also shows that there is a number of 'grass roots' conservation and environmental newsletters. Your magazine fills the gap between the 'cheap' newsletter and technical bulletin. It is to me a highly

readable, visually pleasing, informative magazine designed to educate, inform and entertain (in a visual sense) the intelligent populace who cares for their environment.

Continue to fill the need for an informative magazine for the general public. I believe if you do this then future success is assured. Please don't go technical.

Ross Dowling, PhD student,
Environmental Science, Murdoch
University.

Your letters are welcome. Please address any correspondence to:

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