



DEPARTMENT OF  
**Conservation**  
AND LAND MANAGEMENT  
*Conserving the nature of WA*



# Western Wildlife



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NEWSLETTER OF THE LAND FOR WILDLIFE SCHEME

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## HOPPING INTO A BRIGHT FUTURE - THE WOYLIE SANDALWOOD STORY

*Marie Murphy and Mark Garkaklis*

AT the time of European settlement the woylie or brush-tailed bettong was extremely common and occurred in large numbers across the southern third of the continent. Indeed, accounts from the 1880s reported woylies "swarming" over large areas of the landscape.

Tragically, in just 100 years the woylie had declined to the point that it existed in only three small remnant patches of woodland in the south-west of Western Australia and was on the brink of extinction. The good news is that recent conservation efforts by the Department of Conservation and Land Management has seen a remarkable come back of the woylie, so much so that in 1996 the woylie was reclassified to non-threatened. Since the recovery of the woylie, it has become possible to study their ecology in some detail and it has been shown that woylies are important ecosystem 'engineers'. For example, the woylie can create in excess of 100 small diggings per



night as they forage for underground fungi, or truffles, and a variety of bulbs. These diggings have a positive impact on the soil by allowing rainwater to infiltrate the normally water repellent soil. Woylie diggings also affect soil properties such as bulk density and the behaviour of soil nutrients.

Woylies have another very important role in the ecosystem, which

has been largely over looked until recently. They are very efficient seed dispersers. For the past 30 years anecdotal evidence suggested that woylies disperse and cache seeds from a variety of plants including *Gastrolobium* species, quandong (*Santalum acuminatum*) and Western Australian sandalwood (*S. spicatum*); however, this behaviour was not examined in any detail until recently. In a study carried out in Dryandra Woodland it was shown for the first time how important woylies are to the ecology of sandalwood regeneration through dispersing and caching their seeds.

*continued on page 3*

## EDITORIAL

*Greetings all!*

ANYONE who looks after bushland needs to think about ecology - the inter-relationship between living things and their environment. Sometimes those inter-relationships are amazingly complex and often little understood; the relationship between ants and plants, see p 11 for one example. Observing and recording what you see could provide new information, and help to complete the jigsaw. You can be a real 'bush detective' - as in the clay trumpets example on page 7!

To be a good detective, you have to keep your eyes open and notice even tiny clues. This issue contains a number of articles on the smaller things which we often don't even

know are there - slime moulds are a case in point. Why not create a humid chamber and see if you have some on your block?

Several of the articles in this issue have a research background. Some, like Peter Spencer's work on ancient DNA, involve highly sophisticated techniques, while others, like Marie Murphy's neat

little study, simply involve ingenuity and patience. Marie demonstrates yet again that loss of an organism from a natural community can upset the balance in ways which may not be always obvious - seed dispersal in her case.

See you at the State Landcare Conference in Katanning!

*Penny Hussey*

*Did you know?*



..... that numbats were first recorded by Europeans during Ensign Dale's exploration of the Avon Valley in 1831? "We also found a small and beautiful animal, which appears not to have been before discovered: its size was about that of a squirrel, and its colour of a

yellowish cast, with light and dark shaded stripes across the hinder part of the back; its tongue was very long in proportion to its body, for which reason we supposed it was an Anteater." They were in woodland near Yenyening Lakes, Beverley Shire.

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The Woylie Sandalwood Story continued from page 1

Sandalwood has been harvested for many years in both Western Australia and South Australia and is a profitable industry yielding export earnings of approximately 11 million dollars annually. The heartwood and roots contain the valuable, strongly aromatic oil-containing santalols, which are used in the manufacture of sandalwood scented products. Sandalwood is a root hemi-parasite and commonly grows with nitrogen fixing plants such as *Acacia* or *Allocasuarina*. The tree has pendulous fruit, with red-brown leathery exocarp encasing a large seed; it is the nature of this seed that hints at the intriguing relationship that has evolved between sandalwood and the woylie.

In recent years, natural regeneration of sandalwood has been poor. Habitat fragmentation, its parasitic nature, grazing and poor seed dispersal have all been implicated in these poor rates of recruitment; however, this is not the case in habitats in which woylies are still present. The woylie sandalwood story began in a sandalwood stand just outside the main block of Dryandra Woodland where it was noted that many new sandalwood recruits were springing up across the road from the main plantation. This fascinating development sparked the interest of sandalwood managers and so, in collaboration with scientists from the Forest Products Commission, the investigation into how the recruits got there began.

Throughout this sandalwood site there was extensive regeneration of all age classes of sandalwood, and the young plants are spreading up hill away from the parent trees. Clearly some animal was removing the seeds from where they fell under the adult trees and dispersing them in all directions. In striking contrast, sandalwood stands in Wickepin, 54 km east of Dryandra, showed no regeneration at all and there were literally hundreds of seeds lying beneath the parent, the vast majority of which will perish. Trapping sessions were conducted at the Wickepin site to determine if there were any woylies, but it was

## FAUNA

completely devoid of native mammals. These findings pretty much confirmed the theory that woylies were a significant dispersal agent for sandalwood. The question was... how do we prove it?

We decided to set up bait stations at the Dryandra village where woylie numbers were relatively high. To enable us to determine the fate of the sandalwood seed once it was removed by the woylie, cotton bobbins were used; the end of the thread was glued to the seed and the bobbin was staked into the ground. This allowed the thread to unwind freely if the seed was removed. We then sat and waited. Sure enough, after a short while a woylie appeared at our bait station to investigate the seeds. After a few moments the woylie picked up the seed in its fore paws, put the seed in its mouth and left the area at some speed. The cotton thread unwound rapidly as the woylie hopped away with its prize. A few moments later the cotton stopped unwinding and the woylie returned to the bait station and repeated the procedure.

The trail left by the cotton was clearly visible and was easy to follow around, under and through vegetation. Finally, the trail stopped and disappeared into a small hole in the ground. There at the bottom was the sandalwood seed, pressed hard into the soil. Surprisingly, the cache was not covered by soil in the majority of cases, but after a couple of days the caches were almost completely covered with leaf litter that had fallen into the cache. The distance of the caches from the bait station ranged from 8 m to 81 m and occurred in a scatterhoarded pattern (one seed per cache). So for the first time ever it was shown that woylies do disperse and cache sandalwood seeds and as a result, woylies have an important role to play in the regeneration of at least one woodland plant species.

The study was the first of its kind to link directly the conservation of a mammal to the regeneration

and management of an important plant species. Future studies plan to expand our knowledge on the important role some endangered native mammals play in the regeneration of plant species through caching behaviour. For instance, the boodie or burrowing bettong, a relative of the woylie, is believed to have cached sandalwood seeds prior to its extinction from the mainland. The western mouse is also reported to have relationship with sandalwood, although at this stage it is unclear whether this particular species is a seed disperser or primarily a seed predator. It is hoped that this will become clearer as the research progresses.

The implications of these findings for conservation of biodiversity are clear. The discovery of the link between the woylie and sandalwood provides an 'icon' for the many functional relationships that exist in our landscapes. Over the millennia, many plants and animals have co-evolved, forming close and intimate relationships. The woylie sandalwood story is one example of such a relationship and is a prime example of how biodiverse ecosystems can function; indeed, the woylie sandalwood story can give us a 'functional icon' to drive the conservation of plant and animal biodiversity as a whole. For the first time we have the opportunity to demonstrate to all Australians the relationships, complexity and beauty of the ecology of Australia and hopefully, we can change our current view of degraded systems to one of high functional biodiversity.

*Marie is starting a PhD on this topic. She would greatly appreciate it if readers who may know of any field sites containing sandalwood and native mammals could pass this information on to her as this would be of immense help with her research.*

*Marie Murphy, School of Biological Sciences, Murdoch University, South Street, Murdoch, 6150.  
e-mail: wde\_lc@yahoo.com*



## FUNGI

### MYXOMYCETES: THE SLIME MOULDS

Margaret Brims

DO I hear you say "Ugh! Who wants to look at slime!", people tend to react that way. But a closer look will reveal the beautifully intricate and varied shapes of these tiny organisms, and their extraordinary life cycle - truly, fungi that walk!

Slime Moulds were first collected in the late 17<sup>th</sup> century and thought to be fungi. Since then, biologists in the Northern Hemisphere have collected and studied them with enthusiasm. They require moist, shady places with leaf litter, decaying logs and stumps, mulch, straw etc. The need for a moist habitat may partly explain why very few people know of their presence in Australia. A large part of our continent is very dry, and our extraordinary flora and fauna immediately take the eye of the observer.

There are about 900 species of myxomycetes (myxos) known at the moment and their scientific classification combines the Greek words for slime (myxa) and fungi (myketes). They exhibit two distinct life phases. During the feeding phase the plasmodium (slime) flows very slowly over the rotting substrate, feeding on bacteria and other bits of organic material (figs 1 & 2). The plasmodium can be red, white, orange, violet or yellow, depending on the species. In some, the cytoplasm can be seen streaming along the veins, slowing, reversing, then going forward again.

When the plasmodium is mature, it produces one of four types of fruiting bodies. The most common is the sporangium, which is a small, mainly spherical structure, stalked or sessile, and less than 1mm in diameter (fig 3). The second is the aethalium, which is a relatively large, cushion-shaped, sessile fruiting body. One species, *Fuligo*, is common around Perth (Fig 4). It appears as a yellow mass (a bit like scrambled eggs!) on grass and mulch, and can be 30 cm in diameter. The third type is sessile and can be wormlike, netted, elongated or branched. It is formed in the shape of the main veins of the plasmodium. The fourth type consists of many sporangia packed closely together, so that it superficially resembles an aethalium.

Identification of myxos depends principally on studying (with a microscope) the shape, size, colour and ornamentation of the fruiting bodies and spores. In Australia, there are very few text books which can help.

Areas south of Perth would appear to be the logical places to find myxos in the field, but those of you who live in drier areas have no need to feel excluded. As the spores are air-borne, they may well be present, but you have to provide them with the right conditions to grow in. Line a clean margarine (or similar) container with a piece of paper towel cut to fit and put a piece of bark (about



Fig 1 A lacy type of plasmodium (yellow).

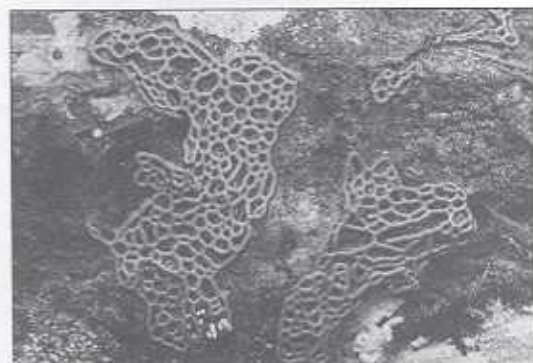


Fig 2 The plasmodium of *Hemitrichia serpula* (orange).



Fig 3 Sporangia of *Craterium leucocephalum* (white with orange stalk).



Fig 4 *Fuligo septica* in a Perth garden (creamy yellow).



## FUNGI

3cm x 5cm) on this. Fill with water, leave overnight, then pour off the water and put the lid on. Put the container on a south-facing window sill, not in direct sun. Inspect daily for a week, then every two or three days, then once a week. They can take up to three months to grow.

At the moment, not enough myxos have been collected to indicate either where they are, or how many there are in a particular area. However, from reports

overseas, it is known that some myxos have a tendency to grow in certain regions, and sometimes on specific substrates. As our trees are so different here, it will be interesting to see whether we have any myxos specific to our region.

Can you help? Perhaps you could look for myxos in your area? Any you find (or grow in a moist chamber as described above) should be allowed to air dry. The substrate can then be glued into a small box

with a lid for storage or transport. So little is known about slime moulds that anything you collect could make a real contribution to our knowledge of local biodiversity.

You could send them to me at the Herbarium, LB 104, Bentley D.C., WA 6983 where I work as a Volunteer two days a week. If you would like to know more, including packaging for transport, ring 9334 0500 and leave a message. I will return your call as soon as possible.

## FLORA

IF there is one fern everyone knows, surely it is bracken! Where it occurs it is very obvious, growing from an extensive network of underground rhizomes, and forming stout, branching fronds that can reach more than 2 m in height. Initially they are covered with chaffy brown scales, but soon become smooth with age. It grows in a variety of habitats in the higher rainfall zone, but always on well-drained soils.

Bracken is the most widespread of all the ferns, growing in every continent except Antarctica, from the tropics to the arctic circle. It's taxonomy is a bit confused, some people consider that there is only one species worldwide, *Pteridium aquilinum*, having geographical variants, while others list six species. If you agree with the multi-species approach, the one in south-west WA is *P. esculentum*.

Bracken responds to disturbance by increased growth. Its rhizomes are well protected from fire and it can come to dominate the understorey in forest country which is subject to frequent burning. It can also take over poorly managed paddocks, displacing feed, though deliberate heavy cattle stocking can be used to control it, as their weight damages even the underground rhizomes.

### Bracken



*Pteridium esculentum*

If you cut the rhizome, you will see that the woody vessels are clustered in the centre - use your imagination a bit and you can see all sorts of shapes. Traditionally in Europe it's a double-headed heraldic eagle, hence the European species is *P. aquilinum*. Alternatively, an elderly Wiltshire countryman (who was hoeing the plant out with a mattock at the time) told me many years ago that the mark is that of the devil's hoof, put there to remind farmers what an evil pest the plant is. It is also toxic to stock when eaten in large quantities, as the fronds contain an enzyme which destroys thiamine and induces severe vitamin B1 deficiency. All of which makes even more astonishing how important bracken

became for the Maoris. Bracken roots are starvation food at best but, once the Maoris had eaten practically everything else on their island home, it became vital for their survival and wars were fought for possession of it.\* There is no record that I have been able to find of Aboriginal people in south-west WA eating bracken.

The word 'bracken' comes from the old English verb 'to break', appropriate enough for the tangle of dead stems, called collectively a 'brake'. Colonists in America used this word for any tangled thicket, whether it had bracken in it or not, and so it has come into general circulation.

So, bracken is part of the ecosystem, especially in jarrah and karri country. But has past management caused it to increase in abundance? If so, you might like to control it's extent. Slashing stems repeatedly is a good method as this eventually exhausts the plant's resources. Brushoff® or Ally® are probably the best herbicides to use.

*Penny Hussey*

\* For the story of how the Maoris adapted to life in their new land, read Tim Flannery's "The Future Eaters".



As many people would be aware, we have witnessed an appalling number of mammal extinctions since European settlement, accounting for about one-third of all extinctions worldwide. The most severely affected Australian mammals have been the marsupials. Because many are now extinct, there is nothing left to 'discover' about these unique animals and their only reminder of what they looked like and what they might have done are left in museums and collected as bones in places such as caves. One recent example of this was a rock wallaby (*Petrogale sp.*), a small kangaroo species from Depuch Island, off the Pilbara coast. This taxa only recently vanished (around the 1970s) and the main reason is probably because of predation by introduced foxes.

One of the problems with the Depuch Island rock-wallaby was that its taxonomic status remained unknown, that is, we don't know exactly which species it actually was. It could be one of two possible subspecies of *P. lateralis*, each possessing a different genetic 'signature'. There are a number of different genetic markers which contain well-defined regions for discriminating differences among marsupial taxa. Therefore, in order to determine the subspecies status of this rock wallaby we used DNA, the building blocks of life. DNA extracted from any sample can identify the species, gender, and provenance (location or place of origin) of the sample animal. It can also provide direct estimates of parentage (lineage) and even the genetic variations within a population. This 'fingerprinting' uses the same technology that human forensic science uses to solve crimes. DNA is the perfect method to determine the species because first, it does not rely on external appearance, and second DNA is a genetic time-capsule containing our history and preserving it long after death.

Ancient DNA is a general term used to describe any genetic sample from 80,000 years ago up to last week. Technically, finding human

## RESEARCH

### HOW ANCIENT DNA WAS ABLE TO IDENTIFY THE EXTINCT ROCK-WALLABY ON DEPUCH ISLAND

*Peter Spencer*

remains that are less than 50 years old is still considered to be part of a forensic investigation. However with animals, once it's dead, it's considered to be ancient. What is more exciting is that there are more than 1.5 billion samples of ancient DNA in museums around the world in the form of bones, skeletons, teeth and even old documents or clothing made from the hide of animals, many of whom are now extinct. The only drawback is that many would be contaminated by other DNA. For instance, just think about how many people may have handled a 100 year old bone in a museum. Everyone who handled it would have 'contaminated' the sample with their sweat, skin cells, hair and even by just breathing on it. What has to be remembered is that there is probably only a little bit of 'real' DNA left in

the bone, and it doesn't make sense to get a result from the last person who handled the specimen! Distinguishing between the *real* and *contaminating* DNA is the important trick in ancient DNA analysis.

This is exactly what we did with the Depuch Island rock-wallaby. DNA was extracted from a tooth-root (which, because it is embedded in the lower jaw is less likely to have been contaminated) and a compact bone sample of the femur, in an ancient DNA laboratory in Germany. The amplified fragments could easily be seen on a special gel for looking at DNA. The result is a sequence of lines in a DNA pattern, rather like a bar code, which is unique to each species (see fig 1). Comparing the codes with each other enables the researcher to determine how closely related they are. This is the same technique that was used to identify endangered species of whale being sold as meat for human consumption in Japan, but with the added problem of going back in time. Sequencing these fragments allowed us to distinguish the species as *P. lateralis lateralis*, which is still found on mainland Australia, but not directly adjacent to Depuch Island (that species of rock-wallaby is the Rothschild's rock-wallaby, *P. rothschildi*).

A clear conservation outcome from this work was the demonstration that the tooth could

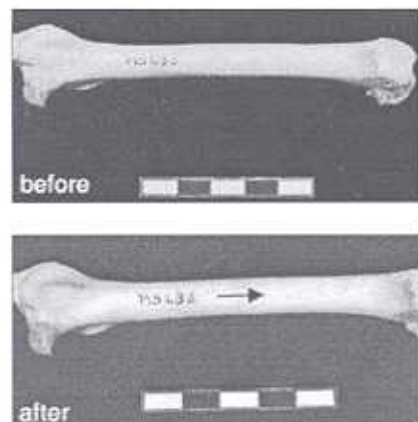
<i>P. sp. unknown</i> <sup>*</sup>	AAATTCTTACTCATGTCTAGTATCAACCACCTACCGTACCTAG
<i>P. l. lateralis</i> <sup>1</sup>	.....
<i>P. l. lateralis</i> <sup>2</sup>	.....A
<i>P. l. hacketti</i> <sup>3</sup>	.....
<i>P. l. pearsoni</i> <sup>4</sup>	.....
<i>P. penicillata</i> <sup>5</sup>	.....T.....T.....A
<i>P. herberti</i> <sup>6</sup>	.....T.....C.TG.....A
<i>P. sp. unknown</i>	TTTATTTTGTTTTTT-ATGCACGTACATATATATGTATAACT
<i>P. l. lateralis</i>	.....T.....
<i>P. l. lateralis</i>	.....
<i>P. l. hacketti</i>	...G.....C.....TC
<i>P. l. pearsoni</i>	...G.....T.....C.....T.
<i>P. penicillata</i>	.....GC.....T.....T.T.C.....T.
<i>P. herberti</i>	.....CT.....C.T.C.....T.

**Fig 1** A number of DNA sequences from seven species of rock wallaby. The sequence at the top is the Depuch Island rock wallaby used in this study, and this has the greatest similarity to *P. lateralis lateralis*. The similarity can be seen by the dots below the top sequence, which represent the same sequence. The main point to note is that there are lots of different DNA sequences in the other rock wallaby sequences.



## RESEARCH

be replaced to reconstruct the skull, as the specimen did not have to be destroyed, so from a morphological perspective the process can be carried out without the need for



**Fig 2** A comparison of before and after the sampling of the femur bone from a museum specimen of the black-flanked rock wallaby from Depuch Island. It can be clearly seen that DNA analysis does not necessarily result in the destruction of museum specimens.

sample destruction (see Fig 2). Furthermore, this type of approach to conservation biology will become more widespread, because the subfossil and museum material may represent a large proportion of, or in many cases the only, material that is available to work with in Western Australia. From another conservation viewpoint, this finding has also been very useful. The Department of Conservation and Land Management have removed foxes from the island (the main reason why the rock-wallabies disappeared in the first place), so it would be an ideal place to put rock-wallabies back. We now know which one to translocate.

*Dr Peter Spencer is a conservation geneticist based at Murdoch University. He can be contacted on (08) 9360 2489.*

## BUSH DETECTIVE

This is a real detective story!

Who made these little clay trumpets and what for?

Jarrad Hollins was walking through his bushland with Emma Bramwell (CALM Covenants) and Mike Griffiths (Woodland Watch) when they noticed these little trumpet-shaped structures. Jarrad thought they were built by termites - but *why*? Mike was so intrigued he ferreted out the story, see p 16.



## Can rock wallabies disperse across farmland?

**C**ONSERVATION genetics has also been used to determine the source of a new population of rock wallabies in the wheatbelt. Fox control has allowed rock wallaby populations to build up at several rock outcrops near Mt Caroline, between Kellerberrin and Yotting. Recently a new population was discovered at Gardners, 8 km north.

To find out where that population came from, genetic samples were taken from animals in all the known locations, and then compared. It seems that the Gardners population had come from Mt Caroline East, and moreover, that the founding member was a single female carrying a pouch young and a quiescent embryo! She would have had to travel through an extensively-cleared rural landscape in order to reach her new refuge. One wonders how many other travellers set out, but get taken by foxes before they reach somewhere safe?

For the full story, read: Eldridge MDB, Kinnear JE, & Onus ML. 2001. "Source population of dispersing rock-wallabies (*Petrogale lateralis*) identified by assignment tests on multilocus genotypic data" *Molecular Ecology* 10, 2867-2876

An exciting new find!

Peter Orell, Western Shield Zoologist, recently (April 2003) found fresh rock-wallaby scats at Kokerbin Rock, south of the cluster of known sites referred to above. The animals were driven to extinction on Kokerbin around 1963. It looks as though some at least of these medium-sized marsupials are capable of moving through an agricultural landscape, as long as there are reasonable habitat islands for them to shelter in along the way.

But widespread feral predator control would really help!



## REVEGETATION

**Y**ES, heap burning can be an effective, cheap and fun way of achieving regeneration of vegetation in open areas.

During the summer of 1992/1993, I decided to try out the 'heap and burn' technique for stimulating regeneration of woodland species in open areas near my parents' holiday house south of Mandurah, adjacent to the Harvey Estuary. The surrounding bushland was mainly open peppermint (*Agonis flexuosa*) woodland, with some flooded gum (*Eucalyptus rudis*) and golden wreath wattle (*Acacia saligna*), but with no regeneration occurring, it was gradually becoming more open.

There were many open areas, and a lot of fallen branches and old wood. I created heaps in six open areas with this fallen material, taking care not to use any large logs that would be providing ground-level habitat, and making sure that the heaps were away from tree bases so that they did not get burnt out in the process. I also took the precaution at the time of burning the heaps, of raking a firebreak around each heap to ensure the fire did not spread out through the dried fuel from leaf litter and old wild oats.

During the Easter break, April 1993, after there had been some rainfall to dampen the ground, I burnt the heaps. This was done one at a time to ensure we could control the fires, and have a safe edge before moving to the next one. Each heap was about two cubic meters in size of stacked wood. The wood was well cured, so with a bit of dry grass and leaves, they took off easily.

As the heaps burnt down, I pushed them in to ensure that they burnt up completely, and were thus safe to leave. This left the edge of the burnt areas reasonably bare, and the centre of the heaps with an accumulation of ash and coals. When the fires were fully extinguished, I raked the heaps over the area burnt to ensure the coals cooled down, and to respread the ashbed over the burnt area.

## YES, IT WORKS!

Ken Atkins

It was now time to wait and see (and pray for good rains).

In December, I revisited the sites, and was amazed to see hundreds of seedlings in the ashbeds (except one). Most of the seedlings were



1 December 1993:  
Ashbed from heap burnt in April 1993, showing peppermint seedlings.



2 March 2003:  
Row of ten year old peppermint saplings in old ashbed.



3 March 2003:  
Large open area with ten year old peppermint and golden wreath wattle regeneration following heap burning, with new heap being created in foreground for next treatment.

peppermint, with a few other species including golden wreath wattle, flooded gum and spearwood (*Kunzea glabrescens* - previously *K. ericifolia*) in single sites. The ashbeds were bare of weeds, giving these seedlings a better chance at initial establishment. It would now depend on follow-up rains.

Over the following years the seedlings thinned out and those remaining grew well, with a number becoming established in five out of the six ashbeds. Ten years down the line and they are over my head in some cases. Success!

So, it proved to be an effective method for establishing vegetation, although the regeneration reflects the depauperate nature of the existing vegetation. As with any regeneration, the success is dependent on the rainfall, and if at first you fail, then try, try again.

It also proved to be a cheap method, with no specific ground preparation, weed control, or seed collection. However, it is dependent on the seed present in the area, either stored on the surrounding trees, or residual in the soil. If seed is not present, then supplementary seeding would be necessary. The cheapness of the method does mean, however, that if it does fail because of lack of rain or seed, then it does not take much to re-treat an area.

And finally, fun? - well yes if you have a teenage son that shares your love of playing with fire. It is a good way of diverting arson skills into something positive! Of course, I only do it for the regeneration (but marshmallows do toast nicely on the coals!).

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Ken Atkins is A/Manager, Wildlife Branch, Department of Conservation and Land Management, responsible for a number of programmes including licensing, rare flora - and Land for Wildlife. He can be contacted on (08) 9334 0425.



## REVEGETATION

### 80 YEARS OF GRAZING, FENCING, THEN - AN EXCITING DISCOVERY!

Alison Doley

SINCE 1970, John and I have been fencing off remnant vegetation on our farm "Koobabbie", south-east of Coorow.

In 1986 and 1991 we fenced off two areas of Salmon Gum and Gimlet woodland. Selected in 1906 and cleared soon after, these timber belts had been grazed by sheep and cattle - and in one case, horses - for close to eighty years. The understorey was reduced to ancient survivors of acacia, hakea and pittosporum. Once stock were excluded, by the mid 1990s, nine eremophilas had established themselves at the first site, four at the second.

An article in "Landscape" on a very similar rare eremophila in the Dalwallinu district prompted me to ask Diana Papenfus if she could take a specimen to the Herbarium for identification. It was sent to Bob Chinnock in Adelaide and Diana rang back with the exciting news that it is a new species. In addition, a single specimen of another eremophila from the first area was identified as *E. sargentii*, a Priority 2 species.

The new species has the manuscript name of *E. koobabbiensis*. Our local nurseryman has found that it grows well from cuttings, and these have been planted at several sites around the farm. As well, material has been sent to Kings Park, and to Mary Squire's nursery at Mukinbudin.

Grazing - by birds, rabbits or kangaroos - was stripping the bark from the plants, so protective netting has been placed around them. The original plants are gradually dying back, so the plant probably has a limited life span, even without trying to cope with the present severe drought. Clearly, the seed has the capacity to lie in the soil for eighty years, then germinate when the conditions are right. The areas have not been burnt, so fire was not a stimulus.

Even small, apparently poor-looking, remnants can give you exciting surprises! John and I are convinced that even degraded remnants are far richer in reptiles, insects and seeds than revegetating in an open paddock, so the fencing continues - assisted of late by some very welcome NHT funding.

Alison and John Doley can be contacted on (08) 9952 3211.

(Nb: Bob Chinnock wrote about *Eremophilas* in WW 6/4, mentioning this exciting find.)



*E. koobabbiensis* m.s. under Salmon Gum and Gimlet. Fenced 1991.



Grazing protection around *E. koobabbiensis* m.s. Fenced 1986.



*E. koobabbiensis* m.s. grown from a cutting. Planted 2000.



## RESEARCH

# ANTS AS BIO-INDICATORS OF DISTURBANCE IN URBAN BUSH - SUMMARY OF A CASE STUDY

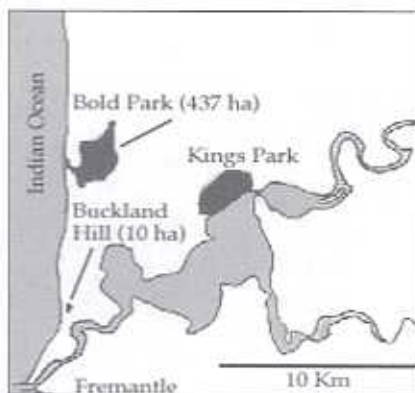
Pierre-Ulric Achour

**N**ATURE enthusiasts spending some time in the field anywhere in Australia will undoubtedly have fascinating (yet sometimes painful) personal experience with ants.

Ants are recognized as numerically and ecologically dominant organisms in terrestrial ecosystems over a major portion of the planet. The group has probably been in this important position for over 50 million years! To date, over 300 genera and 15 000 species of ants have been described worldwide, and these numbers are still increasing as research continues. 103 genera and 1275 species and subspecies have been described in Australia alone. The biodiversity of the Formicidae family is a reflection of the incredible pattern of adaptive radiation which characterizes the group's evolutionary history.

Members of this large insect family occupy pivotal positions in many aspects of terrestrial ecology, and affect their physical and biotic environments profoundly. By facilitating the cycling of nutrients, interacting with flora and fauna and moderating physical conditions, ants promote the establishment and maintenance of complex plant communities and play a part in succession mechanisms and important ecosystem functions. Reciprocally, climate, vegetation and soil type are the main factors determining the composition of ant communities.

The Western Australian ant fauna is certainly very diverse, and most of the local ant species are of significant ecological or economic importance. The use of ants as bio-indicators dates from the mid 1970's, when it was proposed that exploring the structural composition of ant communities would yield valuable information on ecosystem health.



Location of the two study sites. (Illustration: P.-U. Achour)

Since then, the concept has proven itself relevant in monitoring the rehabilitation status of sites after many types of disturbances. These have included fire, grazing, mining and clearing.

Previous studies examining the structure of ant communities around the Swan Coastal Plain have focused on non-developed areas. The remainder of this article shortly summarizes a study undertaken in 2002, around two suburban bushland areas in the Perth metropolitan area: Buckland Hill and Bold Park. The aim was to evaluate the rehabilitation success on Buckland Hill, using Bold Park as a reference site. The two sites, although of very different scale, share a similar geographic, topological and floristic background.

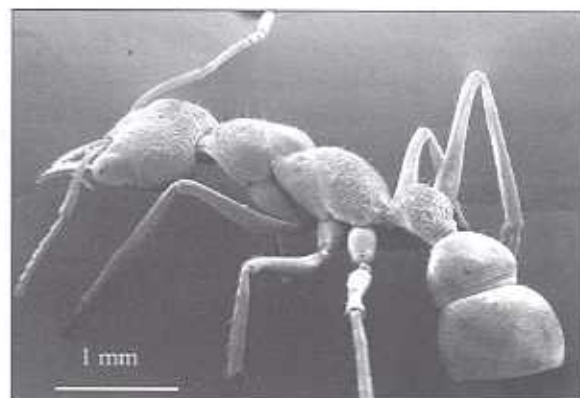
Buckland Hill (10 ha) was used as a limestone quarry and later as a military post during the Second World War. It is now a road-side public bushland area on the coastal reaches of Mosman Park's

residential zone. Efforts to revegetate and protect the site have been sporadically implemented for over a decade by the local council.

Bold Park is the largest remnant coastal bushland in the Perth metropolitan area (437 ha). It is managed by the Botanic Gardens and Parks Authority as a protected A-class reserve. The area comprises important conservation, landscape and recreational opportunities. The park is comprised of many different plant communities, and has retained much of its original vegetation.

The initial expectations for this investigation were that the ant community structure would be significantly different between sites, and that variations in this structure would also be reflected in different vegetation assemblages within both sites.

Ant surveys were undertaken simultaneously along two transects (100m) on each site, during two seasons, to ensure a comprehensive coverage of the existing ant fauna. Collections were made along a poorly vegetated (disturbed) and highly vegetated transect line from each location, to determine the role of vegetation status on ant fauna



Electron Micrograph of *Myrmecia urens*, a specialist predator. This native coastal 'Jumping Jack' is a close relative the larger 'Bull Ant'. It was found in Buckland Hill. (Photo: P.-U. Achour/E. Miller)



## RESEARCH

continued from page 10

composition. A vegetation survey was undertaken along each of the four transects, to quantify litter cover and vegetation density parameters.

Pitfall trapping and manual collection were the main collection methods for ants. The specimens were brought back to the Curtin University Entomology Laboratory and identified to species level.

Pitfall-trapped material, used for the quantitative analysis, comprised 4596 ants representing 60 species and 26 genera. Six additional species were collected manually. The results reveal a distinctly richer fauna on Bold Park (47 species) when compared with Buckland Hill (33 species). Site differences in composition were also very pronounced, with only 31.8% of all species being common to both sites, 45% of the species were limited to Bold Park, while only 21.7% were limited to Buckland Hill.

Ant richness for the transects was positively correlated with important edaphic and vegetation parameters such as litter cover and plant cover. This confirms the tight relationships existing between ants and their micro-habitats.

The two sites also differed in regards to the functional grouping of their ant communities. This model divides the ants into groups on the basis of their habitat or climatic preference, competitive dominance, foraging strategy or disturbance tolerance. For example, the abundance of dominant, opportunistic and generalised species along the most disturbed and barren transects (such as in Buckland Hill) was no surprise. On the other hand, cold climate specialists, cryptic species and specialist predators were better represented in Bold Park, and the well vegetated section of the Buckland Hill transect, where a greater range of environmental niches exist.

It was gratifying to discover that few of the exotic species which now

dominate the ant fauna elsewhere in the Perth metropolitan area were present in the study sites. Two of these species were found in Buckland Hill (*Cardiocondyla nuda* and *Tapinoma melanocephalum*) and are unlikely to affect the persistence or return of native ants species where they occur. The third species, the infamous *Pheidole megacephala* (Big-headed or Coastal Brown ant), was found on the margins of Bold Park and should be monitored. The species poses an invasive threat, especially where severe disturbance such as clearing has been undertaken.

Overall, the study suggested that important differences exist between the ant fauna of the rehabilitated site and the more pristine reference site. The recovery of the original ant communities at Buckland Hill is modest, and the fauna has not yet regained its original richness or diversity, when using Bold Park as a point of reference. This parallels, to a certain extent, the different conservation status of the two areas and validates our stated expectations. It has also confirmed that ants reflect quite accurately the complexity and stability of their habitat, and are suitable indicators for assessing ecosystem health in the remnant vegetation around Perth. In the future, the results of long term studies of isolated urban bushlands could help shed some light on the role of linkage and scale of parks and reserves, in regards to re-colonisation and successional theories.

*Pierre-Ulric Achour is an honors student in the Department of Environmental Biology at Curtin University of Technology. Prof. Jonathan Majer supervised the project and Dr. Brian Heterick provided invaluable help in identifying the specimens to species level. For further information contact Pierre-Ulric Achour at [achourp@ses.curtin.edu.au](mailto:achourp@ses.curtin.edu.au)*

## FLORA and FAUNA

### Ants as defence force?



In beach sand behind the coastal dunes at Broome you can find *Adiantum tomentosum*, a compact shrub to 1.5 m, with three-lobed, slightly hairy leaves. The male and female flowers, which grow on separate plants, are held on a spike above the leaves. The plant grows from the Kimberley south to the Peron Peninsula and the Murchison River. Around Broome it can be quite common on disturbed ground after a fire.

*Adiantum*, like many of the Euphorbiaceae (Spurge) family to which it belongs, has extra-floral nectaries. These are glandular structures at the base of the leaf stalk and on the floral bracts which provide a sugary solution much relished by ants. Ants are aggressive and their presence on a plant often deters other insects which fly in for a meal. It is believed that the plants deliberately provide the sugar as a reward to encourage ants to visit and so, inadvertently, defend the plant against other, more damaging attacks. To test this idea, two researchers studied *Adiantum* at Broome (and at Toowoomba, Qld).

They found that the Broome plants were mostly being eaten by aphids and whitefly larvae. Eight ant species from five genera visited the plants, and their presence was effective in reducing the number of herbivores found on branches and young leaves. Thus the plant's investment in producing sugar to attract ants does seem to pay off, especially, perhaps, during the very dry conditions which occurred at the time of this study.

Have you observed any plants in your area, regularly visited by ants, where the same sort of mutualism might be happening?

For the full story, read: Mackay, D. A. and M. A. Whalen, 1996. "Geographic variation in ant defence of a widespread Australian euphorb." *Australian Systematic Botany*, 9, 235-242.



## RESEARCH

# The Woolly Bear Caterpillar

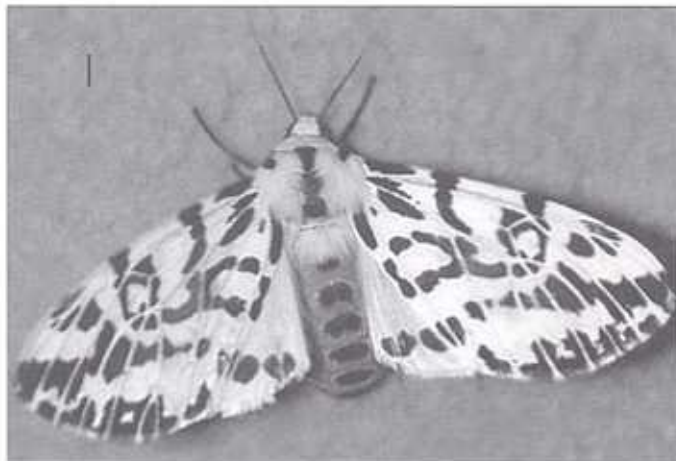
Peter Langlands

A common sight in Western Australian gardens is a black/ brown hairy caterpillar, the 'woolly bear' caterpillar (*Spilosoma glatignyi*). Although this native caterpillar, which can grow to 5cm, is easily seen and recognised, the adult moth it turns into is not so well known. The adult moths have white wings with black patterning (6cm wingspan) and a vivid red and black striped abdomen. Belonging to the sub-family Arctiinae or 'Tiger moths', the bright colouring of the abdomen warns birds that this moth is distasteful and may be poisonous.

The adult moths emerge in April-June, mate and the females lay eggs on suitable food plants. The 'woolly bear' caterpillar is not a fussy eater and is known to feed on 23 plant species, including Artists Acanthus (*Acanthus mollis*) and Paterson's Curse (*Echium plantagineum*). Only causing minor problems in Western Australian gardens, the caterpillar has defoliated pine plantations in South Australia. The larvae emerge and begin feeding, increasing in size rapidly over winter. The thick hairs covering the caterpillar deter birds and allow it to bask in the open while feeding. This does however leave the caterpillar vulnerable to attack by parasitic wasps. In August, the caterpillars become sensitive to light and crawl into the leaf litter or crevices. After spinning a loose cocoon of silk, debris and hairs, they turn into pupae. The following



The Woolly Bear caterpillar.



The adult moth of the Woolly Bear caterpillar.  
(photo: D Herbison-Evans)

year they emerge as adult moths. The moths are often attracted to lights and can be found at night around the house. The moths may be less well known due to high infection by parasites and their brief existence.

An experiment was conducted last year to find out how environmental factors (temperature, light and food source) influenced the time taken by the 'woolly bear' caterpillars to reach pupation. Although overseas species of *Spilosoma* have been investigated, there have been no Australian species studied. Caterpillars were collected from the field and reared at Curtin University in cages, fed on Paterson's Curse leaves,

The study consisted of four treatments: constant increased temperature of 25°C; short light period of 5 hours; decreased food source; and controls. The time in days for each caterpillar to start pupating was recorded, as well as pupal weight. It was found that the caterpillars reared under constant 25°C developed faster, but were smaller, and similar in size to the starvation treatment. The short light period and controls developed at the same time and showed no significant difference in size.

These results show that, although increased temperature leads to quicker development, the resulting moths are smaller and in several cases fail to form proper wings. Likewise, the caterpillars reared with limited food were stunted and many did

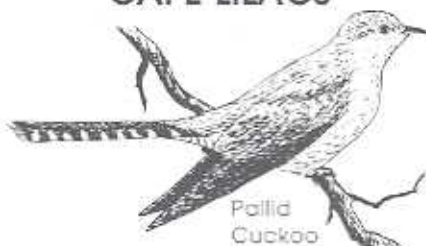
not hatch into moths. A reduced light period had no effect and it is likely that the hairiness of the caterpillars means they are not restricted to feeding under cover of night. Although this experiment has shown that this caterpillar could be easily mass reared, it is unlikely that it could be used as a biological control agent for pest plant species (Paterson's Curse) as it will also feed on many other plants.

*Peter Langlands completed this work under the supervision of Dr B Heterick, as part of his Bachelor of Science (Environmental Biology) degree.*



## MEMBERS' PAGE

### CUCKOOS, CATERPILLARS AND CAPE LILACS



Pallid  
Cuckoo

FOLLOWING the article on caterpillars in Cape Lilacs in the April Western Wildlife, I would be interested to know whether any other readers have noticed a correlation between Cape Lilac caterpillars and Pallid Cuckoos, which, according to the booklet "Common Birds of the South West Forests", feed on hairy caterpillars. At Donnybrook we have Pallid Cuckoos visit our block in spring and our neighbours have beautiful lush Cape Lilac trees. No sign of caterpillar infestation. Have the caterpillars simply not caught up with our neighbours' trees yet, or is the Pallid Cuckoo really a worthwhile ally in the effort to gain control of the creatures?

In Bunbury, where at least two varieties of hairy caterpillars indulge in home invasions every spring in certain areas, I did not hear or see Pallid Cuckoos in the ten years we lived there. Also, do these cuckoos parasitise the nests of 28s and kookaburras?

Hannah Kendall, Donnybrook.

Lesley Brooker, of CSIRO, comments: "Pallid Cuckoos are fond of hairy caterpillars and we've had a juvenile spend three weeks feeding on them in a Cape Lilac. They are nomadic, so may not always be present in a district when caterpillars are infesting the Cape Lilacs. Cuckoos in general parasitise small songbirds - none successfully parasitise parrots or kookaburras. In WA, Pallid Cuckoos prefer the larger honeyeater species such as miners and wattlebirds."

(Note Peter Langlands' article about hairy caterpillars on p 12 - Ed.)

### AN UNUSUAL ORCHID



VERITY HARRIS of Cuballing and her eleven year old son Adam, are keen observers of orchids. Adam found a colony of fifty or so of this interesting plant around sheoaks on granitic sands. It is a pale lemon-yellow colour. Adam tried to identify the plant using Noel Hoffman and Andrew Brown's book *Orchids of South-West Australia* but there were no exact matches. He wondered if it could be the leopard orchid *Thelymitra benthamiana*, but without the spots, or was it a new and rare plant?

Andrew Brown, of the WA Threatened Species and Communities Unit, says: "It is indeed *Thelymitra benthamiana*. The species regularly produces 'lutea' forms that lack the brown blotches and spotting typical for the species. When this happens it often produces pure colonies where all plants lack markings. I have seen it near Frankland, Boyup Brook and Perth but this is a new location for the form."

Well spotted (or no-spotted) Adam!

### BENT BALGA SPIKES

WITH regard to Jennifer Young's comment about bent Balga spikes under power lines (WW 7/2 p16), Betty and Bob Wemm of Kalbarri comment: "We have noticed over the years that grass trees usually produce bent flowers consecutively, although not always. These bent spikes also occur everywhere, we've seen them all over the State. Some Kalbarri National Park and Eradu plants have evidence of three consecutive bent flowers and were a considerable distance from

electricity. We cannot offer any explanation but it would seem to have something to do with the plant, rather than external influences."

(I had a look at some on my road verge, under a power line, and at every bend gum had oozed out, indicating that the stem had been damaged at that point. I wonder if, at a young stage of spike formation, insects such as weevils could be responsible? {see the note on banksia spikes in WW 4/3 p15} Ed.)





## FAUNA

### MONITORING FOR THE PAST AND THE FUTURE

*Wayne and Desraé Clarke*



WHENEVER we visited our 'block' in Toodyay, purchased in late 1984, we were constantly accompanied by a treasure chest of birds. While digging the driveway, a task that took three years of weekends, it was wonderful to be frequently attended by robins, magpies, weebills and a host of other birds fossicking in the soil in front of the shovel. When the 'Birds on Farms' project commenced we were very keen to become involved, to gain an understanding of the bird diversity.

A notation of birds, including where we had sighted them, was made in our handbooks when we moved to live on the property in 1989. Our involvement with the Toodyay community became rather extensive and it was soon evident that, to keep up with the administration, a computer was needed. It was around that time that the decision was made to undertake the recording of 'daily birds' and a database was set up for this purpose. We have been recording birds on a daily basis ever since.

How we went about it was quite simple. A spreadsheet was designed, and all the birds entered that we have ever recorded on our property and two small neighbouring farms. A daily single sheet with the names of all these birds, the date, weather and comments was developed, leaving a few extra boxes for new species (this has proved to be extremely important), and then

about thirty double-sided sheets were photocopied for future use. As we see or hear birds, on a daily basis, we place a pencil mark next to the particular box. After the sheets have been filled, we enter them into the database, and erase all the pencil marks, dates, etc, to re-use the sheets.

The result is a database that reveals some extremely interesting patterns in bird movement, both seasonal and circumstantial, with over seventy bird species being recorded in the last nineteen years. We have been lucky - we don't work full-time, so we are often around the home. Neither is particularly interested in radio and television, so our home is relatively quiet. We have learnt over the years to 'see birds with our ears', as many of their sounds are easily recognisable. While compiling this article, the sounds of at least six different birds are quite audible. Another area of observing and learning has been deciphering the variety of sounds one species of bird may have on different occasions while fossicking, preening, courting or in alarm.

Monitoring in this way has highlighted some interesting patterns. For instance, when the various species arrive and leave with their migratory patterns, like the Rainbow Bee-eaters and the Pallid Cuckoos, or the effect that drought or excessive rains may have in moving birds from their normal areas of habitat - with the recent

drought conditions, the Toodyay area saw an influx of many White Necked Herons, a bird not seen generally in this Shire. A few years ago, the Splendid Fairy Wrens disappeared from the shrubbery around our home for approximately four years. It was after looking back over our records that we realised that this disappearance coincided with the arrival, and nesting immediately behind the house, of the Grey Butcherbird. Fork-tailed Swifts arrived one afternoon, just prior to a cyclone; these species have been recorded twice on our property since we have lived here. These and other sightings form patterns that may one day be extremely important to science. CSIRO (through Denis Saunders and other scientists) highlight the fact that birds are a critical indicator species of the health of any area, but specifically our fragile wheatbelt district.

Not everyone may have the time to undertake this type of monitoring, but we did want to share the tremendous satisfaction we have gained from compiling our database, the great excitement when we find something new and the tremendous pleasure we gain from being with 'our daily birds'.

Wayne and Desraé would be prepared to send a template of their database to anyone interested. Phone on (08) 9574 5574 or email [wcclarke@westnet.com.au](mailto:wcclarke@westnet.com.au)



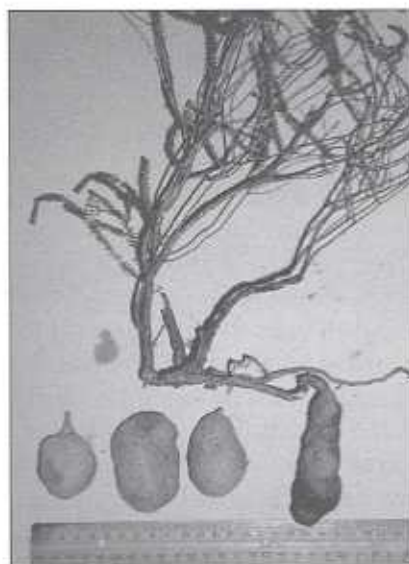
## ECONOMIC ASPECTS OF BIODIVERSITY

### AUSTRALIAN NATIVE PLATYSACE TUBERS: FROM THE BUSH TO YOUR SHOPPING BASKET

Geoff Woodall

NUMEROUS Australian native species are tuberous and within the Western Australian flora there are a least 172 species. Several tuberous species of *Platysace* from southern Western Australia were important food for indigenous people prior to the introduction of western culture. *Platysace* species (19 native to WA) are in the Apiaceae, an important horticultural family that includes many other important edible species such as carrots, parsley, parsnip, dill and coriander.

Over the last few years the horticultural potential of *Platysace* species from southern WA has been assessed. *P. deflexa* appeared to be the species with the best horticultural potential, principally because this species produces numerous large, visually attractive tubers that are pleasant to eat. Field observation suggest that mother plants of *P. deflexa* quickly recover after tuber harvest and rapidly produce new tubers in soil that was disturbed during harvest. This growth characteristic should allow adaptation to broad scale cultivation. This species is a small perennial rhizomatous shrub, up to 50 cm tall, with aromatic leaves and white flowers. It grows naturally in the nutrient poor sandy soils of the Jeramungup-Ravensthorpe area of Western Australia. Field excavations have indicated that a mature plant can produce numerous tubers, 2-5 cm in diameter, 5-15 cm in length and 0.5-1 kg/plant. While *P. deflexa* appears to have considerable potential for human consumption, we know little about its biology, propagation and cultivation requirements. Their tubers are nutritionally similar to



*P. deflexa* plant with tubers. ▲

Healthy *P. deflexa* plants  
at field trial site. ►

other common and widely eaten vegetables (eg. carrots).

There does appear to be a market for *P. deflexa* tubers. Tubers from Ravensthorpe were washed, packaged then distributed to bushfood suppliers and chefs. Most members of the bushfoods industry, including cooks, endorsed the product (raw and cooked tubers) after preliminary tastings. When eaten raw, tubers are crisp, crunchy, sweet and with a slight radish taste. Cooked tubers are crunchy and taste similar to cooked squash. One chef suggested that raw tubers could be used in much the same way as radish. He suggested that they would complement a spicy salad, that is, a salad that contained rocket and or other hot/spicy ingredients. Other industry representatives commented that the colour (yellow outer skin) of the tubers was an attractive feature of the product and that they were



Tubers of *P. cirrosa* on right (dark brown skin). *P. deflexa* on left (yellow skin).



impressed with its long shelf life (at least 8 weeks at 10°C).

In Albany, plants have been propagated from tubers, seed and suckers. A small experimental plot has also been established at Gairdner. The five-year objective is to take this species from "the bush to your shopping basket". So in a few years time look out for *Platysace* tubers at your nearest supermarket! You'll be supporting a new native plant based industry.

*Geoff Woodall is a researcher at the Centre of Excellence in Natural Resource Management, Albany. He has been working on commercialising Platysace spp. for some time, looking at four species (inc P. cirrosa, featured in WW 7/1 p 20). To find out more, contact him on ph. 08 9892 8427,*

*email: gwoodall@agric.wa.gov.au*



**R**AIN has all sorts of effects on the Wheatbelt and its inhabitants - especially when it falls after a drought year like 2002! A group of us inspecting Jarrad Hollins' remnant bushland south of Dowerin in January were surprised to find several small clay 'trumpets' on a patch of bare ground. None of us had seen them before, including Jarrad, who is quite a bush enthusiast. These little trumpets were only about 4 cm tall and 2 cm in diameter, open-ended (just like a trumpet) and were out in the open. They were very fragile, and looked like they'd fall to pieces in the next shower of rain - and probably did! None of us really knew at the time what they were, but the clue was that they were built of granules of wet clay. And only two days before, good rains had fallen and the soil was still damp ...

A close examination and a bit of homework revealed all. The little clay trumpets were in fact built by termites. Late summer and autumn is the time of year that many species release their winged reproductives to fly off and establish new colonies, as far away from the parent colonies as possible. But these insects are very weak fliers and have no means of leaping into the air to launch their flight. Their wings and bodies are designed only for short, once-in-a-lifetime flights. For termite species that build mounds, it is not difficult for these winged reproductives or *alates* (literally meaning 'winged') to simply launch themselves off the top of the mounds. But for species that nest close to the ground or underground, it is an entirely different matter. They must have some sort of 'launch pad' to get themselves airborne, and that's exactly what these clay trumpets were. They were the 'exit towers' or 'release towers' built especially for the launch of the winged termites.

Departure of the alates from the colony is serious business in the world of termites, and is preceded by a frenzy of activity within the nest. Swarming, although only undertaken by certain castes or types of termites in the colony, is an important event, and is akin to

## FAUNA

### TERMITES AND 'CLAY TRUMPETS'

Mike Griffiths

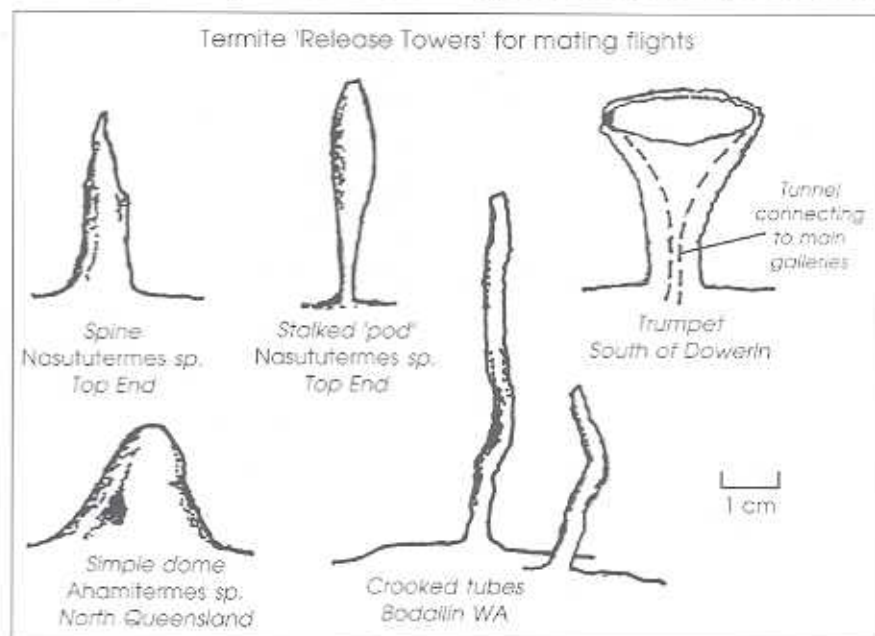
spawning of the coral or the mass breeding migrations of some mammals. Successful dispersion of the species depends on successful swarming of the alates.

Once a year, the alates gather in the upper-most section of the colony, surrounded by worker termites who build the exit towers and open slits or small holes in the outer walls for the final countdown. But conditions must be exactly right for these releases to happen, they will only depart on still, mild days before or after rain. They will not fly if these conditions are not right; alates have been known to mill around in the nests for many days waiting for changes in the weather. Unlike the nest mounds, which may be large and long-lasting, termite release towers are small, built only at certain times of the year and very short-lived. They are rarely seen and not well known! Despite being so poorly studied, it seems that these structures vary considerably according to the species, and can

actually be quite diagnostic for species identification.

It seems that the clay trumpets in the Dowerin bushland were made by a species belonging to the largest Australian termite family, Termitidae, probably in either the genus *Tanulitermes* or *Amitermes*. Other types of release towers are known to be made by other species of Australian termites, including some very curious designs: small domes, small tapering spires, stalked pods and long thin tubes, typically 5-10cm tall (reported and photographed by Buddy Kent, South Bodallin), all built on the ground. One type of ground-nesting termite (*Microcerotermes serratus*) builds additional clay nests 1-2 metres above the ground on tree trunks, especially for the release and development of alates.

Although the world's tropics are regarded as having the greatest diversity of termites, Australia's temperate regions are also rich in termite species; the Wheatbelt alone has over 75 species. Although they might be better known as pests, they play a crucial role in our natural environment, processing vast amounts of plant matter with the help of microscopic protozoans in their gut. Of the wood-eating termites, some only eat old decayed wood on the exterior of logs and old stumps. Many species of termite are not wood-eaters but eat grass, bark or leaf-litter. These are often





continued from page 16

referred to as 'harvester termites' because of their habit of harvesting and storing their food - they are the typical mound builders and include the builders of some of the largest of all mounds including the 'cathedral mounds' of the Top End which can be 3-4 metres tall. The majority of the Wheatbelt's mound-building species are grass- and leaf-eating harvester termites, such as the common Tammin Termite (*Drepanotermes tamminensis*) which builds clay mounds to a height of approximately 2 metres. Despite misnomers such as 'white ants' and 'ant nests' (for the clay termite

## FAUNA

mounds), it is important to note that ants and termites are like chalk and cheese. They are unrelated, have different caste systems, have different life cycles and, when you have a proper look, they aren't even very alike!

So next time you see the swarms of fluttering 'flying ants', remember they are, in fact, more likely to be flying *termites*, off to seek greener pastures for new colonies. Any reports and photographs of these

curious little release towers would be very welcome. Please note for each pic the details of location, soil type, approximate dimensions, weather conditions and date are required.

Contact: Mike Griffiths, WWF Australia (Woodland Watch), c/- Avon Catchment Council, PO Box 311, Northam WA 6401

ph: 9690 2232

email: [mgriffiths@wwf.org.au](mailto:mgriffiths@wwf.org.au)

or contact your LFW Officer.

(A ref. list is available - Ed.)

## FAUNA

### NESTING IN THE WHEATBELT - YELLOW-RUMPED THORNBILL, *ACANTHIZA CHRYSORRHOA*

Heather Adamson



ONCE again these common but possibly overlooked little birds have constructed their bulky nest in *Acacia colletioides* (wait-a-while wattle). Weather-beaten remains of last year's nest still hang in this large old wattle alongside this season's one. It is built with the typical 'false nest' at the top, and the small side entrance to their actual nest concealed underneath. Used in the construction are curly windmill grass, feather speargrass, wind grass, white tops, wool (seems to be the main binding factor - shearing shed nearby), galah and ring-neck parrot feathers, bark, hay, grass seeds, spiders egg sacs (but no cobwebs at all), stubble, very small twigs, and what looks like old clover or capeweed leaves. All of which all sits on the outer branches, about one to two metres above the ground.

One female with several males will rear up to four broods in a good season. All members assist with feeding the young but only the female incubates.

After recent overnight heavy rain and wind the nest became a bit shabby, resulting in three off-whitish eggs with faint speckles on the large end found on the ground - she may have pushed the eggs out after they became wet or cold. Anyhow, the little female was soon back in her nest obviously getting on with it.

Yellow-rumped Thornbills forage in trees, shrubs and on the ground for seed and a variety of invertebrates. If disturbed their flight is 'undulated and jerky' and exposes their characteristic yellow feathers on their rump as they fly away. The group chatters with a high-pitched tinkling song.



Yellow-rumped Thornbills nests in *Acacia colletioides*. Upper nest, current, bottom nest 2002 season.



False entrances at the top of the nest.



## LFW NEWS

### SECRETS AND MYSTERIES OF SEED COLLECTION

EVERY seed collector seems to have their own tricks and hints learned over many years of trial and error out in the bush. At a workshop run on the 27<sup>th</sup> March by *Land For Wildlife* in conjunction with *Green Skills*, twenty eight of us had the pleasure of learning more about some of the secrets and mysteries of seed collection from native plants in the south coast region from local nurseryman, Mark Parre.

Mark hosted us at his native plant nursery at the Denmark Shire Depot. He showed us through the tunnel used for seed drying and then had many practical techniques for more 'tricky' seed like sieving, scarifying, burning and imbibing/soaking. Mark uses an old broken down walk-in freezer donated by the local 'Co-Op' to moderate temperature fluctuations for seed storage. To stop rats getting into the seed Mark promotes the use of glass jars with metal lids for storage, Rats will even chew through plastic jar lids to get to the delicious-smelling seed!

There were some amusing stories about 'exploding' seed pods especially when people have used the dash boards of their cars as the perfect drying place. Brown paper bags or calico fabric sheets should be used to stop the seeds flying in all directions.

Mark emphasised the need for collectors to be ever watchful of weather conditions and ripening. With some wattles and pea plants there is only a matter of a few hours from when the pod ripens to when it cracks open and flings the seed out in all directions. He had stories of being in the bush near pod plants just as they all begin to open. The air becomes alive with cracking sounds and seed flies everywhere. He often has to shake out his beard into the seed collection bins at the end of the day!

Mark emphasised the need for people to be ethical about their seed collection. Everyone should make sure they don't collect more than 10% of the fruit and no

more than 20% of the foliage off an individual adult plant and to make sure they have the correct licences and permits (contact the Department on 9334 0422 for advice). He said that there are some native species like the Brown Boronia which are rapidly disappearing out of the bush due to overharvesting. The flower pickers are harvesting the flowers from the plant and then the seed collectors are taking the seed and so the adult plants do not have enough fruit material left to replenish the populations.

Mark's hints:

- ▶ use black plastic instead of tarpaulins to lie under fruit laden branches. The tarpaulins deteriorate in about two years and the black plastic lasts for up to seven or eight years.
- ▶ When collecting seed from Kangaroo Paws full protective clothing needs to be worn. The seed has tiny barbs which can cause extreme irritation to people's eyes and skin. Kangaroo Paw seed only appears to remain viable for nine years.
- ▶ If storing seed for quite some time, it is important to try and remove as much of the twig and chaff matter as possible (sieves help with this process). This is where insect eggs and fungi spores are often found and they can cause a lot of damage to the stored seed. A small piece of pesticide strip added to the jar also stops insect attack.
- ▶ If a banksia cone is hairy then it is inclined to be excited by fire and this is when you can use heat to assist in opening up the cone, eg: *B. quercifolia*, *B. seminuda* and *B. littoralis*.
- ▶ 'Regen 200' now have available vermiculite with infused smoke. It seems to give better germination results than using the liquid form of smoked water which possibly gets leached down through the soil too quickly.

Sylvia Leighton is LFW Officer at Albany.



Mark Parre demonstrating seed collection techniques at the Denmark Shire Nursery.

### SPECIAL OFFER - LFWERS IN DENMARK SHIRE!

Denmark High School has offered to grow your own local provenance seeds in their school nursery for free! To take advantage of this fabulous offer, contact Jenny Findlay on ph. (08) 9848 0100



## WHEN IS A WATTLE NOT AN ACACIA - WHEN IT'S A RACOSPERMA!

**B**RUCE MASLIN, the wattle man from the Herbarium, reports that in the near future the worldwide genus *Acacia* is likely to be split into at least five distinct genera:

- ▶ Group 1 has about 160 spp, mostly in Africa, the Americas and Asia, with 9 in Australia.
- ▶ Group 2 has 231 spp, mostly in the Americas, Africa and Asia, with 2 in Australia
- ▶ Groups 3 & 4 have about 15 species each and are confined to the Americas
- ▶ Group 5 has 960 species, all in Australia except that about 20 extend to islands from Madagascar to the Philippines and Hawaii.

This move has been discussed by taxonomists for about 20 years and now no-one seems to doubt that different entities exist within *Acacia* as presently defined. The genus must therefore be split. The current concern is: which one of the five groups should retain the name *Acacia*? The *International Code of Botanical Nomenclature* provides a set of rules that govern the applications of plant names. If the normal provisions of the Code are applied, then the species in Group 1 would be called *Acacia*, those in Group 2 '*Senegalia*', Group 3 '*Acaciella*', Group 4 'a new genus' and Group 5 '*Racosperma*'. Thus, most Australian wattles would change their name! In special cases, however, the Code does allow an alternative approach to applying names. Such cases apply particularly in situations (like that which exists in *Acacia*) where changing names is likely to cause extensive disruption. To enact these special provisions of the Code a case must be prepared and submitted to an international committee of specialists for adjudication.

So we change all our wattle names - or do we?

Bruce and his co-workers have put together a case to keep the name

## IN BRIEF

*Acacia* for the largest group, the Australian wattles, as changing this would involve the biggest hassle. When their case has been published, a judgement will be made by the appropriate international committee.

Comments, anyone? You can reach Bruce Maslin by email: [brucem@calm.wa.gov.au](mailto:brucem@calm.wa.gov.au)

(For a detailed discussion, read Wildflower Society of WA Newsletter, May 2003, pp7-11 or visit the web at: <http://farrer.csu.edu.au/ASGAP/APOL29/mar03-2.html>)

## YELLOW CRAZY ANT - NOW FERAL IN THE NT

**N**ORTHERN residents should watch out for Yellow Crazy Ants (*Anoplolepis gracilipes*), an introduced species that is one of the world's worst ant pests. This is the animal that has had such a destructive effect on the famous red crabs on Christmas Island. It has been found at Gove and other sites on Arnhemland and may soon spread to Darwin.

Yellow Crazy Ants are medium sized (about 3-4 mm long), yellow, and fast-moving. They are quite distinct from most native ant species.

These ants can occur in extremely high numbers, forming 'supercolonies' that cover many hectares. They outcompete native fauna and seriously disrupt ecological processes. Their presence may lead to outbreaks of sap-sucking insects, harming plants, and they can be a serious pest around the home. They readily nest in all kinds of materials, from potting mix to packaging, making it very easy for them to be accidentally transported by people.

Please be very careful if you are bringing anything back from the NT that might contain ants. We don't want them in WA!

For more info: [www.issg.org/](http://www.issg.org/) database and type "yellow crazy ant" under species name.

## POPULATIONS OF VICTORIAN TEATREE AND AUSTRAL BLUEBELL WANTED

**A**NNA TRAEGER is a PhD student at UWA who is just starting work on a project "Biological control of Australian native weeds". She has chosen two plants to study, Victorian Teatree, *Leptospermum laevigatum*, native to the East Coast but a very bad weed in WA, and Austral Bluebell, *Sollya heterophylla*, native to WA but an increasingly worrying weed in Victoria. She will be looking at the plants' natural enemies in their home States and also where they are introduced, and seeing if there is any potential for biological control.

She asks: "If either of these plants are present in your area, could you please let me know, so that I can get an idea of their distribution? I am also looking for potential field study sites." You can contact Anna at: School of Animal Biology, UWA, Ph: (08) 9380 2976 Fax: (08) 9380 1040

Email:

[traega01@tartarus.uwa.edu.au](mailto:traega01@tartarus.uwa.edu.au)

## COARSE TEA-TREE - BY ANOTHER NAME - THE SAGA CONTINUES!

**I**N April 2000 (WW 4/2) Chris Robinson, Development Officer at AgWA, Albany, introduced readers to Coarse Tea-tree, a south coast native shrub with potential for essential oils, giving an update on cultivation trials in Jan 2002 (WW 6/1).

We reported that the species had been given the scientific name *Agonis fragrans* in April 2001 (WW 5/2). Well, that's changed. It is now *Taxandria fragrans* ms. as Judy Wheeler and Neville Marchant have decided that the genus *Agonis* contained two entities. (For the trials of being a taxonomic botanist, read Judy's article in WW 6/4, Sept 2002.)

Amend your ID books accordingly!



## FLORA

### WHAT IS HAPPENING WITH WANDOO?

Jack Mercer

OVER the last few years there has been growing community concern regarding the declining health of *Eucalyptus wandoo* subsp. *wandoo* (southern wandoo), throughout the Western Australian wheatbelt and in parts of the State forest. Wandoo is an important habitat tree, relatively widespread throughout the south-west and usually resilient. This present decline of the species is one in a series that have been documented in the latter half of the 20<sup>th</sup> century. I undertook a survey in 2002 on behalf of the Department of Conservation and Land Management's Science Division and explored several factors in order to determine likely potential causes and document the spatial extent of the present decline. Several factors were implicated but no cause or set of causes were isolated. The decline symptoms in tree crowns progress from where clumps of leaves become discoloured, twigs and branchlets firstly begin to defoliate followed by secondary and even primary branches. Progressive crown decline is characterised by intermittent flushes of epicormic growth that may undergo cyclical patterns of decline. Ultimately, there have been some tree deaths.

For this survey, 3 transects comprising a total of 129 sites were assessed. Transects were oriented in an east-west direction, with most sites having relatively easy access for future observations, if required. The extent and approximate latitudes of the transects were: the southern transect extending from Chillinup to just west of Manjimup along the 34<sup>th</sup> parallel; the central transect extending from just east of Kulin to Collie along the 32<sup>nd</sup> and part of the 33<sup>rd</sup> parallel; and the northern transect extending from just east of Kwolyn to Helena Valley along the 31<sup>st</sup> parallel, with some

additional sites included further north in Julimar.

#### Summary of results

Statistical analysis showed that reliable indicators of healthier wandoo throughout this survey were a higher percentage of trees with minimal or no impact, where epicorms were not present or very old and where there was increasing presence of fruit and buds. Insect damage increased as crown health decreased. Insect damage, and specifically damage by lerp insects, may be implicated in the decline but this was more likely a contributory rather than a primary cause. Insects may also be acting as a vector for fungal infection of susceptible trees.

The longer a site was without high intensity fire, the healthier the trees crowns were, suggesting that fire-associated disturbance allowed or initiated tree decline. Similarly, there was evidence of a strong relationship between recent hot fire events and the acceleration of the present decline pattern. Two sites affected by wildfire in 1994 and 2000, in the Stirling Range National Park, showed epicormic recovery after the fires but the new growth was destroyed by mechanisms that displayed symptoms of the present decline pattern. In both years there were marked rainfall deficits, which implicated a lack of soil moisture that could not sustain a post-fire growth flush. However, an active fungal or other pathogen, after fire damage, should not be ruled out.

The higher the position in the landscape, the healthier wandoo crowns were, and steeper slopes also exhibited some of the higher crown health ratings. These areas where wandoo still exist have not been cleared or affected by rising watertables and their deeper root systems may not have been compromised by inundation, as has

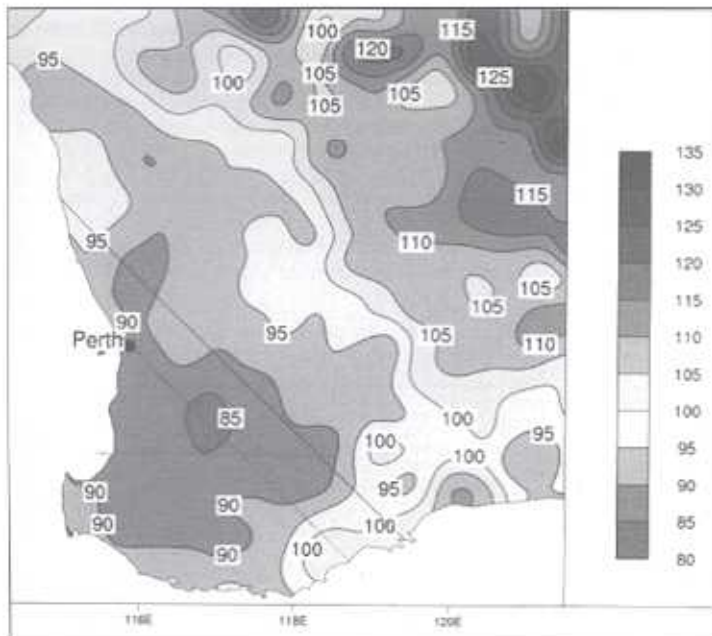
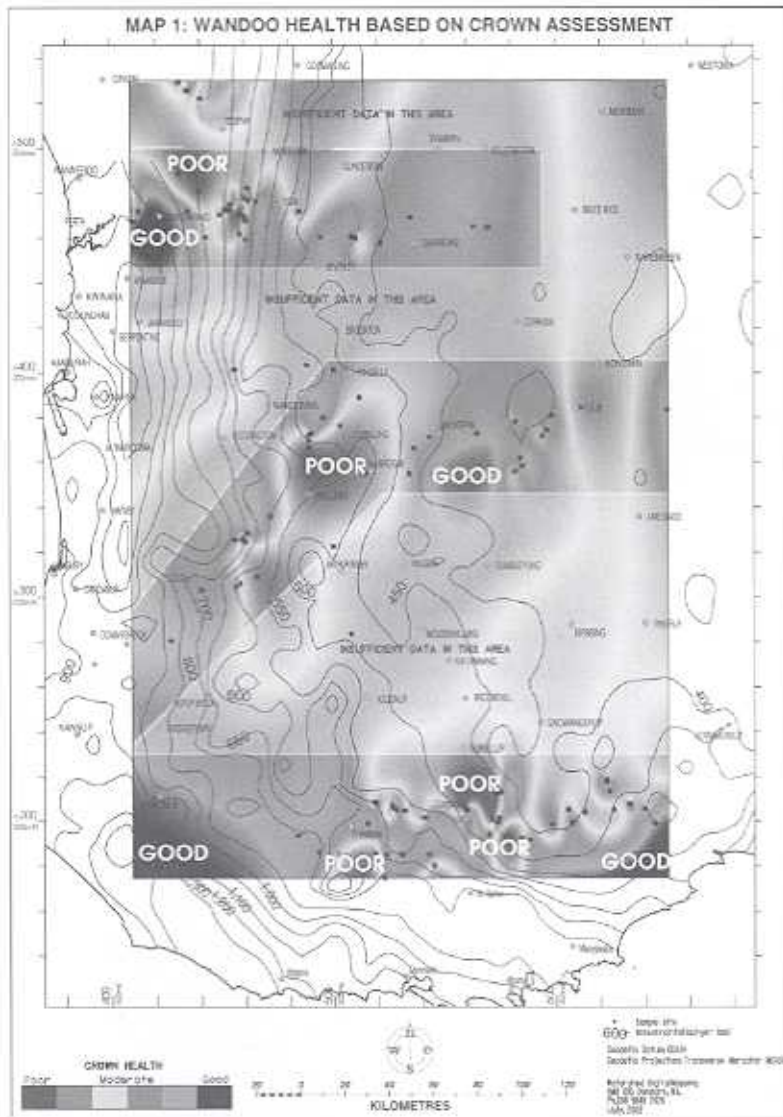
occurred in the lower landscape. The trees may thus be more resilient to drought-induced soil moisture storage reduction.

Lower crown health within National Parks, Nature Reserves and other bushland remnants, suggested that higher stem densities of both canopy and understorey, usually associated with these areas, were predisposing wandoo to less water availability during drought periods. Remnants on privately owned land (that were generally small) and road reserves exhibited the highest crown ratings. These sites were usually surrounded by cleared land, implicating higher availability of moisture that protected trees from decline. Also, roads often act as a water catchment or have a "damming" effect that may increase moisture availability to nearby trees. The data showed that the death rate was less than expected, demonstrating the resilience of wandoo. The loss of leaf biomass, however, throughout areas of decline was significant and has had a high visual impact.

There were some findings that reflected a temporal and spatial trend in decline across the wheatbelt. The decline was broadscale, the pattern was variable and not continuous across the landscape and canopy loss was both very recent and up to 10 years old. In general, regeneration stands across the range of wandoo (approximately less than 30 years old) were little affected. There were also sporadic occurrences of healthy veterans amongst stands of trees that showed marked decline. The zones between the rainfall isohyets of 400-450 mm and 600-650 mm showed the most marked crown decline on the southern and central transects. On the northern transect, there was no definitive improvement of crown health west of the 500 mm isohyet. From east to west, the



# FLORA



Map 2. Rainfall change 1925 - 2001. High figures, increase, low figures, decrease.

relationship between average annual rainfall and crown decline suggested that rainfall is relevant to wandoo decline, but could not be correlated directly with rainfall. However, recent rainfall deficits may be implicated in wandoo decline because zones of marked crown decline roughly coincided with areas where rainfall deficits, over the last 25 years after 1975, have been 10-15% below the average of the preceding 50 years.

Long term dieback, salinity-related dieback and the present decline pattern appeared to be separate events with variable but overlapping time frames. Apart from salinity, the underlying predisposing factors for all these decline events may have been the same. There was evidence throughout the survey that salinity had caused crown decline of wandoo but trees had adjusted and now survived with a contracted crown. It was also evident that the present decline was often not afflicting these trees but was occasionally coincident with them.

On the central transect, there was little structural change within 3 sites assessed for wandoo decline in 1991, and again in the 2002 survey. Old decline symptoms remained much the same, with dead branches, branchlets and even some twigs still intact above tree canopies. With regard to the present decline pattern, sites classed as healthy, intermediate and degraded in 1991 showed no impact, minimal impact and advanced symptoms of the present decline 11 years later, in that order. Therefore previous site condition may have predisposed trees to greater impacts from the present decline.

Over the past few decades, various reports on wandoo decline documented several common factors that may be causal. The greatest impact has been land clearing for agriculture, which has reduced the extent of wandoo and fragmented the remaining woodlands. Increased salinity and waterlogging, a



## FAUNA

# SO - YOU WANT TO KEEP A PET REPTILE DO YOU? WELL, YOU CAN NOW!

Peter Mawson

**I**N late 2002 new regulations were gazetted that allowed for the keeping of a limited range of native reptiles and amphibians as pets. In March 2003 a list of approved species that can be kept was published and from that date people living in Western Australia have been able to make application to own and keep these 'new pets'. The species currently approved for keeping as pets include tree frogs, geckoes, skinks, dragons, monitors or goannas, freshwater tortoises/turtles, pythons, and a range of venomous snakes.

The regulations were developed after a three-month public consultation period, in which most of the comments received from the public were in favour of allowing some native reptiles and amphibians to be kept as pets. For those interested in the specific details of the regulations a copy can be found on the Department's Naturebase website at [http://www.calm.wa.gov.au/plants\\_animals/reptiles/index.html](http://www.calm.wa.gov.au/plants_animals/reptiles/index.html).

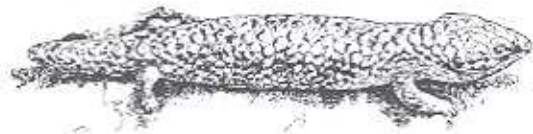
The list of Approved Species is also available at that site, along with application forms for pet Keepers, Dealers, Farmers and what are called Takers licences. There are also answers to Frequently Asked Questions, copies of application forms for the various types of licences and Keeping Advice Sheets for each of the various types of reptile and amphibian on the list along with links to a good selection of books on reptiles and amphibians.

The pet keeping is arranged into five categories with Category 1 species being exempt from licensing. At present there are no species listed in this Category, but it is expected that species will be added to this category over time. Category 2 species are easily kept by anybody and require no prior experience, Category 3 species require more experience and can only be kept by people over the age of 18. Category 4 species require more extensive experience and Category 5 species (the dangerous species) can be kept only by those people with extensive experience who can provide high security facilities.

**Category 1** No species.

### Category 2

*Egernia napoleonis* South-Western Crevice Egernia  
*Gehyra variegata* Tree Dтеля  
*Heteronotta binoei* Binoe's Gecko  
*Litoria caerulea* Northern Green Tree Frog  
*Litoria moorei* Western Green Tree Frog  
*Pogona minor minor* Western Bearded Dragon  
*Strophurus ciliaris* Northern Spiny-tailed Gecko  
*Strophurus spinigerus* South-west Spiny-tailed Gecko



*Tiliqua multifasciata* Centralian Bluetongue  
*Tiliqua occipitalis* Western Bluetongue  
*Tiliqua rugosa rugosa* Bobtail

### Category 3

*Antaresia stimsoni* Stimson's Python  
*Chelodina oblonga* Oblong Tortoise  
*Ctenophorus reticulatus* Western Netted Dragon  
*Egernia kingii* King Skink  
*Litoria splendida* Magnificent Tree Frog  
*Morelia spilota imbricata* South-western Carpet Python  
*Nephrurus levis* Three-lined Knob-tailed Gecko  
*Oedura marmorata* Marbled Velvet Gecko  
*Underwoodisaurus millii* Thick-tailed Gecko  
*Varanus caudolineatus* Stripe-tailed Pygmy Monitor

### Category 4

*Aspidites melanocephalus* Black-headed python  
*Aspidites ramsayi* Woma Python  
*Chelodina steindachneri* Flat-shelled Turtle  
*Chlamydosaurus kingi* Frilled Lizard  
*Heleioporus albopunctatus* Western Spotted Frog  
*Lophognathus longirostris* Long-nosed Ta-ta Dragon  
*Varanus acanthurus* Ridge-tailed Monitor  
*Varanus brevicauda* Short-tailed Pygmy Monitor  
*Varanus tristis tristis* Black-tailed Monitor

### Category 5

*Acanthopis antarcticus* Southern Death Adder  
*Acanthopis pyrrhus* Desert Death Adder  
*Acanthopis wellsi* Pilbara Death Adder  
*Liasis olivaceus* Olive Python  
*Notechis scutatus* Tiger Snake  
*Pseudechis australis* Mulga Snake  
*Pseudechis butleri* Spotted Mulga Snake  
*Pseudonaja affinis affinis* Dugite  
*Pseudonaja nuchalis* Gwardar  
*Varanus gouldii* Gould's Monitor  
*Varanus rosenbergi* Southern Heath Monitor

All of the reptiles and amphibians that are approved for keeping must come from approved captive collections. It is illegal for people to help themselves to animals from the wild. No threatened species are approved for keeping.



## FAUNA

*Pet Reptiles - continued from page 22*

and exotic reptiles cannot be kept. The list of approved species currently contains only species that are native to Western Australia. The risk of species native to other parts of Australia escaping or being released into the wild are considered too great to allow them to be imported.

The Takers licence is designed to allow for controlled collection of certain species from the wild with the Department's approval. In the first few years of this new system reptiles and amphibians can only be bought and sold through licensed reptile dealers. 'Backyard' sales are currently prohibited, but it is expected that once people become familiar with what is required to keep the animals and their obligations under the licensing system these types of sales will be considered.

There is also an embargo on the importation of all pythons into Western Australia because of the risk of bringing a disease called Boid Inclusion Body Disease into the State. The disease is fatal to all native python species and is untreatable and at the moment there is no diagnostic test for the disease. All pythons kept under this new legislation will have to be captive bred or collected from the wild by a licensed reptile Taker.

At present the supply of most species on the approved list is limited and this will influence how easily people can obtain their preferred pet and also the price they might have to pay. As the weather warms up and as more animals are bred in captivity, supply should increase and the prices should go down, but the Department has no control of market forces.

So, does the idea of owning a pet reptile or frog appeal? If it does, have a look at the information on the Department's website or call in at your nearest Department office.

*Peter Mawson is Senior Zoologist at the Department's Kensington office.*

*Wandoo - continued from page 21*

consequence of clearing, were recognisable causes of decline. Some agricultural practices, such as chemical use, may also be having negative impacts. Climate change, periodic drought and decreasing annual rainfall may be contributing to broadscale decline of the species. A changed fire regime in the south-west of Western Australia was also implicated. This latest report addresses similar potential causes of wandoo decline which are proving difficult to isolate. The cumulative impact of periodic decline on the remaining wandoo population is likely to be an increasing rate of degradation and death across its range as older trees capitulate and little recruitment takes place.

*Jack Mercer is an ecologist living in Albany. He can be contacted by email: jackm@omninet.net.au*

## IN BRIEF

### A CAT FIGHT - FLORIDA STYLE!

FLORIDA has an estimated 5.3 million free-roaming felines, and environmentalists are having an uphill battle trying to convince the public (and politicians!) that they are a serious threat to wildlife. Their prey includes everything from common lizards and birds to rare species such as the Lower Keys marsh rabbit, Key Largo woodrat, beach mice, least terns and even baby sea turtles. But groups such as 'Alley Cat Allies' and 'The Cat Network', who daily take cat food out to parks and reserves to feed the strays, say their effect on wildlife numbers is exaggerated.

Do the opposing arguments sound familiar? Older readers (*like me - Ed!*) may remember when people denied that the fox had any effect on medium-sized marsupial numbers in Australia. Then Jack Kinnear did his elegant study at Nangeen Hill in the wheatbelt and proved conclusively that introduced predators have a severe effect on indigenous wildlife.

Meanwhile, in Florida, the sides square off as the fur prepares to fly. In this one, it's the wild critters who have an image problem, because, as the Audubon Society said of the cats: "As environmental menaces go, they sure are cute!"



## LFW NEWS

### VISIT TO 'BARNA MIA'

LFWers around Dryandra got the opportunity to see some rare fauna when Avril Baxter organised two LFW Social Evenings at 'Barna Mia', the new rare fauna viewing enclosure in Dryandra Woodland. Dalgytes and boodies were seen, and also one rather shy mala. The dalgytes were gorgeous, but it was the boodies, quarreling over who got most munchies, who stole the show!

Avril will be organising further visits, probably in September, but in the meantime you can arrange to take your family any night the facility is open for tours. There is a cost involved, and children have to be well-behaved so as not to distress the animals. But it is an enthralling experience, a glimpse back into a previous era - a time before foxes.

For further details and bookings contact:

Dept. of Conservation and Land Management  
Narrogin District Office on 9881 9200.



## NEW BOOKS

### A Long-standing Love Affair with Birds

John S. Pate

Cost: \$25 + p&h (\$5.80 metro, \$7.10 rural WA)

Contact: Pates Patch Press, RMB 1452, DENMARK, WA 6333.

In the words of the author, a retired Professor of Botany at UWA, this is "a light-hearted hybrid between a 'birdography' and an 'autobiography' in which I recount some of the many delightful encounters which family members, friends and I have had over the years with birds ..... I write in a simple and sufficiently humorous fashion, which I hope will keep both learned and less well informed readers reasonably happy."

This book really defies categorisation, reading it is like having a chat with someone who has an endless fund of fascinating stories to chat about. It is great fun to read and contains many details of the kind of habitat creation and protection that *Land for Wildlife*ers are trying to achieve, as well as lots of fascinating animal behaviour. I really enjoyed it! The book would make a great gift - for yourself, or for a friend.

(Nb: All profits from the book will go to the Downs Syndrome Assn. of WA.)

*Sylvia Leighton*



*John Pate leading a field walk.*

### The Moore River Catchment Forum 2000: Thinking Beyond Today: a series of essays by the participants

Curtin Environmental Biology Bulletin No. 24 Ed. S. J. J. F. Davies.

Cost: \$10.00

Contact: Enid Holt, Dept. Environmental Biology, Curtin Uni. Ph 9266 7041

This is the collected papers from the symposium "Thinking Beyond Today: a global perspective for local

action" hosted by the Moore River Catchment Group in July 2000. It addressed a number of issues important for building sustainable development. Fiona Falconer gave a brief report on the event, (WW 5/1, p23) focussing on the landcare perspective adopted by Israeli researchers. People involved with NRM strategic planning will find much to interest them in these papers.

(Nb: if you attended the symposium, and put your name down to obtain a copy of the proceedings, then one will be sent to you.)

*Penny Hussey*

The National Land and Water Resources Audit has produced the

### "Australian Terrestrial Biodiversity Assessment 2002"

It provides lots of information on what is happening to our biota.

Copies are available (free)

from ph (02) 6257 9516

or email: [info@nlwra.gov.au](mailto:info@nlwra.gov.au)

## FUNDING

### Australian Government Envirofund

The second round closed on 4<sup>th</sup> July. There will be another round later this year, contact

Bushcare Facilitator, Anthea Jones (08) 9334 0442 for details.

## COMING EVENTS

### State Landcare Conference

The State Landcare Conference will be held at Katanning from 7-10 October 2003.

For details contact: ph/fax (08) 9821 2251 or email: [yourland@westnet.com.au](mailto:yourland@westnet.com.au)

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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