



# Western Wildlife



NEWSLETTER OF THE LAND FOR WILDLIFE SCHEME

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## WOYLIES FIND NEW LAND FOR WILDLIFE HOMES

A really exciting event happened on 7th Dec - woylies were released on Don Watts' property 'Wildwater' and Warren Tucker's property, 'Sunnyvale', at Harvey. This is a **FIRST** in WA fauna recovery programmes!

Fox predation has meant that the medium-sized native mammals are missing from many otherwise excellent areas of bushland habitat. Many *Land for Wildlife* members are really interested in seeing these animals come back onto their properties again.

Western Shield, CALM's widescale fox baiting programme, has enabled woylies to build up in many reserve areas. From places such as Dryandra, Batalling and Perup, woylies have been translocated to other CALM reserves or securely-fenced private sanctuaries. But now, for the first time ever, they have been released onto 'ordinary' private property.

Peter Orell, the zoologist in charge of the translocation, said that, to be eligible to receive translocated animals, there are two things a landowner must have. One is suitable habitat, and the second is a suitable regime of fox baiting, on the property and surrounding area. Connectivity to other habitat is also a plus.

Both Don and Warren had registered their interest in translocations when they first joined *Land for Wildlife*. Both properties



Above: Peter Orell demonstrates how to hold a woylie.

Top right: Don Watts - ready to go!

Right: Warren Tucker - he's off!



have excellent quality *LFW* habitat, are within the woylie's former range and the landholders bait at least four times a year. Don has also monitored mammal numbers since he started fox baiting in 1994. Then, he trapped six brushtail possums. Later he has caught sixty! Fox baiting has clearly been effective.

If you are interested in this programme, contact your local *LFW* Officer to discuss the possibilities. If you have good to excellent habitat and are controlling foxes, then putting some medium-sized marsupial fauna back into your bushland may be closer than you think!

# EDITORIAL

## Greetings everybody!

**W**ELCOME to the fifth year of *Land for Wildlife WA!*

We are now entering a new and most exciting phase - two *Land for Wildlifers* have received woylies translocated onto their property from reserves elsewhere! This is a most interesting development, as, for the last 50 years or so, the majority of bushland in the southwest of WA has been missing one essential element of the ecosystem - medium-sized marsupials. Now, a real possibility exists that you can put these animals back into your bushland - provided you are controlling foxes .....

I am very pleased to say that will soon have a *Land for Wildlife* Officer stationed in Esperance. Volker Mischker will be well known to people in the region as he has, for many years, been providing

revegetation advice - starting way back, with One Billion Trees! Contacts for Volker, and all the other *LFWOs*, are in the box below. Please pass the contact to anyone you know in the Esperance region.

Thanks to Chris and Joan Moffat for their suggestion for 'Bush Detective'. Has anyone else got

any odd things to puzzle us with? Photos, drawings, observations - even if you don't know the answer to the puzzle it would be fun to try and find out!

Best wishes for a productive year, both economically and environmentally, in 2001.

*Penny Hussey*

### *Land for Wildlife* statistics to the end of Nov 2000

Total registrations	748 landholders
Yet to be visited	194 landholders
Total property area of the 554 visited	460,635 ha
Total area of LFW sites visited	88,957 ha (on average, 19% of the property)

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## OOPS!

Somehow, between proof-reading and final copy, a pic got altered in the last issue. On p9 a Bloodroot appeared instead of a Chocolate Lily, *Arthropodium*. This is what should have appeared:

Apologies to the author and artist, Eric McCrum, and to confused readers.



## FAUNA

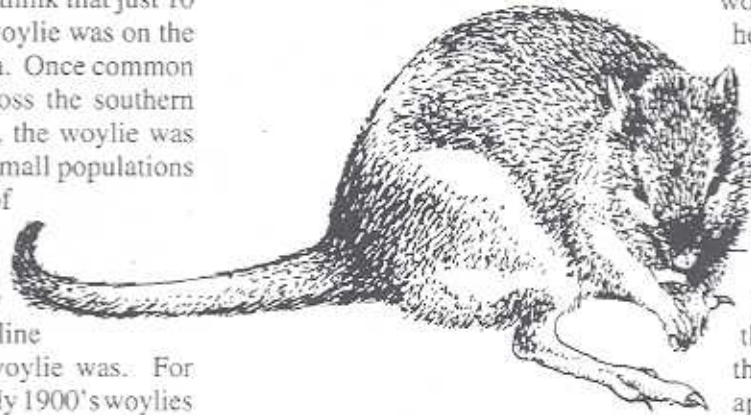
# HOPPING SOIL! WOYLIES DIG UP A TREAT IN OUR REMNANT WOODLANDS.

By Mark Garkaklis

IT'S amazing to think that just 10 years ago the woylie was on the brink of extinction. Once common and abundant across the southern third of Australia, the woylie was reduced to a few small populations in the southwest of Western Australia. It is worth reflecting on how dramatic this decline in range of the woylie was. For example, in the early 1900's woylies were sold by the dozen on market days in South Australia. What for? Well, to train greyhounds. By 1925 there were no woylies left on the South Australian mainland and the decline was so fast that it caught everyone, including the SA Museum, by surprise.

Thankfully, conservation measures implemented by CALM aimed at saving this rat-kangaroo have been a success. In 1996 the conservation status of the woylie was reclassified to not threatened, and visitors to conservation reserves, like Dryandra or the Perup, can now see and enjoy these animals. But perhaps the greatest benefit from woylie conservation will be the opportunity we have to learn about how our woodland, forest and rangeland ecosystems function. To do this we need to have all aspects of these systems in place: the plants, the soil and the animals.

I remember taking students on a field-trip to Dryandra in 1993 and getting the chance to observe woylies in large numbers for the first time. It was remarkable to walk around Dryandra and to see the number of diggings that these animals make. The comment we all made was "they dig a lot don't they." Woylies like to dig-up and eat a variety of bulbs like *Haemodorum* (a relative of kangaroo paws) and



Guildford Grass. They also bury, or cache, seeds and fruits for example, Quandongs. But perhaps their favourite food is truffles. These truffles are the underground fruits of a group of fungi called mycorrhizae and the spores from the fruits of these fungi can be found in the droppings of woylies. We now know that mycorrhizal fungi have a close association with our woodland and forest flora. In fact, these fungi are believed to be responsible for shunting 25% of the nutrients that eucalyptus trees need to survive and grow. In return the trees provide the fungi with sugars that they have produced from photosynthesis. The trees and fungi appear to rely on each other to maximise their productivity in the nutrient poor Australian soils.

But perhaps there is another link in this relationship. The woylie. For several years researchers have been intrigued by the relationship between woylies, truffles and the vegetation. It would appear that it is a win-win situation for everyone involved. Woylies gain by eating the truffles of the fungi, the fungi gain by having their spores distributed around the woodland by the woylie and the trees gain by having a healthy and diverse group of mycorrhizal fungi. In turn, the

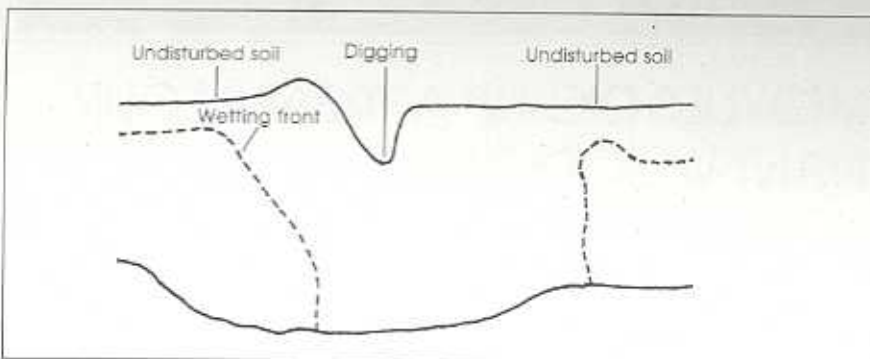
woylies also benefit by having a healthy woodland habitat in which to live. The implication of this relationship are obvious - remove one link and we may affect both the fungi and the trees.

But perhaps there is more to woodland ecosystem function than just the woylie, fungi and the vegetation. To eat the fungi the woylies have to dig and it now appears that this may have just as important implications for the management of our woodlands and forests since it could affect another component of southwest Australian ecosystems - the soil.

With the recovery of the woylie we have our first opportunity to examine how these animals interact with the soil. Initial results are surprising to say the least. It turns out that a woylie can make in excess of 100 small diggings a night. Most of these are about 5 cm deep, but they may be as deep as 15 cm when the animal is digging for bulbs. The numbers soon begin to add-up. In a single year a woylie can turn-over in excess of 5 tonnes of soil. This in itself is a remarkable effort. But it's what happens after the digging that is really interesting.

The main place where woylie digging has been studied is at Dryandra Woodland, just over 2 hours drive to the southeast of Perth. The soils at Dryandra have a characteristic that is common to many soils on the Swan Coastal Plain and the Wheatbelt. They are water repellent. The reason they are water repellent is that waxes from the leaves of eucalyptus trees and organic compounds from soil fungi coat the soil surface. When rainfall hits this water repellent surface layer it can not penetrate, and it pools and runs-off. Water repellency forms

Woylies, continued from page 3



Water infiltration pattern after rainfall in the vicinity of a woylie digging.

as a crust-like feature at the soil surface, whilst underneath the soil is water absorbent. When woylies dig for food they break through this water repellent crust and expose the water absorbent soils. The result is that water from rainfall is able to infiltrate the soil via the woylie diggings. Take the woylies out of the system and we lose this unusual characteristic of our soils.

It appears as though many characteristics of our soils are affected by woylie digging. These include the bulk density, the distribution of gravels at the surface and the behaviour of soil nutrients. It would be fair to say that when we look and appreciate woylies as they are going about their business we are, in fact, looking at a part of our soils. They make our soils 'patchy' in terms of their characteristics and behaviour. But the story will not end with woylies. With Western Shield now in-place there is the real chance that other animals, such as boodies, bilbies and our often forgotten rodents, will make a come back. These animals don't just dig - they burrow! How these animals interact with our soils we can only guess.

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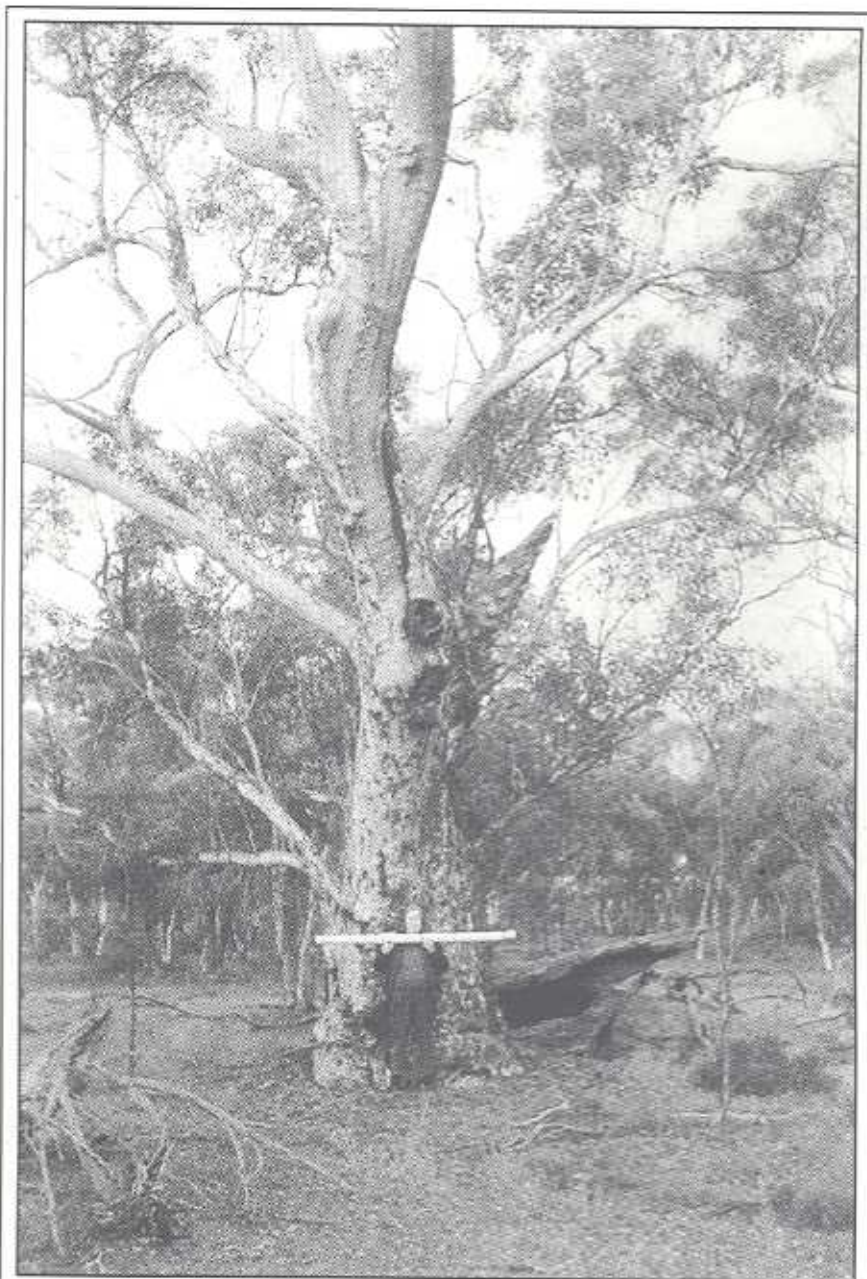
Further reading:

Garkaklis M.J., Bradley J.S & Wooller R.D. (1998). The effects of woylie foraging on soil water repellency and water infiltration in heavy

textured soils in southwestern Australia. Australian Journal of Ecology 23: 492-496.

Lamont B.B. (1995). Interdependence of woody plants, higher fungi and small marsupials in the context of fire. CALMScience Supplm. 4: 151-158.

Morris K., Armstrong J., Orell P. & Vance M. (1998). Bouncing back: Western Shield update. Landscape Spring edition.



Is this the oldest Inland Wandoo in WA?

Agnes is standing in front of 'Wonder Tree' in our bushland at Dudinin. The pole she is holding is six feet long. How old does that make the tree? 1000 years? The table in "How to Manage Your Wandoo Woodlands" doesn't get that far!

Toby Goodhart

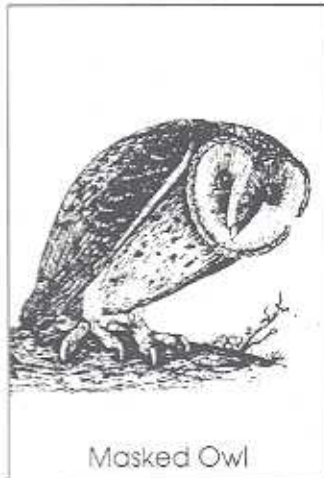
## FAUNA

# OWLS IN THE SOUTH WEST OF WESTERN AUSTRALIA

*by Ian Wheeler*



Barn Owl



Masked Owl



Boobook Owl



Barking Owl

FOR those people who frequent the bush at night-time - walking, camping, spotlighting - many are rewarded with hearing the vocalizations of our owls, and even luckier are those rewarded with a glimpse of these beautiful and seldom seen birds. Unfortunately most owls seen are road kills, where they are often hit whilst hunting. Owls, being the equivalent of our day-time birds of prey, obviously hold a very important role in the ecosystem. How well do you know the owls?

Let's begin. Tawny Frogmouths are often called owls, but in fact are frogmouths not owls; Owllet Nightjars are nightjars not owls. Masked Owls fortunately are owls and so are Barn Owls. Boobooks are owls, and Barking Owls are not dogs but owls.

Confusing, but quite simple really. In the South West we have four owl species, belonging to two genera. The *Tyto* owls, "the white-faced owls", have two species, the Barn Owl and the Masked Owl. The *Ninox* owls have the Boobook and the Barking Owl.

### Barn Owl - *Tyto alba*

The Barn owl is generally associated with open paddocks, and very few scattered trees, it likes

relatively open country. Barn Owls eat mostly mice; small rats and occasionally small rabbits, but generally it is a rodent specialist.

### Masked Owl - *Tyto novaehollandiae*

The Masked Owl, which looks very similar at first glance to the Barn Owl, is a lot larger in size and takes much larger prey. This bird too is one that has a liking for open forest such as Dryandra forest. The edges of forest and farmland are where they hunt and they venture into farmland where suitable patches of trees occur. They catch rabbits, birds, possums, bandicoots and other similar sized prey. Very little is known about its distribution in WA.

### Boobook Owl - *Ninox novaeseelandiae*

The Boobook Owl commonly occurs across the landscape in all forest types of varying density to open farmland. Its diet is extremely diverse, ranging from insects through to rats, rabbits and birds. It is quite an opportunist, which is probably why it is still relatively common. This owl has the most frequently heard call during spring.

### Barking Owl - *Ninox connivens*

The Barking Owl is probably the least common of our owls. It appears to frequent more open country, but is recorded in the literature as often been associated with some water features such as dams, rivers, and wetlands. The Barking Owl's diet consists of possums, rabbits and, in the eastern states, some birds live almost exclusively on a diet of birds - White-wing Choughs, Rosellas and a whole range of other species. Very little is known about the Barking Owl's distribution in WA.

In spring 1999 and autumn 2000 the first systematic survey of owls in the South West of WA was conducted by CALM. The study focused on the Masked and Barking Owls in State forest and national parks. The area covered was from Toodyay in the North, through York, Narrogin, and the Stirling Range National Park to Two Peoples Bay in the east, Walpole on the south coast and over to Augusta/Margaret River on the west coast.

100 sites were selected and surveyed twice, once in spring and once in autumn and all nocturnal birds and mammals recorded. The sites were selected to also cover a whole range of logging histories

# FAUNA

Owls in the South West continued from page 5

from no logging through to logged three or more times. Seventy of these sites were in the Jarrah, Karri, Wandoo and 30 sites were in the Jarrah Wandoo woodland and forest fragments.

At each site, 15 minutes was spent listening for unelicited calls, followed by 10 minutes of playback using pre-recorded Masked and Barking Owl calls and listening for responses. Finally 10 minutes was spent searching a 1-hectare plot for any birds or mammals present.

## Results

A total of 211 Tyto and Ninox owls were recorded on 67% of the sites. 196 of these records were

Boobooks and 15 were Masked Owls. In addition to the owls we recorded 76 Australian Owllet-nightjars and 20 Tawny Frogmouths. There were also three very tired researchers 7000 kilometers later!

WA is a big state, which makes coverage very difficult, but from this survey we can begin to build a picture of owl distribution in the South West. Can you help? We are particularly interested in the Barking and Masked Owls. The distribution knowledge for these species is sparse and it is important to get more records to give a better understanding of where these owls are living and hopefully their habitat requirements.

## What can I do?

Find out what owls you have.

- ▶ Fence out that remnant vegetation to get some regeneration happening.
- ▶ Leave those old trees for nesting or possibly put up nest boxes if you have young regeneration and no old trees.
- ▶ If you have a healthy patch of bush you should have lots of insects, birds and mammals, and hopefully some owls.

Please forward any sightings of owls to Ian Wheeler: ph 9771 7994 or

Email: IanWheeler63@hotmail.com or ianwh@calm.wa.gov.au

*Ian Wheeler grew up in the wheatbelt and moved down south to work with CALMScience on forest ecology. He is very involved in the conservation of plants and animals and the role that landholders can play in this.*

## OWL CALLS

Barn Owl	rasping screech
Masked Owl	strong harsh hissing/screech, also chattering
Boobook	ma poke, or double hoot - repeated monotonously
Barking Owl	series of barks or woofs (very dog-like), also human-like scream

# WEED ALERT

## WATCH OUT FOR BRANCHED BROOMRAPE!

A serious worldwide crop weed has been found in South Australia. Branched Broomrape (*Orobanche ramosa*) is a major weed of pulses, oilseeds and vegetable crops - if established, for example, on canola, it could lead to severe losses. Its effect on native species is unknown.

All Broomrapes are parasites on the roots of host plants, and have no chlorophyll. They produce hundreds of thousands of tiny seeds. Branched Broomrape is fairly small, up to 30 cm high, with pale blueish flowers. As the name suggests, its stem *branches*,



Branched Broomrape

which the stem of the Common Broomrape (*O. minor*) never does. The latter is common on capeweed and other broad-leaved weeds on roadsides; in gardens and in crop and pasture paddocks. Despite its size (it can grow to 1 m tall) it is not an economic problem.

If you see a suspect **BRANCHED broomrape** plant, collect it and a portion of its host, mark the site where you found it, and contact AGWEST Weed Science Branch. A colour leaflet to help with identification can be obtained from AGWEST.

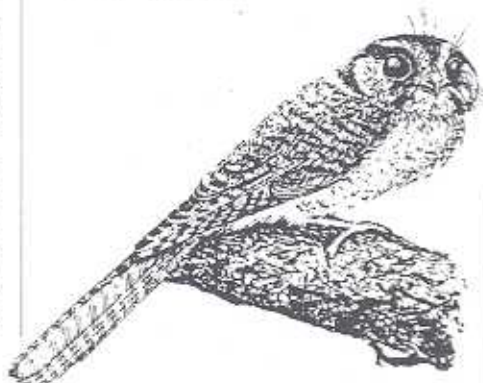
## FAUNA

### OWL SURVEY – A COMMUNITY GROUP FIRST IN WA

by Jenny Dewing



Tawny Frogmouth



Australian Owlet-nightjar

**M**OST of us experience owls only as pictures in bird books or the occasional encounter on a country road at night. Some of us are familiar with the characteristic call of the Boobook.

In July, Ian Wheeler from CALM Science inspired members of the Blackwood Environment Society with a talk on Owls of the South West. Landholders were keen to learn more about these much admired birds. Ian suggested a Community Owl Survey and the audience responded enthusiastically. He provided a tape of owl calls, which landholders are using to improve their recognition skills.

Recent work by CALM is gathering information about the conservation status of these important birds, particularly the Barking Owl, *Ninox connivens connivens* (Priority 2) and the Masked Owl, *Tyto novaehollandiae* (Priority 4). Priority 2 taxa need urgent survey and evaluation of conservation status whereas Priority 4 taxa are considered to be in need of monitoring.

On Saturday November 18th, 33 Environment Society members, including 16 Land for Wildlife members undertook the district-wide owl survey.

The survey aimed to sample a wide range of sites around Bridgetown where owls are likely to occur, particularly the priority species. Sites were chosen around the Blackwood River, in State forest, at the interface between paddock and bush and along major tributaries. A team of seven people spent an extra evening before the survey to train as group leaders so that the survey could cover more sites. Fourteen sites were surveyed on November 18th, and two on the training session.

The survey is simple. It is designed to be compatible with

current surveys so that the data can be included. The procedure for each site is as follows:

- ▶ On arrival at the site, fifteen minutes is spent listening for any owls that may already be in the area. Owls already present often call and leave quickly when they are disturbed.
- ▶ The listening is followed by ten minutes of playback. The owl tape is amplified through a megaphone to increase the coverage of the sound. Between calls, the group listens for an owl response in the form of a call or shape flying overhead. Once an owl is sighted, spotlights are used

to confirm the identity of the bird. It takes some skill to get a spotlight onto the bird before it disappears.

- ▶ After the tape playback a further 10 minutes of spotlighting is carried out to note possums, phascogales and other forest creatures. This information adds to our knowledge of local fauna.
- ▶ Information on habitat type, weather conditions, time and a GPS location is also recorded.

Ideally sites are surveyed four times a year. Owls hunt over a large territory, for Masked Owls some 800 hectares, so it is possible to miss them if they are preoccupied at the other end of their territory. Experience suggests that one visit gives a 30% possibility of detection and rises to 90% for nine visits if they occur in the area.

In the Bridgetown area we are particularly keen to learn the status of the Barking Owl, the largest of these birds. Commonly people say that they have heard one, many years ago, but there are few recent reports. It is hoped that the survey will tell us more about the population status of the birds and the kinds of habitat that they prefer in this area.

Our survey identified Masked Owls at three of sixteen sites, together with a Boobook, a Tawny Frogmouth, an Australian Owlet-nightjar, bats and a number of Brushtail Possums. Conditions were windy which reduced the effectiveness of the playback system. The group has committed to repeating the survey four times next year commencing in February 2001.

*Jenny Dewing is LFW Officer at Bridgetown. She can be contacted on 9761 2318.*

**M**ISTLETOES! Maybe we should begin with these plants, typically summer-flowering, and traditionally associated with Christmas, though less so here than in Britain where the mistletoe at that time, the depth of winter, is in fruit. During our summer, look into wattles such as the Jam Tree and you will spot the Wireleaf Mistletoe (*Amyema preissii*) clinging firmly to the branches, with bright red flowers among the narrow leaves. Around Perth they have 'invaded the invaders' by adapting to non-native species such as the Queensland Silver Wattle. In the Wheatbelt, look into gums such as York Gum and Wandoo and you will see a different species, *Amyema miquelii*, its leaves mimicking those of its host. Maybe mistletoes have evolved to flower at this season because they can provide food for the birds that pollinate them. Drawing on their host trees for moisture and sustenance, the summer drought does not affect them.

Not always thought of as a mistletoe but belonging to the same plant family is the Western Australian Christmas Tree, almost unique among these semi-parasitic plants in being a large tree. It is at its flamboyant best in early summer (and this year is out earlier than usual), but along the south coast it will flower well into summer. Most mistletoe flowers are unscented, but the Christmas Tree has a strong honey perfume. Towards the end of summer the strange three-winged fruit develop, yellow-green at first, ripening to a mid-brown as they dry and fall for the winter rains.

It is commonly held that our native plants flower only in spring, but this is an old wives' tale, originating perhaps from the fact that most massed displays may be seen at that season which is also a good time for travelling. Apart from very few habitats, there is, in fact, something to be seen at any season, and some summer, autumn and winter flowers are just as colourful and intriguing as those of the spring. Indeed, summer flowers are quite amazing in their capacity to appear at a time when temperatures can be

## FLORA

### SUMMER WILDFLOWERS OF SOUTHERN WESTERN AUSTRALIA

by Alex George



*Xylomelum angustifolium*



*Grevillea polybotrya*

very high. Some are so delicate that it is a wonder that they avoid shrivelling and carry through pollination and seed set. Here I have space to mention only a few of these plants.

The northern kwongan has many summer flowers, especially in the banksia and myrtle families. Summer Smokebush (*Conospermum crassinervium*) appears in large drifts on sandy areas, its funnel-like flower head waving atop a slender stem. It is at its best a couple

of years after a fire (Christmas Trees also respond to fire, sometimes showing no foliage as their blazing flowers cover the tree). Summer Dryandra (*Dryandra vestita*), seen on the northern kwongan and through the central wheatbelt, has rather hidden golden flowers but is equally attractive for its whorls of twisted leaves separated by bract-covered stems. Around Eneabba and northwards Caramel Grevillea (*Grevillea polybotrya*) is showy during December and January, its creamy, heavily-scented flowers attracting a wide array of insects. An equally showy species with masses of cream flowers in summer is *Grevillea nematophylla*, a tree of inland districts between the Gascoyne River, the Goldfields and Nullarbor Plain. Another small tree is the Sandplain Pear (*Xylomelum angustifolium*) which also bears clusters of cream flowers; its grey woody fruit remain on the tree awaiting a fire to open them and are an interesting feature at any season.

Banksias are prominent in summer and autumn. Indeed, more species are in flower at these seasons than in spring. Acorn Banksia (*B. prionotes*) is a widespread orange-flowered species, found between Wagin and Shark Bay, with a long flowering period through summer and winter. Its close relative *B. burdettii* is a shrub seen between Eneabba and Muchea but flowering only during February and March. In Kalbarri National Park there are further spectacular species flowering in summer. First is *B. sceptrum*, with large golden spikes during December and January, followed in February by the Woolly Orange Banksia (*B. victoriae*) and clear yellow Porcupine Banksia (*B. lindleyana*).

Along the south coast from the Stirling Range to the Oldfield River *Banksia baxteri* can make spectacular displays at this season. It is another species with attractive features besides the flowers, both the young foliage and new fruit being attractive shades of brown and red. In February, sharp-eyed visitors to the western parts of the Stirling



continued from page 8

Range may spot the curious *B. aculeata* which hides its red and yellow hanging spikes within very prickly foliage. Its fruits are among the largest of any banksia. Travellers along the highway east of Southern Cross may see, in the kwongan in December and January, the small shrubby *B. audax* with intense golden flowers.

Some of our most colourful eucalypts bloom in summer. In January and February the scarlet blossoms of Red-flowering Gum (*Eucalyptus ficifolia*) may be seen in its restricted wild habitat, on the south coast near Walpole and occasionally farther east. Much more common is its near-relative the Marri (*E. calophylla*), its creamy white flowers a rich resource for beekeepers. This year in many areas Marri had two major flowerings, its normal one in late summer and another in May/June. The latter seems to have been a response to the heavy rain that fell in January, an interesting 'throwback' to its presumed origin during a time when the climate was tropical. Most bloodwoods are tropical trees. If you wish you may recognise these gums as a genus distinct from 'true' eucalypts and call them *Corymbia*. Experts are divided in their opinions on this point, but either name is acceptable.

Summer and autumn also see the flowering of the curious Illyarrie (*E. erythrocorys*). Growing naturally from Jurien north beyond Kalbarri, its straggling form is enlivened by the large buds with sculptured scarlet caps that fall to expose clusters of yellow stamens. The massive gumnuts that develop later are also strangely sculptured.

Though its small cream blossoms are rarely noticed, Karri (*E. diversicolor*) flowers during the hot months, as does the Swamp Yate (*E. occidentalis*). One may become aware of the flowers only by seeing them fallen on the ground. Summer-flowering mallees of the South-West include White-leaf Mallee (*Eucalyptus albida*), Hook-leaved Mallee (*E. uncinata*), the blue-leaved Tallerack (*E. pleurocarpa*, formerly known as *E. tetragona*) and Yuna Mallee (*E. jucunda*).

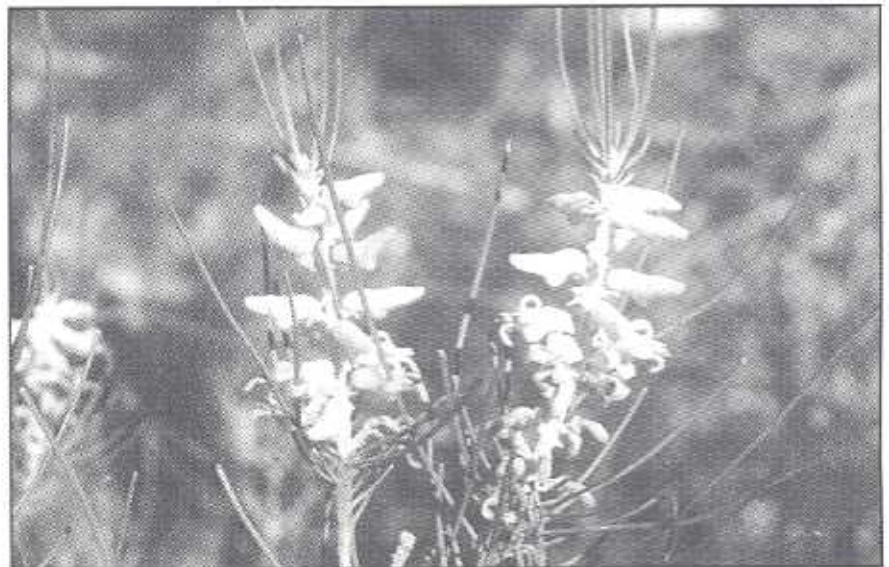
## FLORA

In December the Morrison Featherflower (*Verticordia nitens*) vies with Christmas Trees as its brilliant orange flowers bestrew banksia woodlands north of Perth. Its flowers have a curious 'hot metal' scent. Scarlet Featherflower (*V. grandis*) may be seen in flower at any season between Badgingarra and Geraldton. Other summer featherflowers include the white-flowered *V. albida* near Three Springs, the pink and silver *V. argentea* near Eneabba, and the bright pink *V. tumida* in the central and south-eastern wheatbelt. In late summer, depressions in the kwongan between Albany and Esperance may be colourful with the pink flowers of *V. sieberi*.

Two striking bright red bottlebrushes are *Beaufortia squarrosa* and its recently named

close relative, *B. aestiva*. The former is a small shrub, locally common in low-lying flats and sandy slopes from the Whicher Range north to Eneabba, flowering mainly in February and March. *Beaufortia aestiva* (the species name means 'of summer') is a larger shrub seen from the Eneabba district north beyond Kalbarri; it has been recorded inland at Wongan Hills and Tammin but may have disappeared there now. Besides red flowers it commonly has yellow ones. Flowering starts in late spring and continues throughout summer.

In sandy woodlands near the west coast (where summer sees the last flowers of *Banksia attenuata* and the first of *B. menziesii*) the bright pink Summer Fringe-myrtle (*Calytrix fraseri*) is at its best from mid to late summer. Two more bright myrtles of the kwongan north of Perth are the widespread cerise Summer Coppercups (*Pileanthus*



*Personata saccata*



*Cephalotus follicularis*



*Beaufortia sparsa*

IT has always been exciting to do a 'birding' around the big salt lakes and salt channels in the Murchison - sight of an Orange Chat at Lake Austen or on the Lyndon River being a prize.

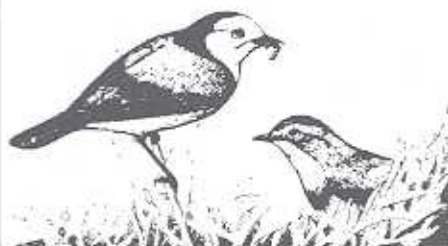
However, in the salt-affected areas of the northeastern wheatbelt the scene varies greatly. There are less small (< 20 cm) land birds in the samphire immediately surrounding the salt lakes and channels. At the end of August 2000, four sites were surveyed for the Bird Atlas. Two received fresh run-off from a large granite rock, one in woodland just behind the low sand dune surrounding a large salt lake and the fourth was in an 'early' samphire area surrounded by degraded crops on two sides, elsewhere by low shrubs grading into woodlands.

The sites with run-off from granite hills yielded many small birds in the fringing shrubs (up to 2 m high) including: Western Gerygone, Grey Fantail, Singing Honeyeater, White-eared Honeyeater (at its northern-most range) and Horsfields

## IN BRIEF

### SMALL LAND BIRDS IN SALT AFFECTED AREAS IN THE NORTHEASTERN WHEATBELT

by Mary Bremner



White-fronted Chat

Bronze-cuckoo. One of the sites had many Native Plum bushes (*Psyrax* sp.) covered in green fruit.

The woodland site had large old Salmon Gums and York Gums with numerous nesting hollows and fallen logs, but no young trees and little undergrowth except for some flowering Daisy-bush (*Olearia* sp.).

The only small bird seen was the Singing Honeyeater. Why the paucity of bird life? Although the eucalypts were not producing nectar there should have been plenty of insects.

The fourth area was a hive of activity, with Red-capped Robin, White-fronted Chat and Splendid Fairy-wren. There was possibly a lot of other small animal life, as Nankeen Kestrels and a Black-shouldered Kite were circling overhead. Perhaps it was the fact that it was the junction of four habitats that made this area so good for birds?

The Salinity Action Plan commenced in 1997. Are we 'birdos' taking enough interest in these saline areas? How important are they or, with revegetation, could they become?

*Dr Mary Bremner is a medical professional, orchardist, and keen 'birdo'. She can be contacted on 9321 4594.*

Summer Flowers continued from page 9

*filifolius*) and Superb Starflower (*Calytrix superba*), the latter confined to the Eneabba district. Through the central wheatbelt one can be surprised to see the deep pink flowers of Large Myrtle (*Hypocalymma puniceum*).

Worth a look at any time in summer are the swamps of the far south-west and south coast. Soil moisture keeps a number of species flowering, and some are at their peak during the hot season. Among the most spectacular is the Swamp Bottlebrush (*Beaufortia sparsa*), at its best in February. The pure white-flowered Swamp Paper-heath (*Sphenotoma gracile*) is very common on sandy flats between Augusta and Albany. A few orchids may be seen well into January, in particular the tall Christmas Leek Orchid (*Prasophyllum brownii*), seen at its best the season after a bushfire, the Chestnut Sun Orchid (*Thelymitra fuscolutea*), and the Club-lipped Spider Orchid (*Caladenia corynephora*). In shady

forests south from Perth the Slipper Orchid (*Cryptostylis ovata*) can be a surprising find. It is pollinated by male wasps that try to mate with the flowers, and flowers right through to autumn.

Most people are familiar with the Albany Pitcher Plant (*Cephalotus follicularis*), at least its modified leaves that trap minute animals and decompose them to provide nutrients for the plant. Few, however, know the plant's tiny flowers. These appear in summer, on long stalks. They have a strong, sweet scent. Always associated with the pitcher plant is the unusual Spindle Heath (*Cosmelia rubra*), with narrow red flowers borne on a slender stem that waves above the dense swamp vegetation. These swamps, and other low-lying parts, are also home to the climbing triggerplant (*Stylidium scandens*) which clings to other plants by its encircling leaf tips and produces clusters of bright pink flowers throughout summer.

An unexpected sight in many parts of the south-west - from the forest to the desert fringe - is the climber *Billardiera bicolor*. Inconspicuous for most of the year, in summer it produces clusters of cream flowers with fine purple lines, opening widely like a hand.

On coastal sand dunes and a little way inland, from Perth to Albany, is the Tangle Daisy (*Ozothamnus cordatus*). A perennial herb, it produces its new stems and foliage during winter, then the leaves die away as the flowers develop in clusters on many fine woolly branches. Picked and dried, these will last indefinitely in dried arrangements.

I do not have space to discuss many other summer flowers of our bushland. Go out yourselves and look (but maybe choose a cool change to do so); you may be pleasantly surprised.

*Alex George is a freelance botanist and editor (phone 08 9337 1655)*

## RESEARCH

## HOW MUCH WATER DO TREES USE?

by Stuart Crombie

A major aim in forestry is to be able to predict tree water use over a wide range of conditions. By knowing how trees respond to drying soils, hot dry atmospheres, salinity and other factors we will also be able to predict which trees will do best in particular locations.

While each species has its own way of reacting to different environments, some general rules have been worked out by studying trees in natural woodlands and plantations.

These studies have shown that there is no magical tree which is completely drought tolerant. In the long-term tree water use cannot exceed long-term water inputs (i.e. rainfall) without the tree suffering severe drought. Assemblages of trees and understorey species in native stands have developed links ("feedback loops") between water availability and water use to keep total water use in balance with long-term water inputs. Dryland agroforestry seeks to recreate some of these balances between water use and rainfall to achieve long-term survival and water use targets.

Total leaf area is the main determinant of water use of both single trees and whole stands. The drop in leaf area from the karri forest, through the jarrah forest and wandoo woodlands to the mallees and scattered trees in deserts is an expression of this balance between water inputs from rainfall and loss from leaves. The bigger trees (which have more leaves) along water courses compared to hillsides and the stunted trees on shallow soils over rock reflect smaller scale differences in water availability.

Growth rates are also very tightly linked to leaf area because it is the leaves that capture light and use it to make sugars that eventually end up

as wood. In a low rainfall environment, having fewer leaves is one of the simplest ways for a tree to reduce water use and avoid drought. However, because the low leaf areas reduce growth rates, a low leaf-area tree avoids drought stress at the risk of being out-competed by faster growing neighbours. Fast growing trees with large leaf areas and high rates of water use dominate in moist environments such as the karri forest where access to light, not water, is the key to competitive success.

Trees have evolved many strategies to limit water loss in low rainfall environments. While all trees can close the pores (stomates) in their leaves to reduce water loss, some leakage still occurs. Some species avoid this by simply dropping their leaves in the dry season while others hold their leaves but have to tolerate increasing drought stress during summer.

Mallees often have shiny leaves hung vertically in self-shading bunches to reflect a lot of the midday heat that drives transpiration. The arrangement of the multiple trunks

and branches of mallees in spreading "V" shapes form a collection system directing water to the base of the tree and away from the roots of competitors. Mallees sometimes have built-in "flow restrictors" between their roots and leaves so that even when soils are moist the leaves are semi-drought stressed and limit water loss to conserve soil water for use later in summer.

Watertables are difficult for trees to use as roots seldom function efficiently when submerged in water. Groundwater is particularly difficult for roots to grow in as watertables are frequently low in oxygen, may contain toxic acids or ions and are often saline. Trees growing over watertables are often not drawing their water from the watertable itself but from the thin layer of moist soil immediately above it. Unfortunately, capillary rise of water into this zone is slow and trees dependent on it seldom transpire at high rates. Typical maximum rates of withdrawal from watertables (or the capillary zone above it) are equivalent to the input of 1-2 mm of rainfall per day.

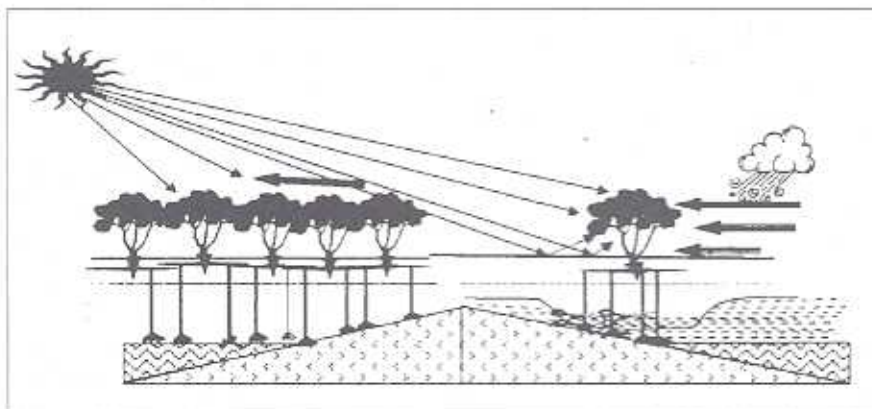


Figure 1. Trees growing in isolation in paddocks are in a more drying environment, with a greater part of the canopy exposed to heat from the sun or ground, and to greater wind movement than are trees in woodlands where they tend to shelter each other. Although paddock trees have less competition for soil water from neighbours, they are also at greater risk of rising watertables which may lead to root loss through immersion or salinity.

## FLORA

continued from page 11

However a tree able to use groundwater, may gain enough advantage over competitors by surviving or growing during dry periods, to dominate the site.

### Some actual figures

Under ideal conditions trees can use water at rates very close to that at which water evaporates from a lake or dam. In the agricultural regions of South-West WA this varies from the equivalent of 1-2 mm of rainfall equivalent per day in winter to 4-6 mm per day in early summer. Trees restrict water use as soils dry out during summer so that late summer water use may be 1 mm per day or less. Overall, tree water use cannot be more than rainfall in the long term without the tree drying out soils and causing their own local drought.

This means that the "average" vigorous tree growing in a plantation stocked at 1000 stems per hectare could use from 10 to 60 litres per day (i.e. 1-6 mm x 10,000 m<sup>2</sup> ha<sup>-1</sup>/ 1,000 trees ha<sup>-1</sup>) depending on water availability and the time of year. In another stand with fewer but larger trees, water use by the stand may not change much but the total water use will be spread between the smaller number of larger trees so that each tree uses more water. In comparison, on a sunny day in spring when soils are moist a wheat crop might use around 4 litres per square metre of crop (or the equivalent of 4 mm per day of rain). The annual crop would of course not use any water when the plants are absent during summer.

A tree growing on its own in an open paddock will typically use more water than the same sized tree in a large plantation or woodland. This is because the plantation tree is partly sheltered from winds and shaded by it's neighbours.

These differences partly explain why shade trees left when paddocks are cleared are often so stressed;

they have the relatively small root systems of a forest tree suddenly having to provide the greater water requirements of a paddock tree. Young trees are usually more able to adjust than older trees.

### Summary

We can measure how much water single trees, tree belts or large plantations use. From this we can work out if tree water use is in balance with rainfall or is causing drying of soils. While the former is ideal for wood growth in plantations, the latter is good for controlling watertables and salinity. Alternatively, we can calculate how much water is flowing across landscapes to roots of single trees or trees in belts or determine if water is "leaking" below crop and tree roots to add to rising watertables.

The emerging picture is that trees in WA's agricultural and pastoral zones often have the capacity to use more water than is available,

especially in summer. This extra water use capacity is going to be very useful in developing sustainable agricultural systems in which soil water balances are similar to those under the native woodlands (i.e. there is no buildup of watertables). However, skilled placement of the appropriate trees is anticipated to result in development of viable farming systems where only part of the land area is covered by trees and the rest of the landscape is used for annual cropping.

A major focus of current research is to match tree species with site conditions and water use to obtain the best possible long term yields from the trees and the crops they protect from salinity.

*Stuart Crombie is a Research Scientist with the Forests and Tree Crops Group, CALMScience, Kensington. He can be contacted on 9334 0523.*

## BUSH DETECTIVE

Chris and Joan Moffet of "Bellaranga", Morawa, suggested this puzzle: -

### Who made this heap, and why?

This pile of sticks is at the edge of a saline drainage area, part of the Yarra Yarra Lake system. The samphire flat flooded after the big rains the last two summers. Who made the heap, and why? Photo: F. Falconer



And, it's a swan's nest! They successfully reared young.

## ECONOMIC VALUE OF BIODIVERSITY

### SO YOU WANT TO GET INVOLVED IN ECOTOURISM?

By Pat Barblett

A number of *Land for Wildlife* members have interests in nature-based and ecotourism. Their interests are described as "special interest tourism", which emphasises contact and understanding between host and guests as well as between the visitor and the environment.

Visitors are reassessing what they want. Current market trends highlight the movement away from the mass produced and standardized tourism packages, and an increased propensity to purchase experiences that involve learning about the environment and interacting with it. Consumers are better educated than ever before, have more disposable income and leisure time and are environmentally aware. Globally, with increased competition in air travel and cheaper airfares in the market place, people are more mobile. These two major factors along with a emergence of a highly competitive global tourism industry, are producing consumers with very high expectations.

Tourism and the environment are closely linked. Many *Land for Wildlife* members, as landowners, are well positioned to package an authentic tourism product. They have complete control over the product developed on their own land. However, with a limited knowledge of the tourism industry this could be a daunting task. So where does one begin?

There are two things I would advise as a starting point.

1. Get to know how the tourism industry works, and consider the characteristics and forces that help shape it. Many products are designed for the mass market and don't allow for individual needs.
2. Strategically plan your tourism product. Identify what makes your product special.

#### Knowing how the Tourism Industry works

WA is divided into nine tourism regions, each with a regional tourism association (funded by the Western Australian Tourism Commission (WATC) and the industry) where decisions are made. They are responsible for marketing the region. The Tourism Council of



Australia WA pursues policy at a national level. There is a regional development section of the WATC located in each of the regions, pursuing development interests.

Local towns have a tourist bureau or centre whose primary function is visitor servicing, with a secondary marketing role. Some receive local government funding. As the most important and valuable marketing you can do for your small tourism business is in the immediate 50 kilometre radius, joining these associations would be beneficial.

The Eco Tourism Association of Australia is a national body, which has a strong voice in the development of eco-tourism policy and accreditation. Some Federal and State Government departments have tourism sections which may charge for their time.

The WATC and CALM have collaborated to develop the Nature Based Tourism Strategy, which has five guiding principles:

- ▶ Conserve the natural environment
- ▶ Involve and benefit local communities
- ▶ Improve the knowledge of visitors
- ▶ Provide quality services and products
- ▶ Foster an effective and efficient industry

#### The need to be sustainable

The tourism industry involves a huge range of enterprises varying from multi-national corporations down to small scale and part-time operators. Tourism also covers a large range of activities such as visiting friends and relatives, family holidays at the beach, coach and tour excursions, walks in the country and trips to museums. Well, we have all at some time in our lives been tourists so we all know what it means to be one!

Tourism is a diverse and constantly changing industry. A healthy tourism industry is vital for a region's well-being. That is not to say that all regions need tourism but it can contribute to the economy and employment of an area, enrich our lives and bring pleasure and enjoyment. However, it must be planned in partnership with the host community or it can have many negative social and

## ECONOMIC VALUE OF BIODIVERSITY

*Ecotourism continued from page 13*

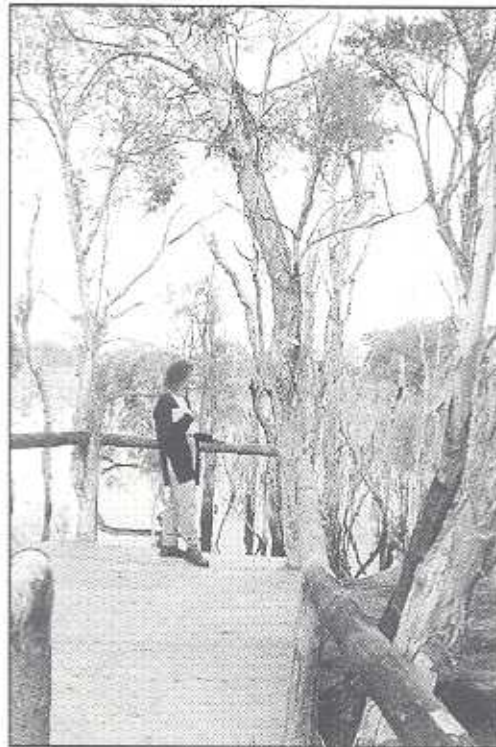
economic impacts. It imposes extra costs on local authorities in the provision of services, maybe leading to higher rates for residents, and on local communities in terms of traffic congestion during peak holiday times. Tourism carries the inherent danger in that it can destroy the very thing that generated it in the first place - **tourism must be sustainable** - the needs of today's visitor should not be met at the expense of future generations.

The English Tourist Board formulated 'Principles for Sustainable Tourism', which are well worth repeating here:

1. The environment has an intrinsic value, which outweighs its value as a tourism asset. Its enjoyment by future generations and its long-term survival must not be prejudiced by short-term considerations.
2. Tourism should be recognised as a positive activity with the potential to benefit the community and the place as well as the visitor.
3. The relationship between tourism and the environment must be managed so that the environment is sustainable in the long term. Tourism must not be allowed to damage the resource, prejudice its future enjoyment or bring unacceptable impacts.
4. Tourism activities and developments should respect the scale and nature of the place in which they are sited.
5. In any location harmony must be sought between the needs of the visitor, the place and the host community.

It is important to understand that nature-based eco- and cultural tourism grew out of a demand for an authentic individual travel experience, as opposed to fabricated mass tourism packaged tours. It has taken the tourism industry some time to come to grips with the principles of sustainable tourism, as stated above. As a result, organisations have been formed to bring together people with common interests. One of these organisations is FACET, Forum Advocating Cultural and Eco Tourism.

FACET formed in the early nineties when it became apparent that the many exciting and interesting developments taking place in the field of cultural and eco-tourism were happening in isolation from each



*So that visitors can see the waterbirds better, Connie Jones built a boardwalk at Matilda Lake Farm, Gingin.*

other. It is a WA-based network and information resource and its birth is directly related to the fact that the tourism industry of the time did not understand the principles and values of this newly emerging part of the industry. FACET is a unique organisation, there is nothing quite like it elsewhere in Australia, and if you are thinking of entering the tourism field, I would highly recommend joining.

In summary, talk to as many people in the industry as is possible.

### Strategically plan your tourism product

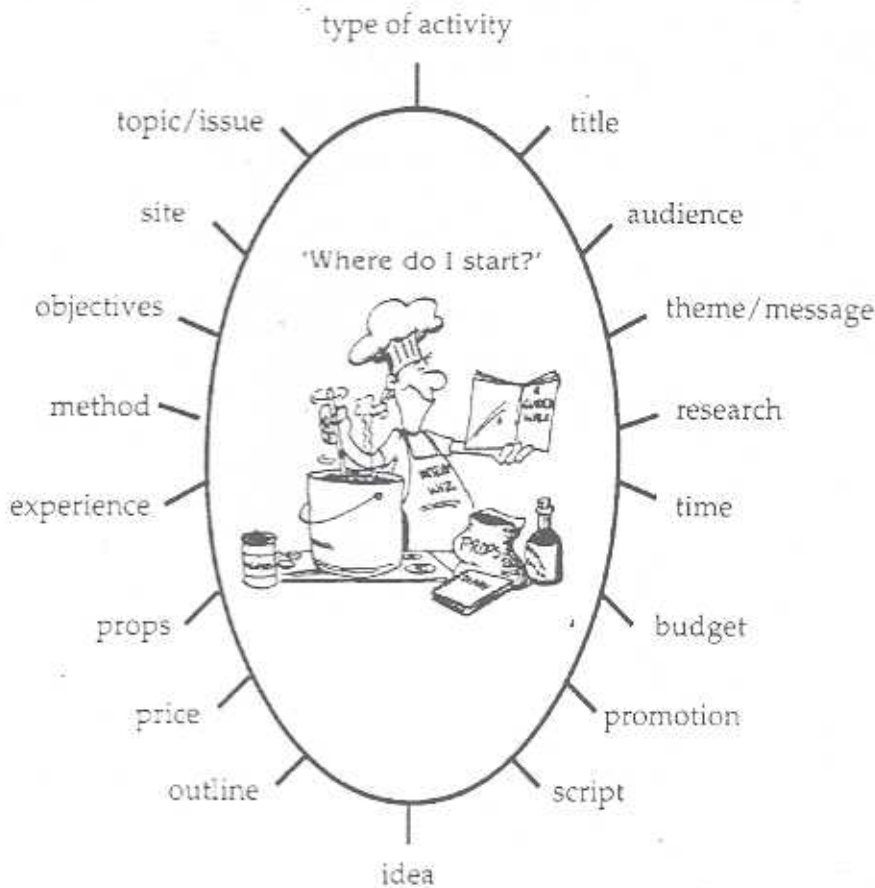
In considering the viability of a tourism product and defining the market, planning is crucial. The first place to start would be to carry out a situational analysis related to your product and the customers you hope to attract. This could take the form of:

- ▶ The region: where you fit - market, infrastructure, industry?
- ▶ Access: what is available eg rail, road, air?
- ▶ Strategic alliances: what opportunities exist to negotiate and form co-operative arrangements with nearby localities and communities in order to strengthen the tourism product being offered?
- ▶ Accommodation capacity: what is the range available locally - will it suit your customers? .
- ▶ Tourism trends: what has been the growth in visitor numbers over the last five years? (A primary source for this information should be the Australian Bureau of Statistics and your local tourist bureau who generally record visitor numbers on a daily basis.)
- ▶ Tourism attractions: list and map significant tourist attractions that can complement what you are offering.
- ▶ Trends in external environment: assess strengths and weaknesses, eg regulatory control by government instrumentalities.
- ▶ Target markets: find out who the existing visitors are - do they suit your product?
- ▶ Market position: what image or icon represents your region? What are the key features in promoting the area?

# ECONOMIC VALUE OF BIODIVERSITY

Ecotourism continued from page 14

## The Interpretive Activity Design Process



The keys to success in putting together a tourism product are vision, determination, hard work and passion.

*Vision* to recognise a need and put together something that is unique and different from the usual. *Determination* to keep on going when the situation seems hopeless and you are being bogged down by bureaucracy, or other restrictions. *Hard work* - the tourism industry is 24 hrs a day, 7 days a week. There has never been another industry more responsible for eliminating Sundays as a day of rest! *Passion* which is the most important ingredient and the one that melds the other three together. Without passion and enthusiasm the whole project will founder.

Of course a love of people is essential and goes without saying.

There are other elements, which should be part of a tourist product, such as accreditation, interpretation, and marketing. Perhaps at another time I could discuss these issues more fully.

### Initial contacts

FACET  
 PO Box 342  
 North Beach 6920  
 Tel/Fax: 08 9448 8150  
 Email: facetinc@inet.net.au

W A Tourism Commission  
 16 St Georges Tce, Perth 6000  
 Tel (08) 92201700  
 Fax (08) 92201735  
 Email: welcome@tourism.wa.gov.au  
 Web: www.wa.gov.au



Cartoons by Terry Roberts from the book 'Developing Ecotours and Other Interpretive Activity Programs - A guidebook for planning, designing, promoting and conducting ecotourism activity programs' by Gil Field and Lotte Lent. See New Books.

Pat Barblett works in the tourism industry, is a Committee member of FACET and tourism person on the newly-constituted Conservation Commission. She is also a Land for Wildlifer with a block on the Leeuwin-Naturaliste Ridge.

## ECONOMIC VALUE OF BIODIVERSITY

### NATURAL PEST CONTROL

**I**MAGINE at least 14 spider species, lizards and frogs being the main insect control method in a commercial blueberry orchard! *Land for Wildlife* members Greg and Susan Luke are the major blueberry producers in the south coast region. After netting the orchard to keep birds out, they noticed a rapid increase in the number of spider webs in amongst the blueberry bushes. Closer examination revealed at least 14 different kinds of spiders that have made their home in the orchard. Along with the lizard and frog populations all the necessary insect control on the orchard is being carried out by our wildlife.

Sue and Greg purchased their 24 ha property along Eden Rd on the Nullaki Peninsula south of Denmark in 1983. The property was uncleared, and included a paperbark wetland, peppermint/sheoak scrubland and karri/bullich woodland. They built a house which looks northwards over Young's Lake, which is called 'Kooriup Lake' by older residents and means 'place of frogs'. From the verandah they do much of their bird watching, contributing to the Australian Bird Atlas project.

Greg, who has worked extensively with AGWEST, has a

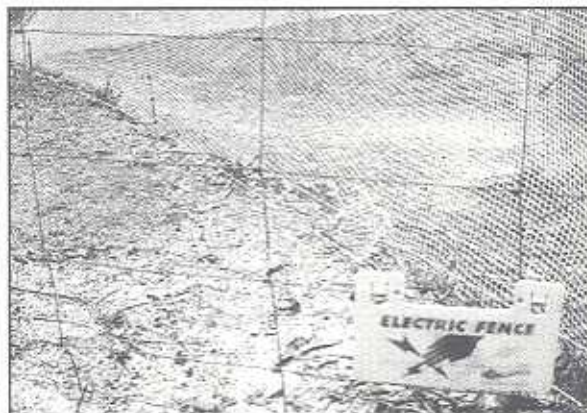
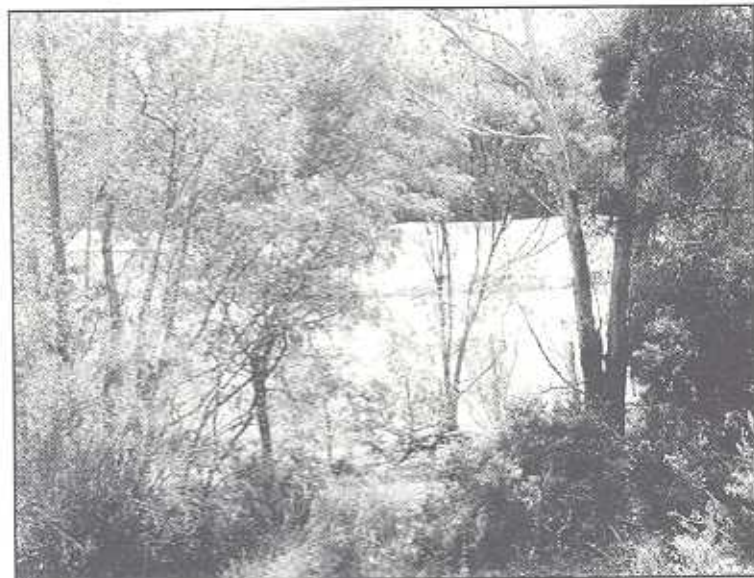
strong interest in soil science. Greg and Susan had specifically been looking for a property with acid soils and plentiful underground water where they could grow blueberries. Examination of topography and soil maps of the south coast showed that the Nullaki Peninsula area had a dominance of old parabolic coastal dunes which have fairly acidic soils and a good underground water supply. The Lukes went ahead, cleared a 3 ha area and installed a blueberry orchard.

As the orchard has grown, the Lukes are learning more and more about the plants. Some of the insects that pollinate blueberries include honeybees and native wasps. They have also found that one of the small local mammals, the quenda, has no respect for man's bird protection endeavours, and can rip holes in the bird netting. This expensive activity had to be managed by installing a 'miniature' 3-strand electric fence round the base of the main fence to keep the quendas away from the netting!

In the peak season summer months, the smell of blueberry jam wafts out of the Luke's kitchen as Susan tries to keep up with public demand. The shop next to the orchard sells a wonderful array of blueberry produce - jam, muffins, icecream and even wine - and these are also sold to local and state markets. Tourists are given the option of collecting their own blueberries, which gives them a delightful close-up experience with the spiders - many a nervous shriek is heard from the orchard! Susan would welcome the assistance of a 'spider person' to visit their "Eden Gate" property to confirm the identity of the resident orchard spiders she has listed. Any takers?

- common crab spider
- giant huntsman
- great garden spider
- red-backed spider
- southern lace weaver
- violin spider
- mosquito catcher
- decoy orb weaver
- malabe orb weaver
- brown widow spider
- glass house spider
- daddy long legs
- Australian trapdoor spider

*Sylvia Leighton*



*The miniature electric fence around the outer edge of the netting to deter the bandicoots.*

*Orchard in the bush*



## LFWNEWS

## BROOMEHILL SHIRE - NATURAL RESOURCE MANAGERS.



Broomehill - The first Shire in Australia to join the Land For Wildlife Scheme. Here Land For Wildlife Officer Avril Baxter presents the blue sign to Chief Executive Officer Peter Fitzgerald. Landowner Jo Kempin and Community Landcare Co-ordinator Anthony Withman are also involved in the project. Jo and Anthony's farms are registered with Land For Wildlife.

**T**HE realisation that the bush needs all the help it can get, led the Broomehill Shire to register its reserves with *Land For Wildlife*.

As landowners they recognised they had a vital role to play in natural resource management, but how to obtain the skills and necessary knowledge to conserve and enhance biodiversity in their area? A partnership with *Land For Wildlife* was the answer.

First steps involved obtaining a map of remnant vegetation in the area and working out exactly where the Shire reserves were, coupled with a systematic investigation of the larger reserves to document their condition and management issues.

Involvement of the wider community is as a vital part of the process. As reserves are examined surrounding landowners are invited to join the walk and provide vital information on the history of the area. In 2001 we will be targeting one of the reserves for a survey of small mammals and will involve the local school.

As the information on reserves is collected a strategic plan for the integration of biodiversity on a Shire wide basis will be worked out. Peter Fitzgerald (CEO) says that his will help the Shire prepare budget estimates and identify potential funding sources.

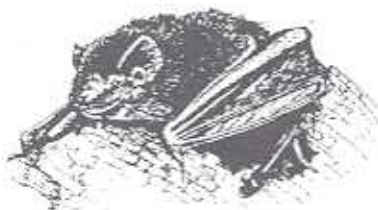
"This is an excellent way to work out the best way to tackle things without spending huge amounts of money," he said. "We need it to become part of our operations without having to raise rates and levies. If we can do some good, perhaps others will follow".

Avril Baxter

## MEET THE ANIMALS!



LFW/CALM fauna day at Lake Magenta Nature Reserve.



Gould's Wattle-tailed Bat

## BATS AT BANNISTER CREEK

**B**ANNISTER Creek is a tributary of the Canning, and runs through the suburbs of Lynwood and Canning Vale. The Bannister Creek Catchment Group have been working on the rehabilitation of the river reserve since 1990. In 1999 they commissioned Kyle Armstrong, Dept of Zoology, UWA, to survey the bats in the reserve.

Two bats were recorded, Gould's Wattle-tailed Bat, *Chalinilobus gouldii*, and White-striped Freetail Bat, *Tadarida australis*. Both of these were foraging over the reserve, though no roosts could be found. It is possible that other, harder to detect, bats may also be present.

These bats are very important ecologically as predators of night-flying insects. The study shows that the greatest threat to their survival in the area comes from loss of roosting sites. This could occur as trees die, from *Armillaria* fungus or human activity, or as suitable hollows become occupied by feral bees. It is recommended that the feral bees are controlled and that bridges or other sites be designed as bat roosts, including perhaps adding bat roosting boxes.

For further information contact Julie Robert or Judy Fisher, Bannister Creek Catchment Group, phone 9458 6746.

## FAUNA

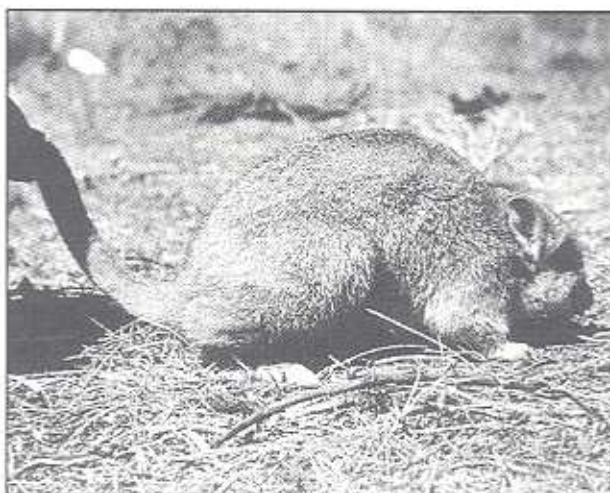
# RELICT BETTONG WARRENS IN WESTERN AUSTRALIA'S PASTORAL LANDS

by Jim Noble

TWO species of rat kangaroos or bettongs, the brush-tailed bettong or woylie (*Bettongia penicillata*) and the burrowing bettong or boodie (*Bettongia lesueur*), were originally the most widespread native mammals on the Australian mainland. These medium-sized marsupials disappeared very rapidly following European settlement, usually after just two decades in the pastoral areas - only one intact specimen of the burrowing bettong exists in the Australian Museum in Sydney and this was collected in 1879 at "Tindarey", halfway between Cobar and Bourke.

There has been increasing interest recently in the landscape ecology of these now rare animals, many of which like the boodie, at one stage only survived on islands off the WA coastline. Research on the woylie for example, which still survives on the mainland as isolated populations in some sclerophyll forests of WA, suggests that this marsupial has an important role in forest nutrition by dispersing special fungal spores which infect tree roots and enhance nutrient uptake by the tree. They may also help in seed dispersal and establishment of grasses and other plants.

My main interest, however, currently lies in the possibility that the bettongs, in association with periodic fire, may have had a role in preventing shrub populations increasing to the densities we now recognise as posing woody weed problems in semi-arid woodlands and rangelands. By gaining a better understanding of how woody weed problems have developed over time, it may help us in turn devise more efficient means of rehabilitating affected areas by employing integrated shrub management systems.



*The Burrowing Bettong. (Bettongia lesueur). Photo: WA Museum, Pingelly, 1942.*

The idea that bettongs may have had an impact on shrubs regenerating after fire is not new. Eric Rolls in his book "A Million Wild Acres" describes how another species, the rufous bettong, together with fire kept the cypress pine under control in the Pilliga Scrub of northern NSW. Similarly, the quokka is another medium-sized marsupial that has prevented woody plants recovering from fire on Rottnest Island.

If bettongs were influential in this respect, they would have needed to be present in sufficient numbers to significantly affect shrub densities. The woylie only builds surface nests out of grass and tree litter and so it has left little trace of its past occupancy making it virtually impossible to gain any realistic insights into its possible influence on various landscape processes. The boodie however, often built major warren systems that are still highly visible in some areas and it is these relict features which may enable us to gain some idea as to its original distribution and abundance.

These warrens were readily parasitised by invading rabbits at the turn of the century and it has

been suggested that if these prefabricated residences had not been available, the rabbit would not have been able to cover the semi-arid pastoral areas as rapidly as it did, nor to survive recurrent droughts so effectively. This was particularly the case in "hard red" country where the powerful boodie was able to excavate extensive warrens by digging through weak zones in the underlying limestone or calcrete rock. Unlike rabbit warrens in sandy soils, these did not collapse during drought and the calcrete provided both structural reinforcement and insulation from high temperatures.

One way of possibly getting a better idea of its past presence throughout a region is by locating relict burrowing bettong warrens. These can usually be identified by means of certain key characteristics, the first of which is to look closely at old rabbit warrens, especially where they are known to exist in areas with shallow soils such as 'hard' mulga country. These are commonly semi-circular in shape, more or less like a giant horse-shoe, and up to 30 m in diameter. In those sites where there has been minimal burial by windblown soil over time, there is often a central rock 'lens' overlying individual burrows dug in the past. In the mulga lands of eastern Australia, the warrens often show plenty of white limestone material lying on top of the perimeter mound, with distinctive calcrete lens exposed in the centre.

*Jim Noble is an ecologist who has worked for many years on rangeland management. He can be contacted at CSIRO Wildlife and Ecology, GPO Box 284, Canberra, ACT 2601.*

## FAUNA

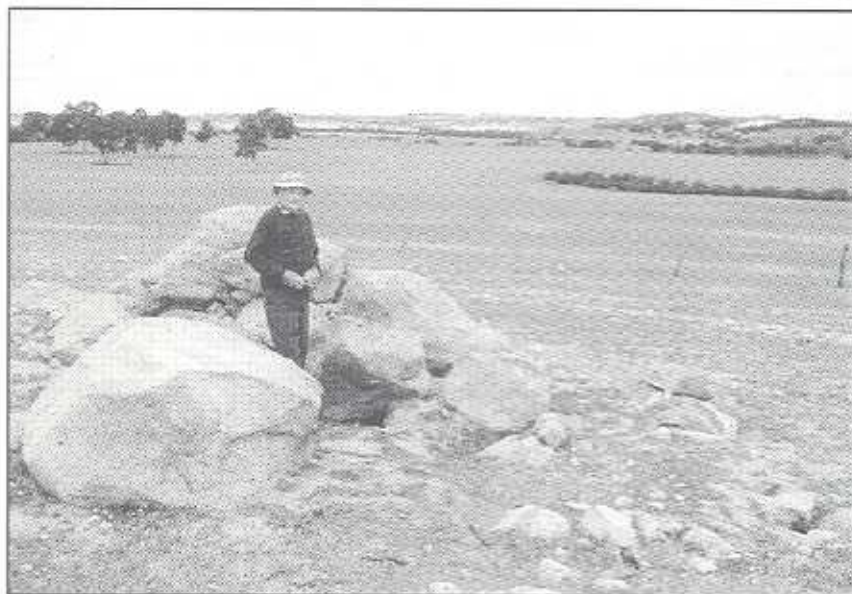
### DO YOU KNOW OF AN OLD BOODIE WARREN?



▲ Boodies once occurred over a large area of Australia but survived only on 4 islands off the WA coast (see map). The last known active warren in the south-west of WA was at Pingelly and is shown in the pic above, taken on a WA Museum expedition in 1942. The distinctive shape of the warren and its multiple entrances, are clearly visible. By this time, rabbits were also sharing this site.



Does anyone else know of an old boodie warren? Or do any older members of the family have stories about them? Have you any historic photos? Or could you take a photo of the site now? We'd love to hear from you!



▲ Gill Gardner rode past this site every day on the way to school in the mid 1920s, and remembers both boodies and dalgites (or billbies, *Macrotis lagotis*) using the same warren system. It is on a granite ridge that was, at that time, part of an extensive tract of wandoo, York gum and salmon gum woodland east of Pingelly. Note that despite clearing, part of the distinctive saucer shape remains, and that rabbits are still using the accommodation.  
Thanks Gill!

WE have a 120ac bush block just outside Popanyinning, 35km north of Narrogin. The property lies at the bottom of the landscape about a kilometre from the Hotham River. There is a gravel ridge running diagonally across the property, which divides up the vegetation. The lower part of the block on the southern and western sides is very salty and has a large number of dead trees with only grasses and sedges as an understorey. Wandoo and other large tree species dominate the slope of the higher part of the block and in the north-eastern corner there is an area of heathland dominated by dryandra.

We bought the property just over two years ago and as Linda is a passionate horse rider, part of the plan is to keep horses in small paddocks where they will be supplementarily fed. However, we did not want to compromise the nature conservation values of the property.

Before we bought it, the property had been part of a farmer's paddock and was grazed periodically. One of the first things we did was to put in a W-drain to remove the surface water that was spreading out across the flats. The regeneration of the native grass species was spectacular, with large areas of this low lying area now covered with Foxtail Mulga, Elegant Speargrass, Wallaby Grass and other native species. This

## PRACTICALITIES

### MAKING YOUR NATIVE GRASSES GROW

by Ed & Linda Blanchard.

was seen as an excellent area to paddock the horses, where by rotating them around some small paddocks, they could encourage the native grasses to persist. The problem was to manage the increase in unwanted weed species such as Guildford Grass (Iris family) and Barley Grass.

The strategies we have adopted include :

- ▶ planting fast growing shrub/tree species to minimise the weed seeds blowing in from the paddock next door,
- ▶ burning areas to minimise the fire fuel and to hopefully destroy some of the unwanted grass seeds
- ▶ a follow up with chemicals to control weed species.

A range of shrub/tree species have been planted on the block, thanks to the generosity of the Western Power Greening Challenge, to complement the species already growing there.

We have worked very hard to reduce the huge fuel burden right

across the block, creating a good firebreak around the property, then using controlled burns followed by chemical weed control, primarily a Glean (Chlorsulfuron) / Roundup (Glyphosate) mix with 20g/ha of Chlorsulfuron and 1 to 1.5 litres/ha of Glyphosate. In some of the areas with a high weed burden two applications were necessary to reduce the weed burden sufficiently.

Glyphosate is a non selective, leaf absorbed, translocated herbicide. As a knockdown, it kills most plants that it touches. It is particularly effective on perennial weeds sprayed after their "dead thatch" has been removed. It is of low toxicity to mammals, birds and fish however, the surfactant used in many generic brands is toxic to frogs but there is a product Roundup Biactive that uses a surfactant which is not toxic to frogs.

Chlorsulfuron is a selective and translocated herbicide that is absorbed through the leaves and roots. It controls a large variety of bulbous and broad-leaved weeds and was included in this mix to control Guildford grass. Chlorsulfuron acts on the ALS enzyme in plants, which is not present in animals, and this is the main reason for its low toxicity. Plants resistant to Chlorsulfuron have developed and are expected after repeated use. *[Nb: be careful - this chemical can also damage trees - Ed.]*

After the chemical applications in June/July and August/September the areas appeared quite bare but within a month there was a good coverage of the native grasses which have expanded their area dramatically.

Even after a very dry spring the native grasses in these low-lying areas are still green in late November and are therefore transpiring soil moisture. However the native grasses that volunteered grow only during the cool part of the year ie. they are winter active. Our challenge is to introduce some native grasses which actively grow over summer eg kangaroo grass, so we can have a truly perennial native grazing system.



Regeneration of native grass species in an area, which had been burnt and then had chemical weed control. Photo: E. Blanchard.

## IN BRIEF

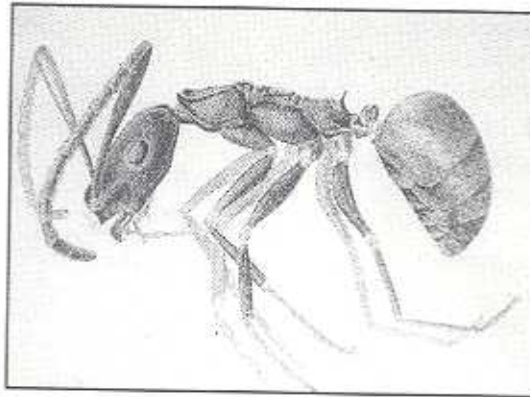
**I**N early Nov, the Friends of Fitzgerald River National Park organised a weekend at Bremer Bay to study three important invertebrate groups, butterflies, ants and spiders. It was a revelation!

Mathew Williams from CALM spoke on butterflies (120 species in WA). They can be distinguished from moths as they rest with their wings upright, have clubbed antennae and usually fly during the day. Although traditionally butterflies are one of the better-known groups of insects, there were no records from The Fitz, so it was exciting to find 12 different species, including the Blue Iris Skipper (*Mesodina cyanophracta*). This caterpillar pulls leaves together to form a wigwam shelter at the base of a Western Iris (*Patersonia*) plant.

The 'ant man', Jonathan Majer of Curtin Uni, gave a fascinating insight into the biology, range and diversity of ants in WA (500-600 species). They can be vital to bushland ecology, as they contribute to pollination of flowers, dispersal of seeds and distribution of nutrients in the soil, as well as helping to recycle animal and plant remains. 24 different species of ant were found by various methods - shaken out of trees; collected from the ground; trapped in pit traps and picked up by torch light during the night. Examining the specimens under the stereoscope revealed how distinctly different the body features were on each species. We also did

## SPINELESS WONDERS

by Sylvia Leighton



*An ant only known to occur on deep white sands in the Wellstead area called Melophorus majeri.*

*Illustration by Nicolett Layover.*

a simple test showing how quickly ants can move acacia seed, even though it may weigh 50 times more than the individual ant.

Barbara York Main of UWA spoke on spiders. She pointed out that ants are just one family, Hymenoptera, whereas there are many families of spider - some 70 in Australia. Spiders are a very ancient group of animals, whose body shape has not changed much from that of their fossil ancestors. They are all predators, sucking the juices from their insect victims, and using a variety of methods to catch their prey. The more primitive form of spiders with vertically-aligned fangs (eg trapdoor spiders) need to be standing on a solid substrate like the ground or a tree trunk to be able to

raise their fangs to strike. More modern spiders with pincer-like fangs can bite their prey while dangling in a web. We collected 24 species from 12 different families.

The biggest threat to spider survival in Australia is fire. Possibly because most spiders evolved in wet conditions, they have very few adaptations to cope with fire. It takes spiders a long time to recolonise an area that has been burnt and many of the ancient species are decreasing in population size and are confined to pockets of microclimate tucked away in the landscape (eg breakaways in the Wheatbelt).

Invertebrates are very poorly known, yet they are such an important part of the ecosystem. *Land for Wildlife* members might like to establish a collection from bushland on their own properties - there are no licensing regulations for this fauna. A big problem is finding the experts to name them. Barbara York Main studied spiders on the family farm at Yorkkrakine, and now she's a world expert. Lets encourage our young people to take an interest in invertebrates and maybe one day many more of our indigenous species will have been taxonomically named.

*Sylvia Leighton is LFW Officer at Albany. Contact her on 9842 4500 to obtain details of books on collecting and identifying invertebrates.*

## DIDGERIDOOS TO BE TAGGED

**D**IDGERIDOOS are made from mallee stems that have been naturally hollowed by termite attack. They are cut, cleaned and painted to create the finished article. Unfortunately, demand for didgeridoos as tourist souvenirs has led to illegal cutting of mallees in remnant vegetation in the southwest and Wheatbelt, especially in nature reserves. Often the cutters do not

know how to determine suitable stems, so large areas are felled to obtain a very few hollow stems. To combat this problem and protect the reserves, a new tagging and certification system has been introduced.

A royalty tag must be attached to all eucalypt stems by the cutter when harvesting. The tag remains attached to the stem during the didgeridoo

making process. In addition, there will be a certification card accompanying each tag, so that people will know that the didgeridoo they are buying has been cut legally and that native vegetation hasn't been degraded. Selling or possessing stems harvested in WA without such a tag will be an offence under the Wildlife Conservation Act.

## MEMBER'S PAGE

### A Moment to Remember

by Carole Sutton

WE enjoyed a very privileged moment with our wild ducks last week. It was 5.30 in the morning, dawn was breaking and the easterly wind was blowing a gale when Bill woke me up with an urgent "Quick! Come and see ...!" Our laundry room overlooks one of the nesting boxes and as we watched, we could see a flurry of movement inside the entry hole. A tiny brown duckling leapt up onto the rim. Without further hesitation, it launched itself into space and like a windblown leaf fell gently to the ground. We were unable to see the mother and her landed offspring for the bushes in the way, but we could hear her calling the babies out. We continued to watch, enthralled, as five more ducklings made their way out of the box. We looked for them after the last duckling had fallen but Mother had hidden them well; they were nowhere to be seen.

*(Thank you, Carole, for this snippet. I am so envious! Wood Ducks nest on my block too, but down the back paddock, and I have never seen this magical moment. Read Carole's story of how birds use the nesting boxes they built and installed in WW 3/3 - Ed.)*



When *Land for Wildlife* member Ann Neame of Baldivis went away for the weekend, her children filled the feeder bin with wheat and put the lid on. They didn't notice the brush-tail possum who had climbed in to get a feed. When Ann returned she found the plump possum waiting patiently for release, causing much excitement for Kathy the Jack Russell terrier. When dusk came, the possum decided it was time to leave and made a hasty exit.

### The Wambenger



Tree whisk of Wamby calls up squirrel.  
Before you can think Wrong hemisphere  
she's gone - somewhere  
demolishing beetles and flies.

The one in our roof scrunches loudly,  
cockroaches diminish, mice keep their heads down  
when this mother of seven is out

There are probably seven -  
the front porch seethes with their weaving;  
noses, claws, whiskers, are glimpsed; brighteyes peep  
between weatherboards inspecting our scalps;  
bodies flatten for nosedown or tails spread for leaps  
till we think we are back in Beijing, the acrobats  
taking our breath.

We wonder how many are males; how long they will live  
before mating - the grand final fling  
(he dies from his efforts,  
she tends the nest)

When they're little both seem to fly;  
feathertail up as they cover the ground  
with their speedy stop-hop, stop-hop,  
angled as rudder in currents of air  
when they're after a moth.

Nine years they've shared our hut on the hill  
with its wooden walls hollow, ceiling shallow.

The red gum and jarrah's receding. The shire  
issues edicts - *NO SHACKS*, ensures  
brick and tile houses fit only for humans.

From nine years of breeding where  
do the wambengers go?

Jenny de Garis

## REVEGETATION

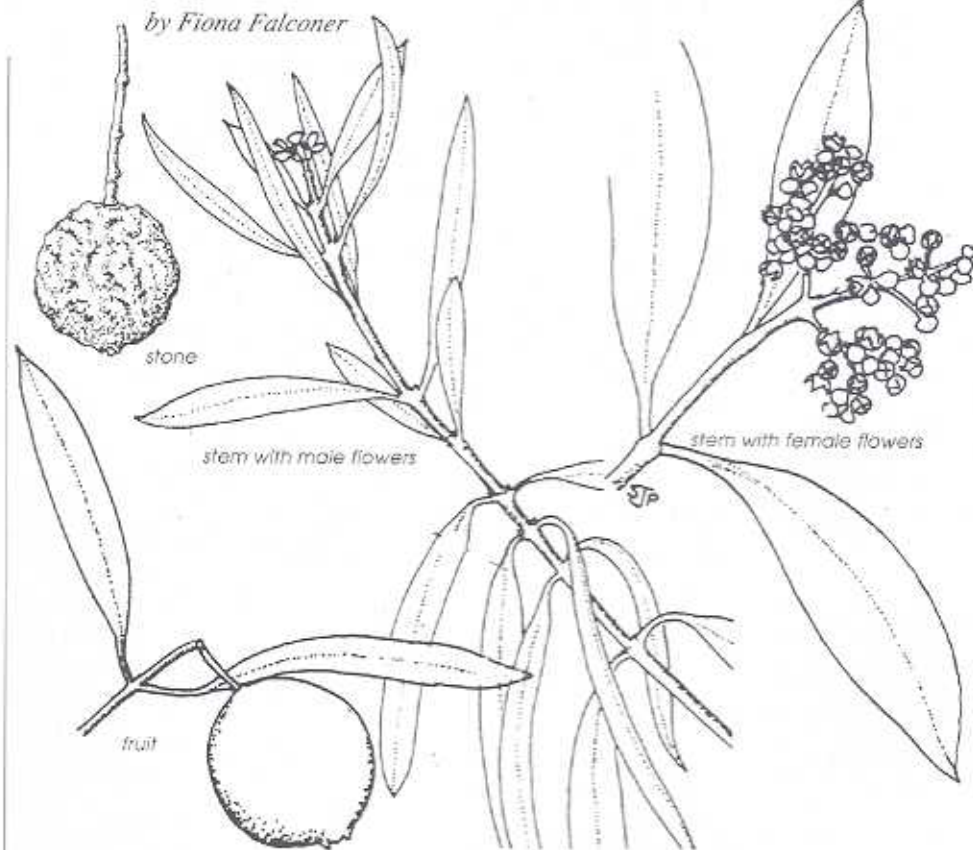
### THINKING BEYOND TODAY: A GLOBAL PERSPECTIVE FOR LOCAL ACTION

**D**EVISE new farming systems! Grow new crops! Pay land managers who are conserving biodiversity! These were some of the challenging ideas put to a forum, hosted by the Moore River Catchment Group at Moora in July 2000, by internationally-recognised Israeli Professors Uriel Safriel and Yosef Mizrahi.

The Moore River Catchment is 14,000 sq km in area, and is under threat from salinity, erosion, soil acidity, declining biodiversity etc, as well as recently suffering from severe summer floods. In addition, we are seeing reduced profitability of the traditional crop and livestock enterprises that have been the mainstay of the region's economy. What can be done?

Prof. Mizrahi urged us to look for new crops that can supply niches in world markets. Since 1984 he has been working with farmers in the Negev Desert to introduce and trial wild plants with potential to become new fruit and nut crops. Of an initial 60 species, seven show real promise, including Pitaya, a climbing cactus from South America which requires little water and so is very suitable for desert conditions. He pointed out that cash crops for export have a prescribed lifetime of maximum profitability, so it is important that research and development is a continuing process. It was also emphasised that the genetic potential in our local native plants is a huge untapped resource, well worth preserving into the future.

Prof Safriel's presentation focussed on global climate change and its potential effects in WA. (As an Israeli representative on the United Nations 'Intergovernmental Panel on Climate Change' he has an in-depth knowledge of the predictions.) Predictions on effects of global warming for Australia included: damage to coral reefs; rise of the snowline and decline of alpine ecosystems; increased aridity in inland areas; forestry in southern



*Quandong, one of the potential fruit crops being investigated by Professor Mizrahi.*

regions being vulnerable because of reduced rainfall and increased fire risk; sea level rise leading to salinisation of groundwaters in coastal areas; and increase in insect-borne diseases.

He said that for the first time, at the Rio Conference in 1992, the world tried to put environment and development together to emphasise linkages. A new term emerged - 'sustainable development' - which was defined as 'the rate of resource use does not exceed the rate of renewal'. We do not know at what point in space and time world development becomes non-sustainable. We do know that we are striving for intergenerational equity.

The loss of biodiversity - ie the loss of species instrumental in providing the ecosystem services which enable both natural and managed ecosystems to remain healthy - is of major concern. Land managers have a role in the conservation of biodiversity - should

society acknowledge this by some level of monetary compensation? After all, the ecosystem services land managers help to maintain include such basics as climate control, maintenance of the water and carbon cycles and providing living conditions for biodiversity of potential economic value. This is most important for ecosystems on the edges of dryland zones. They are natural assets for ensuring future global food security, as the natural genetic variability of the flora and fauna in these marginal zones may mean that some genetic types will survive desertification, and so will be able to be used to rehabilitate and reconstruct the ecosystem functions lost elsewhere.

The Moore River CG hopes that cooperation between researchers in WA and Israel may eventuate and so advance our sustainable future.

*Fiona Falconer is LFW Officer at Coorow. She can be contacted on 9952 1074.*

## FUNDING

### Natural Heritage Trust Funding for 2001/2002 LAST CHANCE!

APPLICATIONS ARE DUE ON 23<sup>rd</sup> February 2001.

#### Further Information

Contact: Sophie Moller  
Bushcare Administration Officer  
CALM, Locked Bag 104,  
Bentley Delivery Centre, WA 6983  
Phone: (08) 9334 0442  
Fax: (08) 9334 0199

For information about the National Landcare Program and the National Rivercare Initiative, contact:

Landcare - Natalie Moore, AGWEST ph: (08) 9326 0009

Rivercare - Luke Pen, WRC ph: (08) 9278 0376



## NEW BOOKS

### The Western Australian Flora: a Descriptive Catalogue

Grazyna Paczkowska and Alex R. Chapman  
Pub: WSWA, CALM, KPB  
Cost: \$49.00 + \$ 9.00 p&h

Simply yet elegantly produced, there is a mine of information packed into this long-awaited book. Concise descriptions of all the 9640 species of plants currently recognised as growing in Western Australia! What plant person can do without it?

Many years ago (1965 and 1970), John Beard published the forerunner of this book, the "Descriptive Catalogue of West Australian Plants", a slim volume which listed known species, gave growth form, flowering colour and month, and, most importantly, the botanical district in which they grew. I well remember, as I struggled to come to grips with the staggering diversity of the WA flora, patiently ploughing through Blackall and Grieve only to find, when I checked Beard, that the rotten plant I thought it wasn't occur in that area! Over years of use, my Beard grew very scraggly!

This new book is in the same tradition, but contains more descriptive detail and it uses IBRA regions to list where the plant grows, rather than Beard's phytogeographic regions. It is also very large (A4) and heavy, not suitable for taking into the field.

That said, if you are interested in WA plants, you will want your own copy.

### Developing Ecotours and Other Interpretive Activity Programs

Gil Field and Lotte Lent  
Pub: CALM  
Cost: \$27.50 + \$5.00 p&h

The book is designed particularly for industry newcomers and people who'd like to set up nature-based tourism activities, giving a step-by-step guide of how to create a successful business that sustains the environment.

## COMING EVENTS

### Restructuring rural landscapes in the WA wheatbelt and Austria, with emphasis on the social and economic imperatives

- ▶ 22<sup>nd</sup> and 23<sup>rd</sup> February 2001
- ▶ CSIRO, Underwood Ave., Floreat.

Earlier workshops in Australia have described the impacts of land clearance on nature conservation and revegetation methodology. Work has also been done to show what mechanical and revegetation procedures will reduce the amount of land subject to salinity. The purpose of this Workshop is not to go over that land again, except to summarise the key findings. It is concerned with the social and economic forces driving reconstruction. Ideas may be gained from the European experience.

The first day will be talks, the second workshops and discussions. You can register for one or both days. For further info contact Dr. Graham Arnold, 0419 914 881.

### National Nature Conservation on Private Land Forum: 'Overcoming barriers - exploiting opportunities'

- ▶ 21 - 23 March 2001
- ▶ Alexander Library Building, Perth.

This forum will allow participants to share experiences and information on initiatives occurring across a range of jurisdictions, with special attention given to the role of conservation trusts, protected area networks, best practice management agreements and revolving fund initiatives. It aims to stimulate further discussion and identify actions to maximise the effectiveness of government, NGO, private and philanthropic investment in nature conservation on private land.

There will be two days of talks and workshops, and a field trip. For further info, contact Lesley Thomas, National Trust Covenanted Programme, phone: 9321 6088 or email: [covenanted@ntwa.com.au](mailto:covenanted@ntwa.com.au)

### Festival of Trees

- ▶ 31<sup>st</sup> March 2001

Men of the Trees will be holding a day of talks and demonstrations at their Nursery, Stirling Cres, Hazelmere. For further info ring Jackie Schoen on 9330 1078, or Jeanette Chalon on 9443 6397.

### Fungimap Conference

- ▶ 21<sup>st</sup> - 28<sup>th</sup> June 2001
  - ▶ Denmark
- For further info, email: [environ@denmarkwa.net.au](mailto:environ@denmarkwa.net.au)

### Conservation of Acacias

- ▶ July 2001
  - ▶ Dalwallinu
- Further info will be distributed when available.

### State Landcare Conference: 'Partnerships and Diversity'

- ▶ 11<sup>th</sup> - 14<sup>th</sup> September 2001
  - ▶ Mandurah Performing Arts Centre
- Put the date in your diary. Detailed info available through CLCs etc.

This Newsletter is a compendium of articles written by many different people. The views expressed are those of the authors, not necessarily those of the Department of Conservation and Land Management.

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