



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



# Western Wildlife



January 2004 Vol. 8, Number 1

NEWSLETTER OF THE LAND FOR WILDLIFE SCHEME

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## Shearwaters at Rottneest

*Wes Bancroft and Mark Garkaklis*

IT is dusk on the western coast of Rottneest Island. The summer daylight is fading and it's blowing a gale. On the horizon, out to sea, the silhouettes of hundreds of birds rapidly rise and drop from view, as they glide over the ocean's contours. While the whipping of the sand- and salt-spray makes it difficult to watch them for long, it is clear that these birds are masters of the wind. They're shearwaters, and they're coming home.

Every night, from mid-August until late April, flocks of Wedge-tailed Shearwaters descend on their nesting colonies on the south-western headlands of Rottneest Island. Having spent the day fishing at sea, diving and pursuing their prey to depths of 10 m, they return to their nests under the cover of night. But unlike many birds that are familiar to us, the shearwaters, often known as muttonbirds, don't build stick-cup nests in trees, or even scrapes on the ground. These birds are burrowers, and they're really good at what they do.

Their nesting burrows are dug by both birds in the monogamous pairs, and may reach depths in excess of 1.5 m below the soil surface, and lengths beyond 4 m. Burrows are 20 cm high by 27 cm wide and, more often than not, curve to the left. On average, the birds shift



*Wedge-tailed Shearwater*

some 82 kg of soil from their burrow. All this can be done from scratch in six days. No mean feat, considering the equivalent would be two 70 kg humans shifting almost 15 tonnes of soil between them!

So why all the effort? Not surprisingly, there is method to this digging madness. Each year, pairs raise only a single offspring, and it is thought that by

keeping the chicks in burrows they reduce the chance of the young being taken by aerial predators. On Rottneest Island, up to 20 Osprey (also known as Fish Eagles) patrol the cliffs, beaches and ocean throughout the daylight hours. With their chicks safely below ground, parents need not worry about the Osprey and can spend all day out at sea collecting dinner for them instead.

The life of the burrow-bound shearwater chick is, however, a lonely one. After spending three months digging or clearing burrows (birds will regularly reuse the same burrow year after year), an adult pair will incubate their single egg from late November. As soon as the chick hatches in mid-January it is left alone, by day, in the burrow. Both parents tend the chick, and at least one of them will return every one to four nights to deliver a meal of fish and squid. Even when the parents

*continued on page 4*

## EDITORIAL

*Greetings all!*

I am sorry to report that Jenny Dewing, who has been operating as *LFW* Officer from Bridgetown ever since the programme started, has resigned. Though she will continue to work in the environment field, on projects with the Shire and the Blackwood Environment Society, we will all miss the direct input of her extensive knowledge, as well as her energy and enthusiasm. Hopefully we will be able to find someone else to work in the Blackwood area, but in the meantime, if you have any specific *LFW* queries, could you please ring the Perth office.

There is some good news to report, though. Mundaring has a new *LFW* Officer, Zara Kivell, who comes into the environment area from a career in health. She is particularly interested in interactions between flora and fauna. It will take her a while to get to know everybody, so, if you are in the Hills or the Avon



Zara Kivell

Are, why don't you give her a ring to say 'Hi'?

Last issue, we pointed out that you ought not to eat weedy watercress, unless you wanted arsenic with your salad! In this issue, Steve Appleyard follows on with an introduction to acid sulphate soils, which generate the arsenic in the groundwater. If you live on the coastal plain, it is well worth not only reading this article, but following up on the various web sites he can direct you to.

Summer is the time for going to the beach and, hopefully, we don't leave our interest in biodiversity at home while we are on holiday! This issue contains two coastal articles to stimulate your thinking, Wes Bancroft's study of Shearwaters on Rottnest and Elizabeth Rippey's call for care in managing the coast. There is also more on pollination in carnivorous plants, as well as some interesting articles on revegetation and new product development.

Receiving the winner's certificate for a category of the WA Environment Awards, on behalf of *Land for Wildlife*, made me reflect on how lucky I am to be able to work with such a great team. *LFW* Officers and landholders, colleagues and supporters, you are all such inspiring people, and such fun to work with! *LFW* is now entered in the national 'Banksia Awards' in May. Wish us luck!

Best wishes for a great year in 2004.

Penny Hussey

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## Please note:

In WW 6/3, July 2002, we noted that the Department of Conservation and Land Management no longer wished the acronym 'CALM' to be used, instead preferring 'DCLM'. In October 2003, we were informed that the Department does not want 'DCLM' to be used, but asks that users revert to using 'CALM'. Thank you.

## NEWS

# AWARD WINNERS - CONGRATULATIONS!

Some finalists who have worked in various ways with *Land for Wildlife*:



Doug and Eva Russell with LFWO Sylvia Leighton



Penny Hussey in the 'Wildlife East Garden'

### WA Landcare Awards 2003

to **Doug and Eva Russell** of "Bundilla", Manypeaks - State winners of the 'Bushcare Nature Conservation Award'. They have demonstrated through their own action and by inspiring others that nature conservation can enhance a property. Their farm is a showcase of fenced and regenerating native vegetation, protected waterways and wetlands, and established wildlife corridor belts designed to link to nearby Waychinicup National Park. As Doug said in his acceptance speech, despite the farm being over 20% remnants and revegetation, this does not represent a loss to production, as the stock carrying capacity continues to increase. Very well done folks, and best wishes for the national awards next year!

to **Ron Watkins** of "Payneham", Frankland, State winner of the 'AFFA Landcare Individual Award' and joint runner-up in the 'Primary Producer Award'. Ron has been working on his own place and inspiring others since 1973. (For an early airphoto of "Payneham" see 'Managing Your Bushland' p 94.)

to **Michael and Penny Moir** of "Chillinup", Borden, who were joint runners-up in the 'Rural Press Landcare Primary Producer Award'. This is a very prestigious and strongly-contested award, embracing all aspects of property management, and the finalists - indeed, all entrants - are outstanding farmers.

to **Geoff Woodall and Chris Robinson**, runners-up in the 'Telstra Country Wide Landcare Research Award', for their work on Sandalwood. Western Wildlife readers will be aware of this work as well as some of their other projects using native species - *Platysace* tubers and tea-tree oil, for example - and look in this issue for wattle seeds as human food.

### WA Environment Awards 2003

to the **Porter family**, of "Riverside Sanctuary", Northampton, who won the 'Small Business Leading by Example' category. As well as a farming property, the Porters run an eco-education and eco-tourism business and, of course, are *LFWers*!



To us - all of us in *Land for Wildlife*! - for winning the 'Promoting Behaviour Change' category. On behalf of the team - staff, landholders, CALM - thank you all for being such inspiring people to work with!

These two projects are now the WA entries in the national Banksia Awards.

## FAUNA

*Shearwaters continued from page 1*

do return, they don't spend long with their chick in the burrow, often preferring to sit on the surface and wait for dawn. The adults depart well before sunrise, so that they can be at their preferred feeding ground and ready to fish at first light.

For all their time alone, the chicks do get fed well. At the end of the season they can weigh more than one and a half times as much as an adult bird. There is a catch, though. In late April the adult birds choose not to return to the colonies at all. They leave the chick, alone again, to use its reserves of fat to complete the last of its growth and juvenile moult, before leaving the colony to join the rest of the population at sea for the winter.

Immature birds will spend three or four years at sea before they will begin to breed. Often the young birds will return to the site from which they fledged, and in the case of Rottnest Island, the colonies have been expanding in size and in number. The number of burrows on the island has nearly doubled in the last decade, with some 11 700 burrows now spread across six discrete colonies. The first recording of Wedge-tailed Shearwater nesting on Rottnest Island was of a single active burrow made in 1889. By the mid-1950s there were over 500 burrows, and more than 2500 in 1982. One colony increased 23-fold in burrow number in this period. Growth of this magnitude has to almost certainly have been driven by immigration of birds from other areas, rather than just the return of Rottnest-bred birds.

Why the increase in population? One might think that, like us, once the shearwaters found the beauty of Rottnest Island, they could not get enough, and made sure that all their friends and relatives paid the island a visit. In some sense this is true, but not just for the shearwaters. Many other seabird species of tropical origin have expanded their breeding range into southwestern Australia, including the Red-tailed Tropic-



*Wedge-tailed Shearwater (ph: W. Bancroft)*



*Shearwater colony on Rottnest, the white dots are the spill-piles at the mouth of the burrows. (ph: W. Bancroft)*

bird, Bridled Tern, Roseate Tern, Common Noddy and Sooty Tern. While we are only just beginning to think that we understand, it appears that these expansions are correlated with an increase in the frequency of El Nino-Southern Oscillation (ENSO). The impacts of ENSO on weather patterns (and farming) are well known, but its effects on organisms are less well understood (although probably no less important). We do know that ENSO alters oceanographic factors that, in

turn, probably affect the availability of food. It is thought that when times became tough in northern waters, the breeding seabirds may have followed their food resources southward. Once in the south, the birds found Rottnest, and it wasn't long before the romantic West End sunsets had large numbers of shearwaters nesting on its cliff tops.

As a consequence of the expanding shearwater colonies, the amount of soil displaced by the birds has also increased. Soil

*Shearwaters continued from page 4*

displacement, turnover and modification can have vast-ranging effects on the ecosystem. Studies elsewhere in the world have shown that digging and burrowing (termed biopedturbation) can alter soil nutrient regimes and the physical properties of soil. Flow-on effects have been increases or decreases in plant biodiversity, altered plant community composition, and, while not well studied, changes in the animal species (or their abundance) present. Terrestrial animal species may also benefit from the physical habitat alteration by burrowers. The creation of a burrow may provide shelter for animals that would otherwise go without. The habitat is so valuable for some species of reptiles, such as the Tiger Snake on islands in the Bass Strait, that they have evolved to co-habit burrows with the owners (Short-tailed Shearwaters in the snake's case). This process of non-trophic (food-related), non-competitive species interaction has only recently been formalised by ecologists, who

## FAUNA

have termed it 'ecosystem engineering'.

The question that interested us was, 'In light of the expanding colonies and soil disturbance by shearwaters on Rottneest, are the birds ecosystem engineers?' The answer to this is certainly 'yes', and we are investigating the magnitude of any effects that the birds may be having on the ecosystem. While we are still working through the data and preparing publications, it has become clear that almost all characters that we have measured (including soil bulk density, soil water repellency, soil nutrient content, plant biodiversity, plant productivity and animal biodiversity) strongly differ between the shearwater colonies and adjacent heathland. There is no doubt in our minds that the shearwaters are playing a major role in structuring components of the island ecosystem. We will continue to investigate.

So now the wind has dropped, and the first rays of sun are painting the western end of Rottneest with its light. The adult shearwaters are hunting well beyond the horizon, and their chicks sit quietly underground. Were it not for webbed footprints on piles of soil, the activities of the previous night, and the fascinating life that these birds lead, may never have been suspected.

*Wes Bancroft is a PhD student from the School of Animal Biology at UWA, investigating the role of Wedge-tailed Shearwaters on Rottneest Island as ecosystem engineers, and their modulation of ecosystem function. He would be happy to answer questions or hear your stories about these birds, and can be contacted by phone: 9380 1493 or email: wes@cyllene.uwa.edu.au*

*Mark Garkaklis is a postdoctoral research fellow in the School of Biological Sciences and Biotechnology at Murdoch University.*

## EVERYONE PLEASE READ!!!

### LFW SITES ON MAPS FOR NRM PLANNING

EVERYONE with a rural property will probably be aware that the six NRM Councils are developing strategies for sustainable land management in their region, through which funding such as NHT will be directed. As part of this process, it is important for the NRM groups to know as much as possible about the land whose future they are planning. Maps help in this process, by showing the spatial extent and relationship of features. It is becoming obvious that it would help the NRM groups if they had LFW sites identified on their planning maps.

A LFW report is a confidential document between LFW staff and the landholder concerned, although

many landholders are quite happy for their CLC, eg. to have a copy. What we would like to do is to highlight the LFW sites (by shape only, not by name or contact details), that were identified in your LFW Report, as an extra 'layer' on the NRM planning maps.

That would indicate to the planners that (a) here is some land for which there is recorded biodiversity information and (b) here is a landholder who is working to maintain biodiversity on that land. They would approach LFW if they needed other data, and we would check with you that it is OK to pass it to them. Allied with other 'layers', such as natural vegetation maps, it could be very useful to help the NRM Council to determine priority

areas for action. Other sites, such as RVPS areas, NHT reveg projects etc. are also likely to be added to the maps.

Because this possibility wasn't considered when we started back in 1997, we have not asked, during the visit, if you are happy for your 'LFW sites' to be indicated on an NRM mapping database. Please could you consider this? If you would like to discuss the implications further, please ring me on 9334 0530.

If I have NOT heard from you by 1<sup>st</sup> February 2004, I will assume that you have no objection to your 'LFW sites' being indicated on an NRM mapping database.

*Penny Hussey*

## FLORA

# COASTAL CONSIDERATIONS

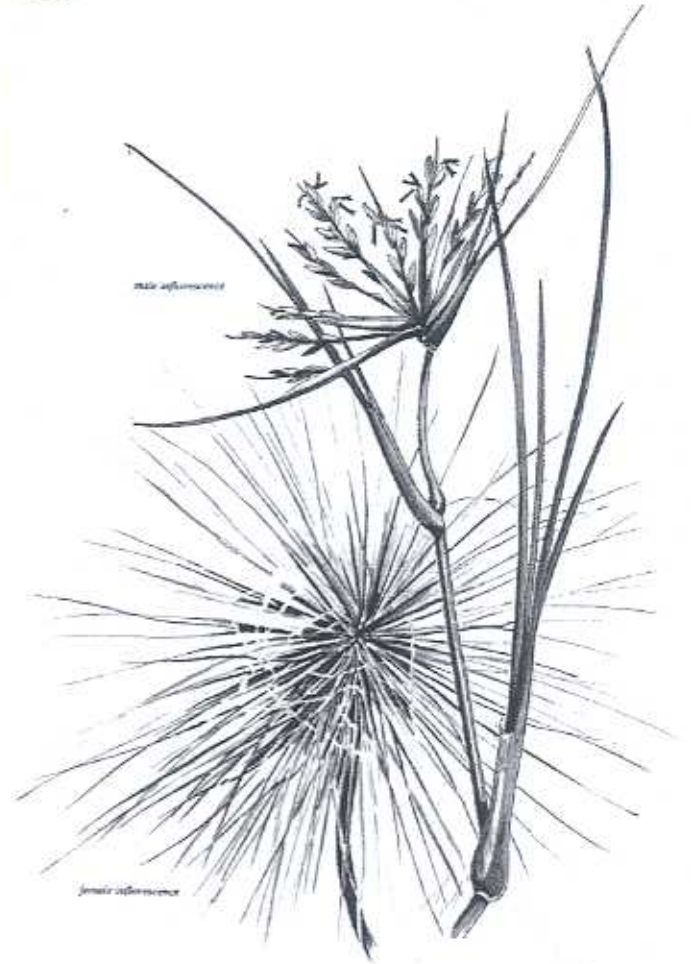
Elizabeth Rippey

AUSTRALIANS have two impulses towards the coast: they want to preserve it, and they want to possess it. They want to keep it unspoiled and beautiful, the wilderness which they knew as kids or which they still seek out in national parks and forests and secluded beaches. And yet Australians also want to use it; for holidays, for living, for entertainment, for tourism, for work....\*

Our beguiling coastline, 12,000 kilometres of it, is extraordinarily difficult to bring into focus, including as it does the tropical, rugged Kimberley to the north, flats and estuaries with 10 metre tides and mangroves at the Fitzroy River, dry salt-laden regions with coral reefs at the western extremity of the state, to the gentler south west with winter rain, then the granite cliffs and domes that dominate parts of the south and finally the coastal sand plain and limestone of the western Bight. This coastal zone is a dynamic strip of erosion and deposition, cyclones and salt, wild winds and great dryness. And except for the south west, it is scarcely populated.

Perhaps the *plants* of the coast are easier to encompass, although their form and design vary to accommodate this most challenging range of environments, and only a few species occur throughout the region. The plants of sandy areas, beaches and dunes, exemplify the extraordinary capabilities of coastal plants. Here the sands move with the wind, storm events can eliminate a dune overnight, soils are very low in nutrients, salt spray is a constant factor and heat can be extreme. But these plants not only tolerate these conditions, they require them, and usually they can grow nowhere else. Some species that grow on the shifting sands and foredunes beside the beaches have their seeds spread by the ocean, such as the pantropical Beach Morning Glory (*Ipomoea pes-caprae* subsp *brasilensis*) to the north. Some species accommodate rapid deposition or erosion of sand around them, as do *Spinifex longifolius* and *S. hirsutus* (true spinifexes, not the widespread Porcupine Grasses of the outback). Heat can be countered with strategies such as hairiness, shiny leaves, or loss of leaves altogether; and salt with fleshy growth, excretion of salt onto leaves, concentration of salt in certain parts which are discarded. Comparatively few species populate the foredunes, but further back where the dunes are more stable, there is greater diversity. The vast majority of species continue to be perennial, providing all-season cover for the sandy substrate.

In rocky areas species that are tolerant of salt spray overhang the seaside cliffs, but there can be considerable plant diversity very close to the ocean on these more stable substrates.



*Spinifex longifolius*. (illustration: E. Rippey)

The coastline is naturally in a state of flux, particularly sandy parts, with dunes changing and patches of bare sand appearing and disappearing seasonally and in the longer term. It is plants that provide the stabilizing force, preventing erosion, and revegetating denuded areas.

The coast is perfect and needs no management.

As we embrace this paradise, perhaps Australia's greatest asset, for houses and resorts, but equally for wilderness time and beach access, its character changes. Tea rooms and parking places, icecreams and the smell of coconut oil are treasured parts of the Australian experience. But throughout the State every bay and promontory is explored in the search for beauty and sometimes isolation. This sharing of the commonage is a right to be defended, but we need protection from destroying what we love; from the sorrow of a return visit to find shady groves denuded or burnt and tracks scribbling throughout coastal heath and cliff tops, the paths widened and shifted as drivers and walkers sought purchase on new plants.

# FLORA

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Farm land is pay dirt. The coast seems unproductive and unworthy of expenditure of time and money, but if the value of a seaside plot is contrasted with that of a similar stand inland, the monetary worth of coastal recreation and aesthetic value is evident.

There is a lot of know-how on coastal maintenance, and it is readily available. Experts have found that it is good to start coastal work by identifying user patterns, and rationalising access to an area so as to benefit both users and the coast. Education and signage will make most people cooperative. Natural revegetation can take place remarkably quickly if the pressures on the coastal plants are removed.

Rehabilitation of seriously damaged areas depends on the needs of the area and resources available. It may require a long term plan, implemented in stages. The help of volunteers and community groups in coastal rehabilitation projects has proved very successful.

Sand blowouts first require stabilisation, at least in part, so that plants can take root. This can be achieved by laying down branches (brushing) or putting up fencing laced with brush or netting. If planting is attempted, it is helpful to seek advice about which species to use, whether to use seed or young plants, and what planting methods are appropriate for local conditions. In conservation areas local provenance (seeds from that area) should be used but in less significant places this is not such an issue. Coastal nurseries can identify and supply many species found on the dunes. It is important not to succumb to the temptation of using fast-growing introduced species as these can cause grief by invading the surrounding bush and becoming weeds in their own right.

Removal of introduced species may be simple if done at an early stage (as in the case of groves of Prickly Pear and Agave on one suburban foreshore, deposited with garden refuse!), but weeding may require a long term effort, with specific objectives.

A Coastal Planning and Management Manual has been put out this year by the Department of Planning and Infrastructure. This divides the Western Australian coast into bioregions and suggests techniques for weed removal, interpretive signage and recreation and access management. Funding for coastal rehabilitation is also available from the Commonwealth and State Governments, as well as from some local sources. Coastal facilitators with Coastcare can be approached for details.

The coast is perfect: only people need management.

\* Craig McGregor 1992, *Different coastal people*, in *Resource Assessment Commission Coastal Zone Enquiry* draft report, Australian Govt Publishing Service, Canberra.

Elizabeth Rippey is a botanist and artist with a particular interest in coastal plants.



Volunteers working on dune rehabilitation at Quarrum NR, near Denmark. (photo: Barb Green)



## WANT TO IDENTIFY COASTAL PLANTS?

You need **"Coastal Plants: Perth and the South West Region"**

by Elizabeth Rippey and Barbara Rowland.

Pub: Dec 2003. UWA Press.

The book contains information on the flora of the entire coastal dunes of the South West corner of WA, with descriptive information and superb watercolour drawings.

(This is a revised edition of "Plants of the Perth Coast and Islands" by the same authors.)

LAWRY, Jenny and Clint Pitman, who farm west of Corrigin, have made it their goal to demonstrate and test sustainable agricultural practices on a whole farm scale, for 100 years, and to make their results open to the public. They wanted to show that broad acre farming could be environmentally, socially and economically successful.

This program became the basis of a Corrigin Landcare Project where environmentalists, farmers, scientists, corporations and Government provide financial and intellectual support. As such, selected practices acknowledged as "sustainable" are physically and financially monitored within the 3100 ha property.

One of their objectives is to increase biodiversity. In a property that has 4.5% remnant vegetation they are buffering this perennial vegetation by revegetating a further 20% of the property, 10% of which will be dedicated to nature conservation plantings. These numbers are arrived from "gut feelings", but the Pitmans do not plan on going broke in achieving them!

One focus on Valema Farms was the creation of 25 km 50 m wide corridors throughout the property. This program was completed over four years and involves boundary, creekline and keyline plantings.

Design was a large part of the process and undertaken by Robin Campbell. In order to mimic the natural environment, Robin mapped the soil types along the corridors, and then examined remnants within the property to see which species were growing on these soil types. If suitable sites were not available on the property she went to others within a 20 km radius of the area. In one 2 km corridor situated on the keyline and connecting two of the larger patches of bushland, Robin mapped seven soil types. This corridor now occupies 9 ha of arable land.

## REVEGETATION

### VALEMA FARMS – PUTTING SUSTAINABILITY TO THE TEST

*Avril Baxter*

During this first year of the project, a grant was sought from the Gordon Reid Foundation for this and other properties to create the Upper Kunjin Catchment Nature Conservation Corridor. When the grant was approved, plant lists and numbers required were prepared, the seed collected and provided to local nurseries. This saw 55 000 trees and shrubs over 40 different species being planted during 1999-2000 on this property alone. In subsequent years another 90 000 seedlings were planted. Seeds were also collected of grasses, sedges, ground covers and annual flowers for direct seeding into the planting site.

Planting was done in clusters depending on soil type. Within each planting area, tall trees were planted in the middle of the corridor to stop roots invading the cropland. Outside were rows of small shrubs, which could act as breaks for weed invasion. The tall trees in the inside rows were planted by machine and the smaller shrubs by hand.

Many lessons have been learnt from this exercise:

- 1 For a precise matching of vegetation to soil type, successful weed control and to obtain funding, the project must be planned several years in advance.
- 2 Timing can be hard when grants must be acquitted within one year.
- 3 Planting local provenance seedlings matched according to soil type is very time consuming. For the 9 ha of planting, 10 working days were spent in surveying, seed collection and ordering seedlings. The farming family alone cannot do this. The work needs to be supported by grants for wages as well as materials.
- 4 Seeds must be provided to nurseries by September to allow slower growing species to reach a manageable size for planting.
- 5 Different soil types need different site preparation – survival rates were excellent in duplex soils (90%) but less in sticky clays (60%), this was due to the chasm left by the ripper in the heavier clays.
- 6 Weed control is a major issue and must commence in the year before planting.

Overall the corridor cost \$2375 per km not including the cost of fencing, something the Pitmans could not afford without the aid of a grant.

Seeing red-capped robins moving through the young corridor is one of the rewards for their time spent in planting. Other on-farm benefits are still to be measured. Such a large integrated project could not have been undertaken without the passion for "nature conservation". As Lawry says "seeing the corridor makes me feel good in my heart – aesthetics is a large part of working and living on the farm".

*The Pitmans can be contacted on 9065 7074 or via email at [lawpit@bigpond.com](mailto:lawpit@bigpond.com)*



*Clint and Lawry Pitman and Robin Campbell in the three year old corridor*



## REVEGETATION

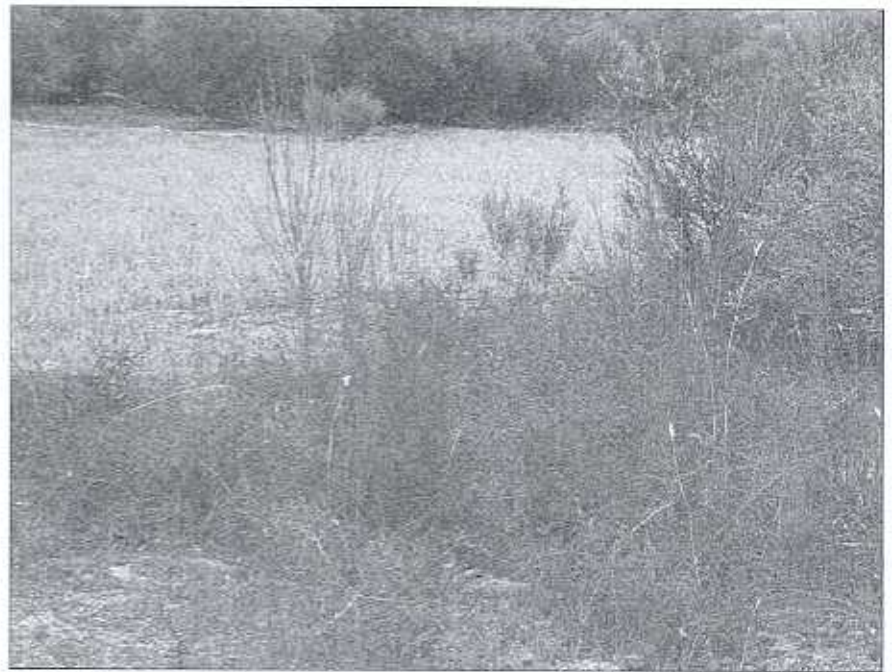
# THE VALUE OF PRICKLES

Rosemary Jasper

**P**RICKLY plants are common in south-western Australia and while they may not be endearing to humans who want to walk through the bush, they can have significant value in revegetation. The following example is an illustration of the type of benefit they can provide.

On our bush property near Ravensthorpe, there is one area that has been cleared in the past (within the last 30 years) but which is now being recolonised gradually by a variety of native species. There are very few introduced plants, but in parts of the area there are still only annual native herbs or native grasses, whereas originally there would have been a dense cover of small trees and shrubs as well. One small 'shrub' that is a feature of the area however is the low-growing, prickly wattle, *Acacia acanthoclada* subsp. *acanthoclada* (Harrow Wattle). This plant is growing here to about 30 cm high, and has rigid fine spines at the end of each branchlet, making it a very prickly plant, with a well-deserved common name.

Although I do not find this *Acacia* a natural favourite, it appears to be serving a very useful function in the regeneration of this area. The photograph shows a typical patch of *Acacia acanthoclada*. The patch, made up of several individual plants, is about 4 sq. metres in area and only 20 - 30 cm high, and it forms a dense prickly mat of vegetation. Growing up through this apparently inhospitable tangle are some young *Allocasuarina huegeliana* (Rock Sheoak). There are 11 Rock Sheoaks in this small patch and they vary in height between 25 cm and 1 metre.



*Acacia acanthoclada* patch with sheoak seedlings

These plants show no signs of having been grazed even though rabbits and kangaroos use the area and are known to favour *Allocasuarina* sp. There are no young sheoaks growing in the open ground in this vicinity. I assume that the wattle has afforded the young sheoaks protection from grazing and allowed them to become established in the area.

Harrow Wattle itself may be short lived, because many of the patches have sections that are dead, but even so the framework of dead branches and spines continues to provide a very prickly habitat. There is also a noticeable spread of the plant with small plants of a variety of ages growing on the periphery of each of the mature patches. This species therefore appears to be a very successful coloniser in this situation. It has required no soil disturbance or fire for the seeds to germinate and the young seedlings have been left alone by grazers.

But this story doesn't stop with plants. In the patch shown in the photograph, there is also an active Tawny Crowned Honeyeater's nest. This was a very exciting discovery and illustrates the possible protection value of prickly plants for animals as well.



Tawny Crowned Honeyeater  
*Phylidonyris melanops*

This all suggests that if you are planning some revegetation, look around the bush in your area for prickly plants that could be expected to protect other plants and also animals from grazing and predation and include them in the revegetation species list. If the plants are themselves good colonisers then so much the better.

Rosemary Jasper is LFWO at Ravensthorpe.

## FLORA

WHILE insects undertake the majority of pollination activity amongst carnivorous plants, some recent observations have shown that this is not always the case, it appears that birds may pollinate some species. A colleague, Alan Burbidge, passed on to me an observation from Cheryl Gole [the WA organiser of Birds Australia's Atlas survey - Ed] who had watched a honeyeater feeding on a climbing *Drosera*. From her pressed specimen, I determined the plant to be *Drosera macrantha* subsp. *macrantha*.

Cheryl reported: "On the 7<sup>th</sup> Aug, 1998, between 11.00 am and 12.25 pm, I observed a Brown-headed Honeyeater feeding from the flower of a *Drosera* species. The bird was observed feeding at the flower and did not appear to be taking insects from the leaves of the plant. The bird was perched on one of the dead branches of a fallen shrub and the *Drosera* was twining through the twigs and branches of this."

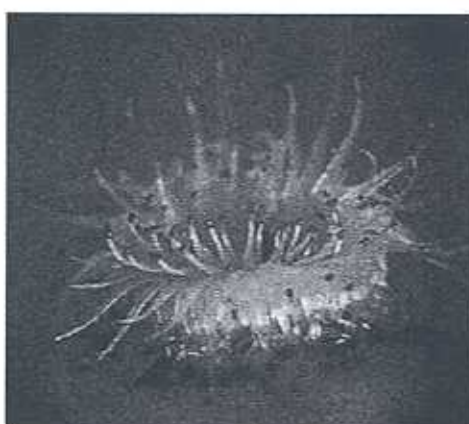
Although Cheryl's observation that she did not see the bird taking insects from the leaves - ie, insect prey caught by the dewy glands on the leaves - Brown-headed Honeyeaters do take insects as part of their diet. Perhaps the bird may have been taking the small, free-roaming *Drosera* bugs which are always present on *Drosera* species throughout Australia (see Lowrie 1998, pp34-36).

On the other hand, the bird may indeed have been taking nectar from the flowers. The anthers of this species are long and erect, as are its branching stigmas. A honeyeater taking nectar from around the base of the ovary would certainly have its facial feathers dusted with pollen. In the process of nectar-gathering, pollen would be transferred from the anthers to the stigmas, from one flower to the next, as the bird went about its feeding activity.

The climbing species of *Drosera* have certainly evolved to provide the perfect conditions for birds to

## BIRD POLLINATOR OBSERVATIONS IN CARNIVOROUS PLANTS

Allen Lowrie



*Drosera macrantha* subsp. *macrantha*

visit their flowers. By growing up through the branches of low shrubs they have not only managed to display their flowers well above the supporting vegetation, but have also provided many strong host-plant perches for the birds to gain access to the flowers. These quite delicate climbing *Drosera* species would not stand up to birds climbing along their length. It makes sense to provide strong nearby perches for your pollinator visitor.

There are a number of climbing *Drosera* species in south-west WA with one *D. macrantha* subsp.

*planchonii* extending to the eastern states of Australia. Species such as *D. pallida*, *D. subhirtella* and *D. erythrogyne* to name a few, may also be pollinated by honeyeaters. It is interesting to note that all of these species climb up their supporting host shrub by cementing some of their alternate leaves, especially the longer ones, onto various parts of its supporting host. It always amazes me that these climbing species, using only a small number of leaves for attachment, always manage to openly display their flowers above or to the side of their anchor host.

The cementing process of the leaves to their anchorage post is also an amazing adaptation. The long glands around the rim of the lamina not only catch insect prey but when needed can also be used by the plant as support on nearby branches of shrubs. When glands come into contact with a suitable anchorage position a number of glands somehow cement the back of their glands onto the support host. The adhesion is so complete that the glands will break from the rim of the lamina before they will part company with the host branch.

I have often wondered what strange insect could be the pollinator of another carnivorous plant, *Utricularia menziesii*, a common species found north of Perth to east of Esperance. This species captures and digests prey with bladder-like traps which are positioned on and in the wet soil amongst, as well as below, its compact clump of basal leaves. The nectary spur of this species is huge and is generally about three times longer than the lower lip of the flower. It is not only long but thick and wide as well. It contains a large amount of nectar. I have often thought the insect pollinator would have to be one strange insect, to have a proboscis of similar length to the nectary spur of *U. menziesii*!

My thoughts on what insect may be this species' pollinator reminds me of the story of Charles Darwin who received an orchid *Angraecum*

# FLORA

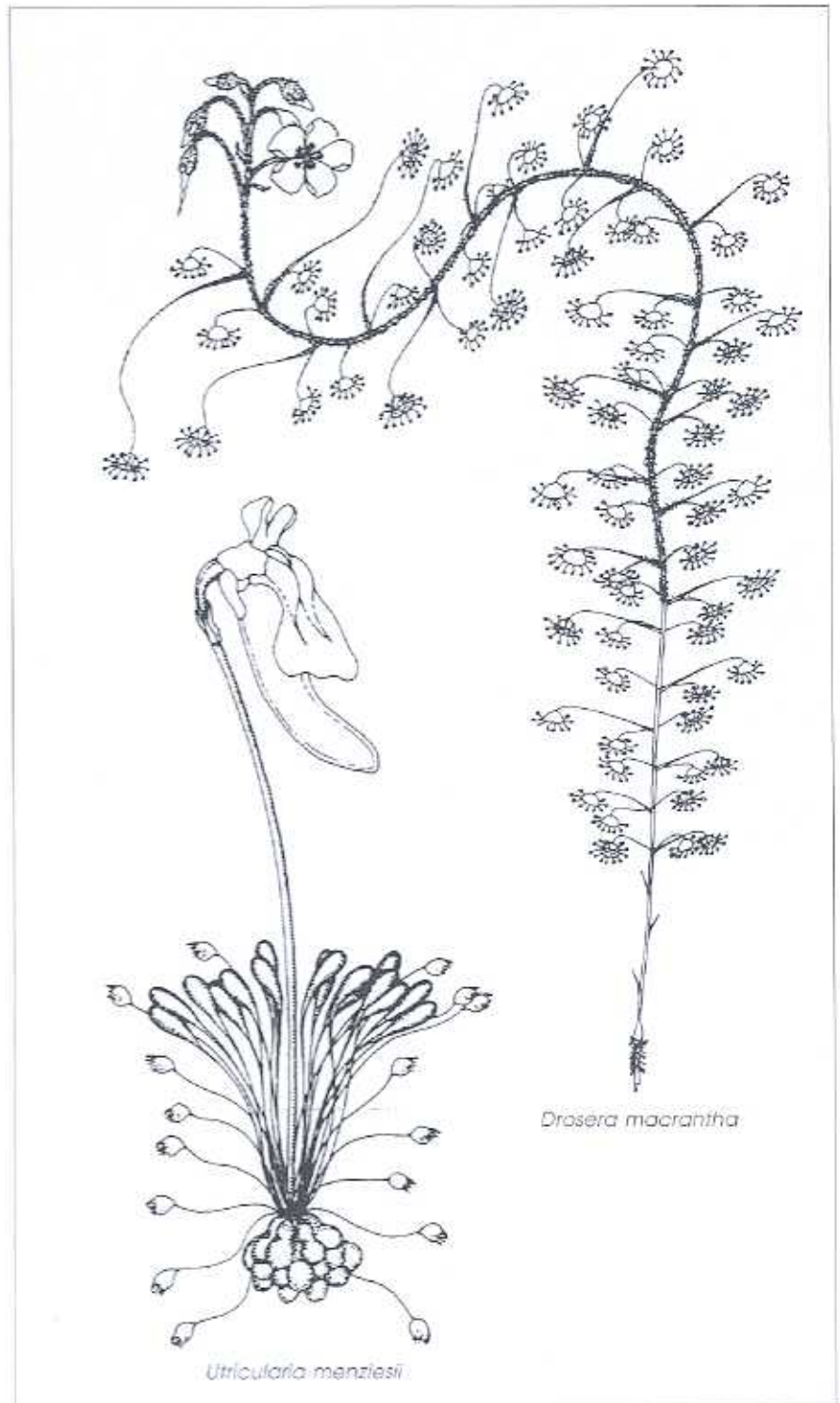
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*sequipedale* from Madagascar with a nectary spur some eleven and a half inches (28.55 cm) long, of which only the lowermost inch and a half (3.75 cm) held nectar. He suggested there must be moth pollinator with an eleven and a half inch long proboscis. Entomologists ridiculed his theory at the time but later Darwin was proved correct when a moth, the pollinator of this orchid, was discovered with an eleven and a half inch long proboscis.

My thoughts of an insect possibly being the pollinator of *U. menziesii* were wrong. It is now known that a bird is the pollinator, in this case a honeyeater. In my discussions with Alan Burbidge regarding Cheryl Gole's observations he told me that another colleague, Greg Keighery, had observed a bird pollinating *U. menziesii* flowers. I contacted Greg and in our discussions he recalled the event he saw.

Greg told me he was botanising on the peaks of the Stirling Range, in particular working on the *Darwinia* species that exist there. The mountain peaks in this region are often within the cloud-line. As the cloud mists were rolling in, Greg observed many flowering *U. menziesii* plants on a nearby moss-covered area. He watched a Western Spinebill hopping along the ground from flower to flower pushing its beak deep into the long nectary spur for its nectar meal, in the process transferring pollen from one flower to the next.

This amazing observation opens up new ideas. When I think about it now, I can see the relationship between *Grevillea* flowers (a common source of nectar for many honeyeaters) and *U. menziesii* flowers. Not only do many species of *Grevillea* have brilliant red flowers like *U. menziesii*, but rather deep nectary tubes as well. Furthermore, many *Grevillea* species display their flowers on and very close to the ground. To Western Spinebills, *U. menziesii* flowers close to the ground are no different



to that of prostrate *Grevillea* inflorescences.

The anther-stigma arrangement of *U. menziesii* is similar to that found in all *Utricularia* species. The stigma is like a hanging tongue, the front of which has the stigmatic surface. At the back of the hanging tongue two anthers are present. As the bird plunges its beak between

the upper and lower lip of the flower to gain access to the nectar deep in the nectary spur, the base of its beak and probably the surrounding facial feathers rub at first against the stigmatic portion of the hanging tongue and as the beak is withdrawn from the spur it pulls pollen from the anthers at the back of the hanging tongue onto the base of its beak.

## LANDFORM

# THE DEVIL'S SOILS: THE SOILS THAT BITE BACK

Steve Appleyard

THE first Europeans who settled in coastal areas of Australia brought with them a myth from the Old World about the role of humans in dominating the land, and about how ever-willing soils would offer up the fruits of the earth to their Masters. But in doing so, they forgot their own stories, told since at least the Middle Ages, of the soils that would not be dominated but would bite back.

People who used to live on the North Sea coast of what is now Germany knew these soils as *Maiboldt*, the Devil's soils. To the Dutch, *Kattekleigronden* were soils inhabited by evil spirits that refused to give a crop. We now generally call these materials "Acid Sulfate Soils" (ASS).

ASS are naturally occurring waterlogged soils that contain iron sulfide minerals, generally as the mineral pyrite. These soils are mainly found in coastal regions of Australia (Figure 1) and mostly have been formed during the last 10 000 years when the sea level rose to near its current position after the last ice age.

These soils are absolutely benign when undisturbed. They are also very unexciting to look at, and consist mainly of grey or greenish-grey clayey, silty or sandy materials below the water table, often with orange or yellow iron-rich mottles just at, or above the water table.

But don't be fooled by their appearance. These soils are anything but dull if they are drained or dug up without care.

The pyrite they contain can react with oxygen from the air to form a toxic brew of sulfuric acid, metals leached from soil minerals and often arsenic that has been trapped within pyrite crystals. This acid leachate can be washed into drains or into groundwater and can cause a variety of environmental problems. These include causing fish kills due to deoxygenation and aluminium toxicity; loss of biodiversity in estuaries, wetlands and waterways; contamination of groundwater resources by acid, arsenic, heavy metals and other contaminants; loss of agricultural productivity; and, corrosion of concrete and steel infrastructure by acidic soil and water.

The National Committee for Acid Sulfate Soils estimates that there is potentially \$10 billion worth of liability in coastal regions of Australia if the disturbance of these soils is not well managed.

### Historical background

Environmental effects caused by the drainage of ASS in Australia were first described in WA in 1917. The Government Geologist of the time, H.P. Woodward,

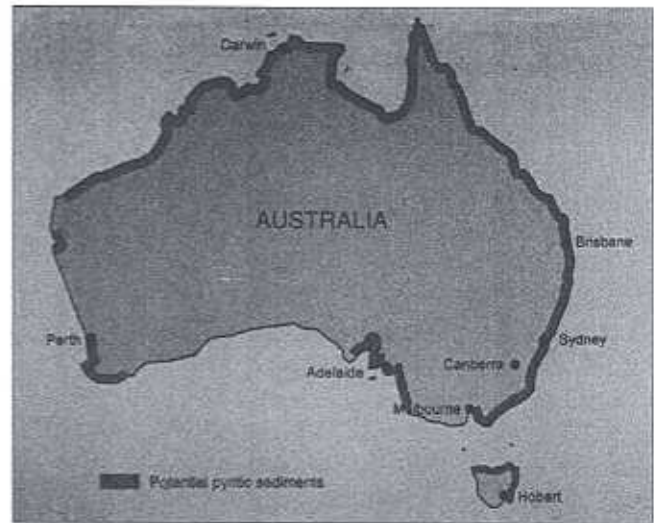


Figure 1. Coastal areas of Australia where there is a high risk of acid sulfate soils occurring

visited an agricultural development at Torbay near Albany where entire crops had been killed following the construction of an extensive drainage scheme. Woodward identified pyrite oxidation caused by the drainage as the source of the acidity, and he recommended intensive liming of drain water and soils to control the problem. Soils in the area are still acidic and generating acidic leachate more than 100 years later.

However, the lessons learnt were quickly forgotten, and ASS were not "rediscovered" in WA until 20 years later (which was still 30 years earlier than the description of these materials from the eastern seaboard). Teakle and Southern from the Department of Agriculture identified highly pyritic peaty soils in many areas on the Swan Coastal Plain and on the South Coast. In many areas there was evidence that pyrite oxidation was occurring due to soil disturbance and drainage. Once again, this work was largely forgotten until the 1960s when it was picked up by researchers working on ASS on the eastern seaboard where concern arose because of outbreaks of the fish fungal disease Epizootic Ulcerative Syndrome (EUS or "Red Spot" disease) which were thought to be exacerbated by exposure of fish to acidic water.

In WA the problem was generally not considered significant, however, this view changed in January 2002 with the discovery of widespread groundwater acidity problems and contamination by arsenic caused by the disturbance of sulfide-rich peat soils for urban development in Stirling. Not only were ASS present in the heart of the Perth Metropolitan Region, but also their

## LANDFORM

*continued from page 12*

disturbance was causing arsenic and acidity contamination in a resource that provides about 70% of Perth's water usage and which is accessed by more than 135 000 domestic bores!

### What's happening now in WA

The Western Australian Acid Sulfate Soil Working Group has been established to oversee the development and implementation of measures to manage environmental effects caused by ASS disturbance in the State. Department of Environment is mapping at-risk soils and has developed management guidelines; the Department of Planning and Infrastructure has developed planning guidelines and workshops have been held. A State Strategy is being developed.

However, there is a very long way to go, particularly for ensuring that existing land use and groundwater abstraction in high-risk areas does not cause environmental problems or lead to widespread groundwater contamination by arsenic or other by-products of pyrite oxidation.

For more detail, contact Steve Appleyard or Stephen Wong at DoE for a list of relevant websites:  
email [steve.appleyard@environment.wa.gov.au](mailto:steve.appleyard@environment.wa.gov.au)  
or [stephen.wong@environment.wa.gov.au](mailto:stephen.wong@environment.wa.gov.au)

*Dr Steve Appleyard is the principal officer involved with acid sulphate soils at Department of Environment. He can be contacted on 9222 8626*

### Identifying Acid Sulfate Soils (ASS)

#### and indicators of their disturbance on your property

The term "Acid Sulfate Soil" refers to a whole soil profile consisting of oxidising materials above the water table (known as "Actual Acid Sulfate Soil" or AASS) and unoxidised material below the water table (known as "Potential Acid Sulfate Soil" or PASS). To identify these you will need to be able to dig a test pit to just below the water table and be able to measure pH (with pH test papers or a meter). ASS are most likely to occur in low-lying swampy areas of your property where the water table is near the surface. Typically, these are areas where *Metaleucas*, Saltwater Sheoaks and rushes grow.

Firstly, look at the material above the water table. It will typically have a mottled appearance. Mix about 1 teaspoon of soil material with about 5 teaspoons of distilled water and measure the pH. AASS materials typically have a field pH of less than 4. The presence of straw-yellow to butter-yellow mottles in the soil profile is indicative of AASS – these are made up of an iron sulfate mineral called jarosite which only forms when the soil pH is less than about 3.5.

Now look at the material below the water table. This may vary in texture (clay, silt or sand) but will typically have a "gun metal" grey colour, often with an odd greenish tinge that disappears rapidly on exposure to air. The pH of a soil paste of this material is usually about 7 to 8. Now put a sample in a Zip-lock sandwich bag and leave in a warm place indoors (not too hot, and do not let the material dry out). If you see yellow mottles of jarosite developing in the material, it is definitely PASS.

For a more rapid assessment of PASS, react one teaspoon of soil with 5 teaspoons of 30% hydrogen

peroxide in a small plastic container (**CAUTION!** This is a very hazardous chemical that can cause severe burns – always wear gloves and eye protection when using concentrated hydrogen peroxide). If the material is PASS, there will be a violent reaction after about 5 to 10 minutes, and the final pH of the solution may be less than 3. The greater the pH change, and the lower the final pH, the higher the pyrite content of the soil is likely to be.

In addition to looking at soil profiles, there are a number of visual indicators that ASS have already been disturbed and are generating acid on your property. Typical signs in drains or other surface water bodies are: opaque yellow-brown or red-brown water due to a thick suspension ("floc") of iron oxides; turquoise milky coloured water due to aluminium oxide floc; or crystal-clear water with iron or aluminium precipitates sitting on the bottom. You may also see a jet-black oily looking material accumulating on the bottom in deeper parts of your drains. This is iron monosulfide black ooze which forms as a result of dissolved iron reacting with organic carbon in drains. This material is washed away when there is heavy rainfall, and can rapidly deoxygenate water and cause fish kills in water bodies that receive discharge from drains.

In areas where ASS have been disturbed you are also likely to see iron monosulfides forming at the surface, usually beneath cyanobacteria mats or adjacent to clumps of vegetation. This material oxidises during dry summer months to form acidic salts that are washed into surface drainage with the first rainfall of the season.

## ECONOMIC ASPECTS OF BIODIVERSITY

### LOCAL ACACIA SEEDS FOR HUMAN CONSUMPTION

*Chris Robinson and Lincoln Morton*

WITH a flora as diverse as ours in southern Western Australia, there must be some plant species which could be commercially adapted to produce food for humans. After all, the Noongars survived here for tens of thousands of years eating the local plants and animals. All the plants that provide food for modern humans came from the wild, and most, like wheat, have been developed for human use from humble beginnings over thousands of years. Development of wheat still continues, and in WA wheat yields have risen 100% over the last 70 years and half of that increase occurred in the last ten years!

Narrow leaf lupin (*Lupinus angustifolius*) however, is an example of a species adapted from the wild to a major production variety in less than one human generation. The work to select non-toxic seeds and non-shattering pods was carried out here in WA! The attitude of scientists at the Agriculture Department in Albany was that selection and breeding would achieve huge improvements in production from wild plants if enough research effort was applied. They suggested if we wanted to develop native seed producers for agriculture, we should look for characters such as non shattering pod, suitable form, non toxic seed, high protein, high oil, large seed, consistent fruiting, desired life span, harvestable form and disease resistance.

Traditional agricultural species are dominated by grasses and legumes. Our acacias are legumes and are conspicuous in the landscape and many species visibly produce masses of seed from time to time. We have over 500 species of *Acacia* in southern WA. It seemed worth a look to see if we could eat any of them.

So, in 2002, a small Chemistry Centre WA/NHT funded project was undertaken to look at the possibility of using our own native species of *Acacia* to produce seed for human consumption. We were aware that certain species of central Australian wattles were exploited by Aboriginal people for food and that some of these were actually being used commercially in the bush food industry. However, very little information could be found about the use and edible seed value of our south west species. Only *Acacia acuminata*, *A. microbotrya* and *A. saligna* have received published mention.

The poor knowledge of the south-west acacias as food may be because Noongar knowledge has been lost. However, grinding stones that may have been used to grind *Acacia* seeds have been found in the south west.

The project began by asking a group of experienced seed collectors which of our local species they recognised as having potential for commercial harvest. The result was a short list of *A. microbotrya*, *A. redolens*, *A. cyclops*, *A. saligna*, *A. harveyi*, *A. acuminata*. The species selected could be considered the "obvious" ones as they are most frequently used in revegetation and are more likely to be available for seed collection than other less well known species. This initial selection did not imply that other species were not suitable but it was important to **start the investigation somewhere**. The next step was to simply go out into the field and collect some seed of these species for nutritional analysis and also gather some rough base-line data on production per tree, so that some sort of scale could be placed on eventual production in tonnes or kg per hectare.

In January 2002, wild populations of all species except *A.*

*saligna* were located between the Porongorup and North Stirlings area. Seed from selected plants was harvested and possible production estimated (based on density of 1250 plants per ha). Percentage of plants within the population producing seed, and seed drop were taken into account when calculating production. A stand of *A. saligna* cultivated near Borden was also harvested. The rough production estimates were:

<i>A. microbotrya</i>	87.5	kg/ha
<i>A. redolens</i>	187.5	kg/ha
<i>A. cyclops</i>	206.25	kg/ha
<i>A. saligna</i>	33.8	kg/ha
<i>A. harveyi</i>	55	kg/ha
<i>A. acuminata</i>	21.45	kg/ha

Although some of these production figures appear quite low, this data is from non-selected, unimproved wild plants which have had no agronomic development and were harvested in a poor season. Breeding could make them competitive with current lupin production. Bruce Maslin's book on *Edible Wattle Seeds of Southern Australia* identifies a potential yield of 1.25 tonne per hectare under cultivation.

Samples of these seed collections were then sent to Chemistry Centre WA for analysis. Seeds were also analysed at Melbourne University for cyanogenic glycosides (toxins).

The results for all species investigated are, on all counts, very encouraging. Generally the protein is high in comparison with existing legume crops, a little behind Lupins except *A. saligna*. This is a positive sign, as it provides evidence that improved *Acacia* species may rival lupins as a protein source.

Our acacias appear to be slightly higher in oil content on average compared to existing legume crops

## ECONOMIC ASPECTS OF BIODIVERSITY

continued from page 14

and the type of fatty acids in the oil tends to differ slightly. Acacias have comparable saturated fatty acid levels (palmitic acid) but have more polyunsaturated (linoleic acid) rather than monounsaturated (oleic acid) fatty acids. *A. saligna* actually has around half the saturated fatty acid content of lupins, suggesting superior quality fats for human consumption.

Many forms of carbohydrate exist and each has its own properties. Fibre and cellulose (indigestible carbohydrate) and other structural components of acacia seed are relatively high. Presumably this reflects the thickness of the seed coat and a breeding program aimed at reducing this component of the seed would increase digestibility. However, from a human food perspective, increased fibre in the diet has been associated with positive health outcomes. Indeed, some dietary studies have shown that replacement of wheat flour with acacia seed flour can induce a lower blood glucose concentration and insulin response – valuable characteristics given the incidence of diabetes and heart disease.

The mineral content of the natural acacia seeds appears to be comparable or slightly higher than in current fertilised legume crops.

Anti-nutritional entities are those which reduce the nutritional value of the food. Of greatest concern are the relatively high levels of lignin in acacia seed, most likely from the seed coat. Lignin reduces the availability of carbohydrate for digestion, probably by binding to it and making it unavailable for enzymatic breakdown. Polyphenolics, which behave similarly to lignins but tend to reduce protein digestibility, are present but the levels detected in acacia are not considered high. The levels of phytate (a compound which binds minerals such as zinc, calcium and magnesium and reduces their availability for absorption) in the acacia samples is similar to, or slightly lower than, the levels in

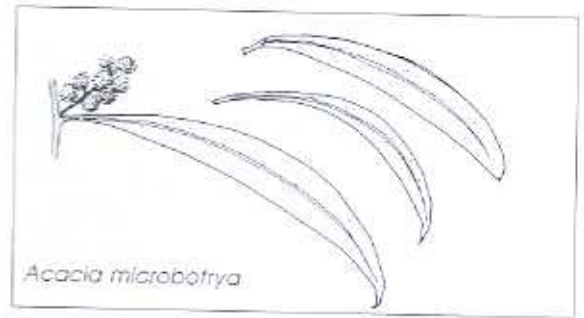
conventional legume crops.

No alkaloids or lectins were detected in the acacia seeds. Alkaloids are potentially toxic or bitter constituents while lectins are proteins which bind to red blood cells and cause agglutination (clotting). In contrast, lupins contain an appreciable content of alkaloid (hence the need for a breeding program before human consumption) and most of the other legumes contain lectins to some extent.

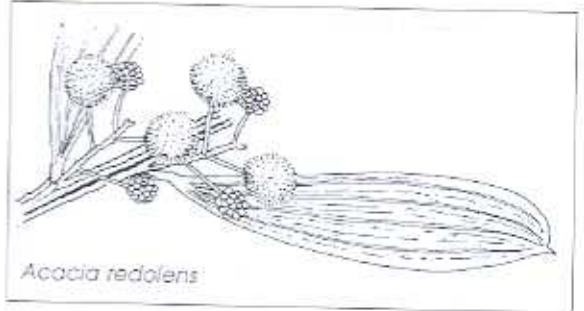
It is also important to bear in mind that this data is from wild plants and therefore demonstrates the worst quality of seed likely to be encountered. Further study of the carbohydrate portion is required to quantify the metabolisable material and the oligosaccharides (not discussed above). No study of protein quality has yet been undertaken nor has there been any work done to quantify the vitamin content of the seeds.

In general however, the acacias sampled appear well suited to human consumption without further improvement, although palatability and physical characteristics of the flour will need to be assessed prior to incorporation into food products. (It should be noted that Aboriginal knowledge identifies some highly toxic *Acacia* seeds. The authors do not recommend use of any *Acacia* seed for human or animal food, except when sold by reputable bush food dealers.)

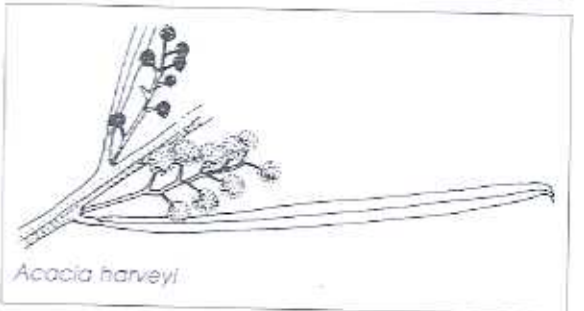
As an animal feed, it would be desirable to reduce the seed coat thickness. However, it is perhaps more beneficial to screen for high oil-yielding *Acacia* varieties and



*Acacia microbotrya*



*Acacia redolens*



*Acacia harveyi*

subject these seeds to processing for higher value end-products which would be suitable for both the human and animal food sectors. Other than this, all we need is an economically viable production strategy.

We are currently collaborating with other interested parties to develop a more comprehensive project which should identify the best species for food production.

### Can you help?

Please contact Dr. Lincoln Morton (Chemistry Centre WA 9222 3037) or Chris Robinson (Greening Australia 9892 8486) if you know of any *Acacia* species that grows in your area that may be worth investigating as a commercial seed crop.

## FAUNA

# WESTERN SHIELD ~ REVIEWED

Tony Start

**B**ECAUSE recent media reports about a review of CALM's ambitious program, Western Shield, were brief (TV, radio and newspapers are always pressed for space) we'd like to give Western Wildlife readers some of the

missing detail. We'll fill in some gaps by looking at the history and scope of Western Shield, why it was reviewed, who did the job and what they concluded. We too are somewhat pressed for space so we'll tell you how to find out more.

Basically, Western Shield aims to recover threatened fauna by controlling feral predators, particularly foxes and cats – but that is deceptively simplistic. The project's origins were in research that showed two basic facts:- (1) dwindling remnants of once-common species like numbats, woylies and rock-wallabies could recover if foxes were removed from their habitats and (2) native animals are very tolerant of the toxin, 1080, in poison-bushes (*Gastrolobium*; they grow naturally in southwest habitats) but minute quantities are lethal to exotic mammals. It is no coincidence that the last populations of woylies and numbats were found in places where poison bush is abundant: if foxes eat animals that have eaten 1080, they die.

Now we could dream of reconstructing mammal faunas and the ecological services they provide. Western Shield is turning the dream into reality but it requires a huge commitment to public relations, manufacturing and distributing



bait, constantly seeking more effective and more efficient ways to do things and monitoring the results. We've improved all those things as well as minimising risks, and translocating captive-bred and wild animals. Unlike foxes, cats generally shun carrion (and baits) for live prey. However, as they prevent recovery in more arid areas, researching ways to control them is critical and there have been huge advances in that direction.

At the moment, CALM drops 5 baits per ha four times per year over an area of about 3.5 million ha from aircraft fitted with state-of-the-art navigational equipment that controls precisely where the planes are and where baits are dropped. Moreover, every baited piece of land is subject to an annual risk-assessment and prescription. During its seven-year life, the complexity and sophistication of Western Shield has grown so fast that CALM's Executive Director decided it was timely for us to stand back while a panel of experts, who have had nothing to do with the project, review the whole program.

An independent and competent review was assured by appointing three eminent scientists from other States who have complimentary skills in economics and

management. They were Professor Hugh Possingham, Chair of Mathematics and Zoology at Queensland University, Professor Peter Jarman, an expert in wildlife management at the University of New England and Allen Kearns, Deputy Chief of CSIRO's Sustainable Ecosystems Division. Allen is Canberra-based.

The panel spent a week in Western Australia during which members attended a workshop to hear a dozen papers encompassing management, PR, operations and R&D presented by key staff to an audience of about 200 people representing the community, sister agencies and people from all walks of life who are involved one way or another in aspects of Western Shield. The panel spent a second day discussing issues raised at the workshop with authors, senior staff and other key people. The rest of the time was spent meeting the Minister, the Conservation Council, viewing captive breeding facilities at Perth Zoo, the bait factory at Harvey, Barna Mia and other facilities at Dryandra. Unfortunately Prof. Possingham had to return home but the others visited Project Eden facilities at Denham. At all the field sites, they met informally with the local staff.

The panel's report is now on the CALM web site. If you have the opportunity, view it (at [www.calm.wa.gov.au/projects/west\\_shield\\_indep\\_review.html](http://www.calm.wa.gov.au/projects/west_shield_indep_review.html)). If that is hard for you to do I'd be happy to send you a copy (contact details below). In any case, here's a



## FAUNA

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summary. The panel noted a series of substantial achievements in the areas of threatened species recovery and the status of a broad spectrum of other species, skills in captive breeding and translocation of fauna, bait manufacture and baiting technology and public awareness. They summarised their view of the project thus:

We believe that Western Shield is a world-class predator threat abatement program that is strategically targeted at the recovery of a wide range of threatened fauna. The success of the program has been a consequence of:

- ▶ southwest Western Australia's natural advantage in having 1080-tolerant native fauna, while introduced mammals remain susceptible;
- ▶ implementing a scientific research and management framework that exploits that natural advantage;
- ▶ a clear vision of the scale of the predation control challenge and the potential rewards in terms of reintroductions and in situ recovery of native fauna;
- ▶ dedicated and competent staff, and operational efficiency,

particularly with respect to baiting operations.

However they also made seventeen recommendations. Some are very specific. E.g.

- ▶ Western Shield should continue!
- ▶ Western Shield's scope needs to be clearly focused and defined to eliminate ambiguity. They suggested "*Feral predator control (where predators include foxes, cats and in particular cases rats and maybe even pigs) for the purpose of recovering remnant, and re-establishing new, populations of critical weight range mammals and associated terrestrial vertebrates (eg reptiles, ground-nesting birds)*".
- ▶ The project has reached a complexity that requires one, clear, senior leader to coordinate and integrate the various components
- ▶ Community involvement should be moved from consultation and publicity to genuine dialogue and real partnerships at strategic and project levels

Others raise issues that they say CALM must address. While there

are observations on options, the panel recognised that the Department is ultimately responsible for deciding how to act in those areas, and addressing the issues should be a priority job for the senior leader when an appointment has been made. The topics include: a need for full-cost accounting, bait development, procurement and delivery, monitoring, research (more on cats and the role of dingoes in predator complexes), moving into arid areas, future directions for Project Eden at Shark Bay and the use of islands for marooning threatened fauna, public relations, publication of scientific work and captive breeding. The final recommendation stresses the need to use 1080 wisely. They say it is critical to the survival of many native animals and nothing should be done that might jeopardise public acceptance of its use for that purpose.

*More information from Tony Start, Wildlife Research Centre, PO Box 51, Wanneroo WA 6946. Phone: 9405 5146 or email: tonys@calm.wa.gov.au*

## NEWS

### Launch of the Drummond Natural Diversity Recovery Catchment Plan.

IN October, some 50 people (including many LFWers) assembled at Drummond Reserve in Toodyay to hear Environment Minister Dr. Judy Edwards officially launch the plan. It was lovely weather, the reserve looked superb, and people took advantage of the attendance of experts such as botanists Neville Marchant and Greg Keighery to meander through the bushland, learning about its ecology. The photo shows a group looking at one of the reserve's gems - a pristine clay-based ephemeral wetland covered in Robin Red-breast Bush.



## MEMBERS' PAGE

### Ivan Carnaby and the black cockatoos

ABOUT 1958 a fellow called Ivan Carnaby was caretaking the Galena Mine for Frank Burnett, the owner. Ivan was a handyman and he removed most of the old Jarrah weatherboard cladding from our farm house and re-clad the walls with nailed-on asbestos sheets. He also made two gates for Grandpa's six-foot high, chook-proof wire-netting garden fence. These gates were wood-framed (Jarrah) with corrugated iron on the bottom half and rabbit netting on the top. They were beautiful gates, easy to open and close and so much better than the old ones which you had to fight your way through.

Ivan Carnaby had a couple of pet red-tailed black cockatoos. I recall one used to camp on the bottom rail of his iron bed at Galena. I had never seen black cockies in captivity. Dad would only let us keep galahs or twenty-eight parrots as they were considered to be vermin. The black cockies, or 'Titandees' as we called them, were harmless, ate double gees, never came near the house and had to be left alone. Carnaby actually did research into black cockatoos; one of the white tailed species is called Carnaby's cockatoo.

The Titandees have always been around Galena. By the 1930s huge flocks could be seen on the cleared paddocks cracking open dried double-gees and eating the small yellow seed inside. The red-tailed black cockies didn't seem to nest on the Murchison River around Galena but flew into the area from further north where some nesting sites are known. Those who study these birds, and others, tell that although we see big flocks of black cockies around the numbers are static or declining. This is because they live for many years and we are continually seeing the same birds

### A STORY OF RED-TAILED BLACK COCKATOOS \*

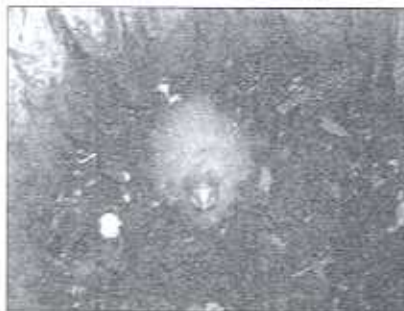
Bob Porter

whose numbers may suddenly dive to dangerously low levels. They may not produce new offspring due to the fact that their nesting areas have been disturbed.

In 1995 I met Dr Denis Saunders who was a leading WA-based bird scientist. When I told Dr Saunders that we had known Ivan Carnaby in his hey-day (1950s) he was very surprised - and impressed. He obviously thought a lot of Carnaby's research, but being a much younger man than myself, had never had the chance to meet him.

#### Red-tailed Black Cockatoos nesting on "Riverside"

In March of 2002 we noticed that some Red-tailed black cockies were hanging around a hollow Coolibah (*Eucalyptus victrix*) near the Murchison River down from the



Very young chick (April)



Older chick (June)

homestead. I had seen this before but never had I been able to find a pair actually nesting. One morning on our walk a large female black cockatoo came out of the hollow and we decided that they may be serious about nesting. Later I began driving past slowly a few times as they seemed less afraid of a vehicle than people on foot. The female bird would just look out of the hollow and remain there. I was now certain that they were nesting and was very excited to think that we were able to be hosts to this rare event.

I rang Kevin Marshall from CALM in Geraldton and he told me that the black cockies nest in autumn which surprised me as other cockatoos all appear to nest in August/September. As the tree was fairly short and the hollow quite open I was worried that a cat or bungarra would invade the nest, so kept a look out. After a week or two (about the 5<sup>th</sup> of April) I noticed that the female was not there. The male bird had not been seen since the first sighting in March. I climbed the tree and looked in the hollow and could see a single tiny chick about 600mm down. A week later I took the ladder and photographed the chick - who appeared as a yellow prickle of fluff looking up for food.

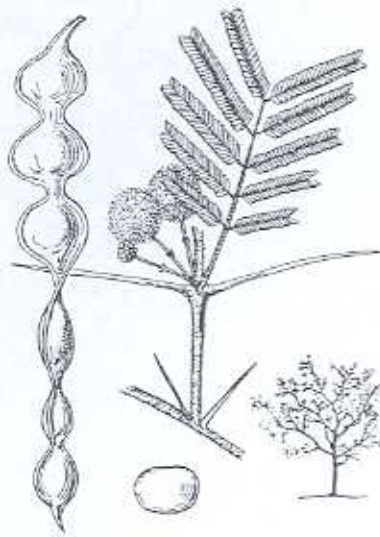
For the next eight weeks we inspected the female chick every few days and by now she was large and I would say ready to leave the nest. During this time we never once saw the parents but by the chick's healthy condition it would seem that they had fed her well.

In April and May 2003 we checked the nest site and found no nesting signs but in early September we saw the female fly out of the hollow, and later I watched the parents from a distance when they would fly in and land near the tree - I presumed to feed the offspring.

(\* In part adapted from "Pure Galena - a story of settlement in the Australian Outback" by Bob Porter)

## WEED ALERT

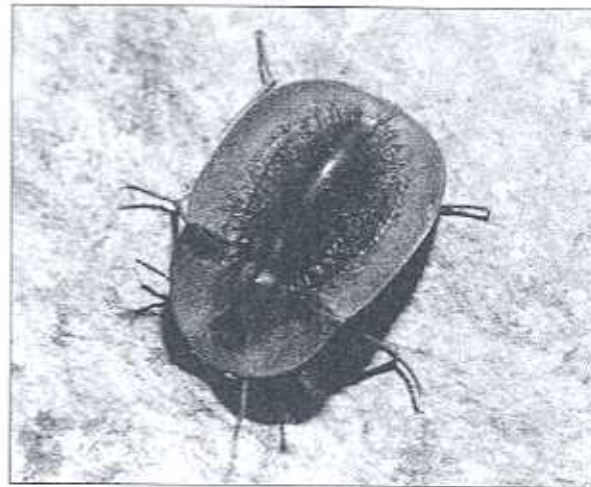
### *Acacia nilotica* on the Durack River



A huge infestation of pastoral Australia's 'worst weed' Prickly Acacia, *A. nilotica*, has been discovered, covering 100 sq km near the Durack River in the East Kimberley. It is estimated that it has been established more than 20 years. Please, residents and visitors, keep an eye out for this serious invader, and take a piece of any suspect plant to the nearest Dept. of Agriculture office. Remember, it has big thorns, ferny leaves and pods like beads on a string.

*Pic from "Weeds of Natural Ecosystems", by NM Smith, Environment Centre NT, 1995.*

## PIE-DISH BEETLES



Hairy-backed Pie-dish Beetle, *Helea perforatus* photo: Jan Taylor

COMMONLY seen foraging among the leaf litter in woodlands and shrublands are the odd-looking Pie-dish Beetles. They have a broad flange around the body and head, giving them a very distinctive appearance.

These beetles are in the genus *Helea* and in the meal-worm beetle family Tenebrionidae. The genus is found only in Australia and has 50 or so species, with some 20-30 found in WA. The one pictured – the Hairy-backed Pie-dish Beetle – is found from Geraldton to Cape Arid, but not usually far from the coast. Other species occur further inland, including out into the mulga country.

The larvae are probably cylindrical, meal-worm-like, and feed on the roots of plants. Adult beetles emerge in early summer

and are active during the hottest months of the year. They are flightless, and scavenge on dry plant material found in the litter, thus helping to break it down into humus.

It is probable that they are eaten by all sorts of small reptiles, birds and carnivorous mammals and often one finds the distinctive pie-dish back, with the innards eaten out of it. Possibly the hairs on the back of the species pictured may serve to anchor sand and debris to their backs, and so provide camouflage.

How many kinds of pie-dish can you find in your woodland? You may need to go out at dusk, or on a moonlit night with a good torch. Happy beetle-hunting!

*Info from Terry Houston, WA Museum.*

*Bird pollinators observations in carnivorous plants continued from page 11*

When the bird visits the next flower, pollen is first placed on the stigmatic portion and fresh load of pollen is deposited when the bird's beak exits the nectary spur.

Both the Greg Keighery and Cheryl Gole observations and interesting discussions with Alan Burbidge have certainly opened a new and interesting area of research on the alliance between birds and carnivorous plants. I hope that this report will stimulate discussion with

others in this area of research. I would be most interested in hearing from anyone of observations they may have seen with regard to the pollination of carnivorous plants either by insects or by birds.

*Allen Lowrie is a botanical author and artist. He can be contacted by mail at: 6 Glenn Place, Duncraig, WA 6023.*

### WANT TO KNOW MORE ABOUT CARNIVOROUS PLANTS?

You should get Allen's three detailed and superbly-illustrated books:

Carnivorous Plants of Australia  
Allen Lowrie

Pub: Uni WA Press

Vol 1 1987

Vol 2 1989

Vol 3 1998

## ECONOMIC VALUE OF BIODIVERSITY

### Tax Concessions now available with the Nature Conservation Covenant Program

If you have bushland on your property and are interested in preserving it for the long term, you might be interested in the tax concessions available to people who enter into conservation covenants.

Recent changes to the Federal tax legislation mean that landowners who have entered into conservation covenants since 1 July 2002 may now receive a tax concession. Briefly, there are two types of tax concessions available, one for income tax and the other for capital gains tax. There are a number of factors which affect the landowners' eligibility, and anyone who is interested should consult their taxation agent or the Australian Tax Office before proceeding. However, the good news is that two

of the three covenant programs operating in Western Australia are now eligible to offer the tax concessions. These programs are the Department of Conservation and Land Management's (CALM's) Nature Conservation Covenant Program and the Conservation Covenant Program offered by the National Trust of Australia (WA).

Conservation covenants are voluntary, legally binding agreements taken out by landowners who are interested in protecting the nature conservation values of their land for the long term. Many landowners enter into covenants over land they have worked hard to manage and protect, and they want to see that land looked after when it changes hands. There are also other

benefits from joining a covenant program. Some financial assistance is available (through the CALM Covenant Program) to assist with land management costs, and advice and assistance are also provided. Conservation covenants are usually provided free of charge; entering into them is entirely voluntary, and they are designed to be flexible provided that the nature conservation values of the land are not compromised.

Anyone interested in finding out more about covenants (and tax relief!) can contact either the Nature Conservation Covenant Program Coordinator, Sophie Moller on (08) 9334 0477 or the National Trust Covenanting Coordinator, Scott Morath on (08) 9321 6088.

## NEWS

### CALM Bush Rangers to feature on the Japanese environmental documentary program 'The Wonderful Spaceship is named The Earth'

A film that will feature CALM Bush Rangers will be broadcast on 'The ASAHI television'-Channel 10, Tokyo, in April 2004. The Japanese environmental documentary program 'The Wonderful Spaceship is named The Earth' is a half hour weekly program on Sunday night in Japan.

The program will introduce the conservation projects the CALM Bush Rangers are doing across WA and then feature on one issue – fighting dieback in their local community. Roleystone District High school's CALM Bush Ranger Unit has a history of outstanding work in this area of biodiversity conservation. The film will focus on this Unit working with the



Roleystone DHS CALM Bush Ranger Unit contributing to Western Shield monitoring trapping with CALM Science at Perup Nature Reserve

Roleystone Community Dieback Action group to control dieback disease on the school grounds – an area that looks more like a national park than a traditional playground. The Unit will also work with key

dieback staff in CALM.

The opportunity for CALM Bush Rangers to participate in the filming has created much excitement for our up and coming teenage enviro film stars!

## IN BRIEF

### Plant regeneration following fire in Bungendore Park, Bedfordale, WA

**M**ANY *LFWers* express concerns about fire management of their bushland. If you live in the Hills, you might find Jeffrey Lewis' article in the June 2003 'Western Australian Naturalist' interesting. He reports in great detail the results of seven-year study into the Park's regeneration after a wildfire on 9<sup>th</sup> December 1994, finding that regeneration was often correlated with variables such as the past fire history of the site. He reports especially on the reappearance and rapid growth of wattles, and their subsequent equally rapid decline. A special study of orchids also revealed interesting changes.

Well worth reading to help with understanding the dynamics of post-fire succession in Jarrah and Wandoo forest.

Ref *West. Aust. Nat.* 24: 37 - 72  
For how to obtain a copy, contact the WA Naturalists' Club on email: wanats@iinet.net.au

### Shire of Beverley - Conservation Policy

**T**HE Shire of Beverley has produced a Conservation Policy to: "... provide the Council and community with a clear position and a range of strategies for ensuring that the conservation, protection and management of local remnant vegetation and biodiversity within the Shire is optimised".

It sets out 34 Policies in 10 Strategy areas and outlines how the Council will implement these - truly a most commendable attitude. Other Shire Councils could well consider a similar approach.

For a copy of the document, phone the Shire on (08) 9646 1200 or email: admin@beverley.wa.gov.au

### Wanted: Swamp Sheoak sites across Great Southern farms for farm forestry survey



**A** project is under way in the Great Southern to develop Swamp Sheoak (*Casuarina obesa*) for wood production, with particular focus on the lower rainfall salinity-affected agricultural belt. This tree shows great promise as a tree crop and the project hopes to do the further practical work needed to develop its potential.

Have you got either established plantings of *C. obesa*, or natural remnant stands of this species, on your property? Ideally, the sites should be pure wood-lots more than three years old and 1 ha in size. The

sites would be evaluated for their farm forestry wood production potential, and silviculture guidelines for future management developed. For priority demonstration sites, work teams will carry out pruning and thinning. The project is also looking for farmers to enter into partnership projects to establish woodlots of Swamp Sheoak in 2004.

Interested?  
Contact Basil Schur at Green Skills, Denmark by phone: 9848 1019, or email: basilschur@greenskills.green.net.au

### Portuguese Millipedes



**H**AVE you been bothered by Portuguese Millipedes this autumn? The Department of Agriculture has produced a very good leaflet explaining all about them and methods of control: "Portuguese Millipedes (*Ommatoilus moreletti*)" Gardennote No 2, Sept 2003. Free from DOA, call Marie Bracks-Burns on 9368 3411 or email mbracksburns@agric.wa.gov.au

## MEMBERS' PAGE

### THE CLASSROOM IN THE BUSH

Claire Blechynden finds it hard to believe that Tammar Wallabies are listed by CALM as a Priority 4 species. As far as Claire is concerned they are everywhere. Twelve-year-old Claire's world is a little biased – her family farm is next to Tutanning, a 2206 ha Nature Reserve which is baited for foxes once a month through CALM's Western Shield Program.

Growing up next to Tutanning, Claire has developed a great love of nature and as part of her home schooling curricula, Claire has been working through "Exploring Wheatbelt Woodlands – Teaching Activities For Upper Primary Schools" developed by CALM.

Her family's farm is also within Dwarlaking Catchment Group, most of whom are also members of *Land*



Claire and one of the red-tail phascogales trapped in Miss Green's Bush

for Wildlife. As a group they are fencing off bushland, creating corridors and undertaking fox control, and they wanted to obtain some baseline data on animals within the catchment. So when *Land for Wildlife* helped them undertake preliminary fauna monitoring, Claire was keen to turn the week-

long exercise into a major school project entitled "Animals of Tutanning Nature Reserve and Surrounding Areas".

Claire had a busy week setting out trap lines, weighing animals and recording the information. She learnt the importance of placement of traps and how to approach and handle animals caught in the traps.

Results showed a healthy population of woylies and possums within Tutanning Nature Reserve, however the only mammals trapped within the farm remnants were red-tail phascogales and an echidna. Fifty-seven species of birds were also noted.

As for Claire's future career? Well it's too soon to tell, but something to do with animals.

Avril Baxter  
LFWO at Narrogin

### "WRITING THE WILD" AT PERUP - AN INSPIRING WEEKEND

Pamela Valton

AS I traversed the dusty road, a map on my lap, winding my way to Perup Forest Ecology Centre, I was full of thoughts of inadequacy. Would I make a fool of myself? After all, I'm no writer! Nevertheless I duly arrived, to find Brian and Jenny de Garis setting up for our writing adventure. Soon others began to trickle in and we were thrown into our first writing assignment. A great introduction and ice-breaker. We had started and it wasn't so scary after all!

Later, Ranger Julia Norton led us on a spotlight walk, Marissa Mayer enfolded us with Bibbulmun (Noongar) traditions and Jenny de Garis skilfully directed us through the many and varied forms of writing. We all shared something

of ourselves and in the wonderful surroundings of Perup with its vegetation, wetlands and wildlife, it wasn't long before inspiration engulfed us.

Each of us had something to contribute, even though our writing experiences varied immensely. We applauded some truly talented writing and encouraged, nurtured and grew as we discovered something inside each of us that was looking to find an outlet to express the thoughts and feelings that need not be hidden. I even wrote some poetry - and this was only the beginning!

Mornings started with quiet reflections, time to wander, to enjoy the surrounds, to become one with nature and ultimately write our

experiences in prose or verse and share our efforts with the group. Filled most satisfyingly with delicious food conjured up by Brian, the words materialised seemingly effortlessly on our papers - I'm sure there's a poem in there somewhere! When like-minded people with such a love of nature get together in such harmony, success and fulfilment is unavoidable.

*(It was a bit of a departure for us to put a flier for a "non-ecological" event into Western Wildlife, as we were not sure whether LFWers would be interested. From Pamela's letter above, it seems that one person, at least, enjoyed the event. And after all, one of the reasons we are managing bushland is so that we can gain inspiration from it! - Ed.)*

VAL AND STEVE DAVIES of Gull Rock (just east of Albany) provide us with another interesting 'nature observation'.

In the early winter months they noticed they had a resident grey huntsman spider living in their letterbox, which made it a bit tricky sometimes removing letters. However, over time they established a fairly respectful relationship with the spider and the mail deliveries didn't seem to cause too much disturbance. Then one day they were most surprised when they noticed a web suddenly appear in the corner of the letterbox and the huntsman spider appeared to hide under the web. Most people are under the impression that huntsman spiders don't make webs. The web extended all the way across the letterbox's width and half way up it forming a right angled triangle at the delivery end of the letterbox. It seemed to be several layers thick and was very tough – they poked it a couple of times with a stick. Val and Steve were even more surprised when a few weeks later they noticed all these baby huntsman spiders running around underneath the web. Some of the babies were on the mother's back (or is it the father?) and some were inadvertently brought in with the mail, despite trying to leave them all behind! Over the next week the baby spiders seemed to disperse with many of them also dying inside the letterbox.

## MEMBERS' PAGE

### THE WEB TAKES OVER THE MAIL BOX

Sylvia Leighton

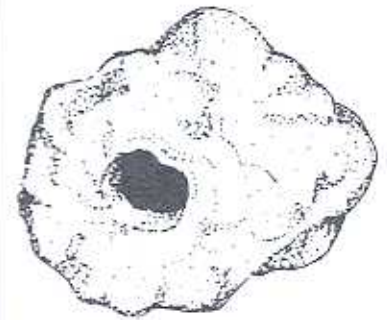
*Land For Wildlife* contacted Barbara York Main, who has studied spiders nearly all her life, for comment on these observations.

*"Huntsman spiders usually live under bark or rocks and they often enclose openings of the shelters with silk. Some actually live in holes in the ground lined with silk and may even make trapdoors to burrows. The female spider makes an egg cocoon like a little pillow. In some species it is more circular. Usually the young stay for a while and then disperse but at least one species of Delena is social and several generations may live happily together in bark shelters. Technically a 'web' is a silk snare. Apart from Delena the only other non-snare building social spiders that we know of are several species of Diaea (a crab spider – family Thomisidae). I made this discovery at West Cape Howe and it is written up in Main B Y (1988) Biology of a social thomisid spider in 'Australian*

*Arachnology* Eds AD Austin & NW Heather (The Australian Entomological Society, Brisbane. Miscellaneous Publication No. 5). Subsequently Theo Evans has described the eastern Australian social Diaea spiders as several distinct species. David Rowell discovered the social behaviour of Delena and he has published several papers on its behaviour & genetics."

## BUSH DETECTIVE

Note something unusual? Ask LFW!

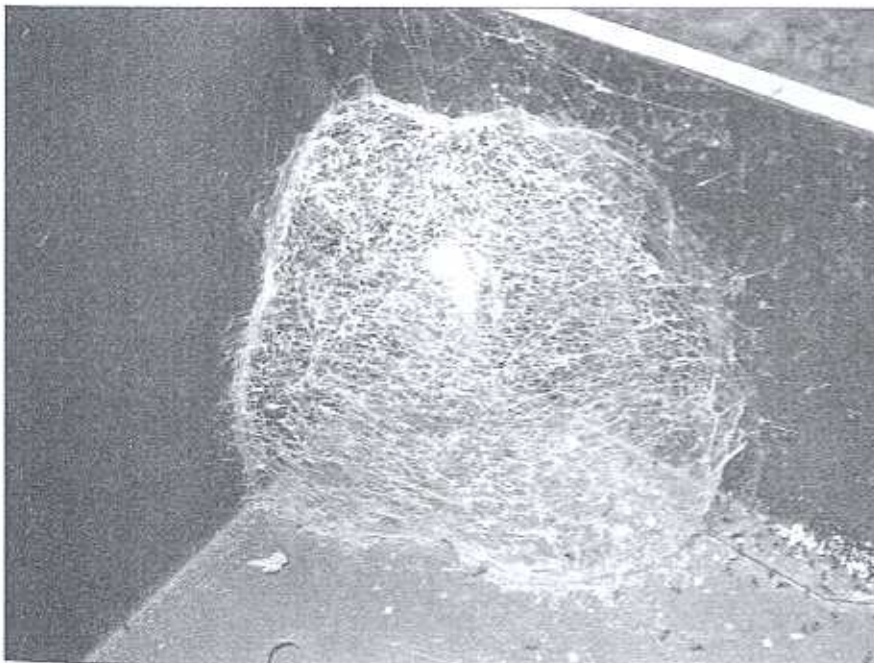


Mt Marshall Shire have been doing up the road outside the Mukinbudin Hotel, in the process bringing in loads of gravel. Many of the gravel nodules have a smooth, cylindrical hole in them. 'How was this made?' we were asked.

Those members who have been in LFW from the very beginning will, of course, know the answer! In Western Wildlife Vol 1 no 3, July 1997, we featured this as the 'Bush Detective'.

For those people who have joined LFW since then, here is the info on 'fossil bees' nests!

In some laterite areas, gravel nodules with a smooth cylindrical hole in the centre may be found. They are the remains of the burrow of a solitary bee, which laid its egg in a cell constructed in soft clay while the laterite was forming, millions of years ago! The fossil closely resembles the larval structures of some modern native bees.



# NEW BOOKS

## Introduced Mammals of the World

John Long  
CSIRO Publishing  
Cost: \$135 + p&h

This comprehensive work provides an account of the movement of 337 species of mammals around the world. It provides details on the date of introduction, the person or agency responsible, the source populations, the location of release, the fate of the introductions and the impact, if known, of the introduction.

This book will be an essential reference for students of ecological systems management and biological conservation. It provides an invaluable tool by which the potential of introductions can be assessed, and so avoid costly mistakes. It also provides tangible proof of the need for political decision-makers to consider good advice and make wise and cautious decisions.

Eg. of distribution map below.

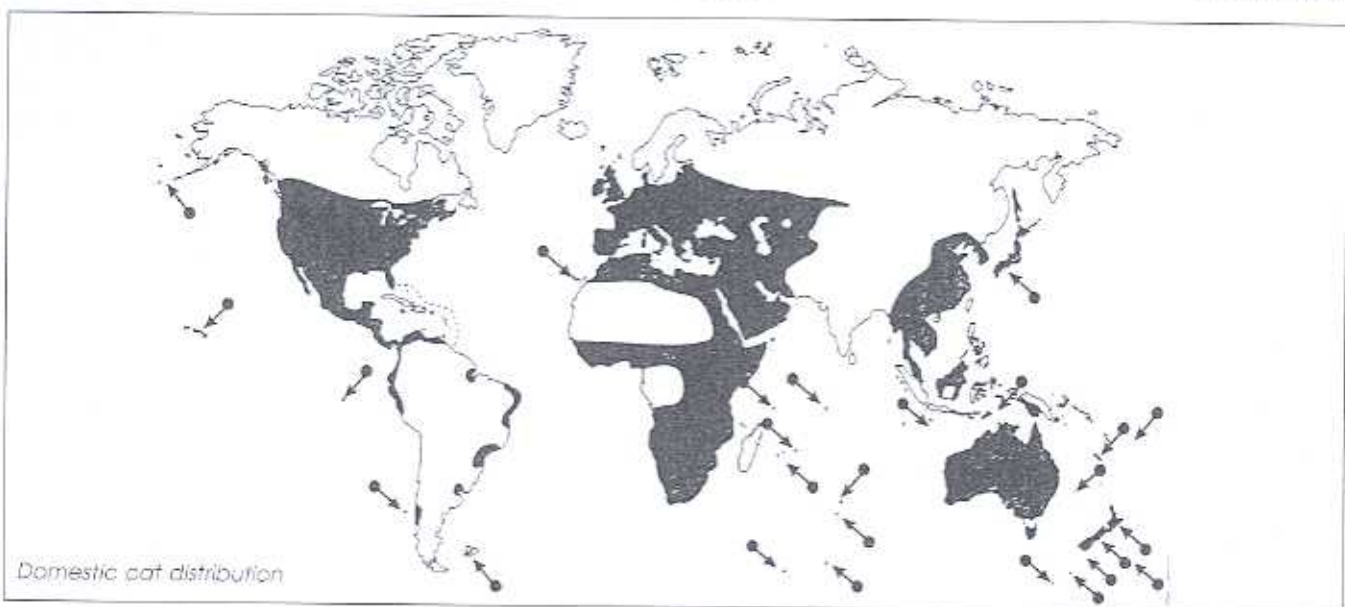
## Saltland Pastures in Australia: a Practical Guide (Second Edition)

E. Barrett-Lennard  
Land and Water Australia, Canberra

Cost \$26.00 + \$5.00 p&h. ph: CanPrint Communications, (02) 6293 8383

This new edition of Ed Barrett-Lennard's popular book is a must for any farmer who wishes to graze saline soils. Attractively presented and easy to read, it brings together the very latest information on saline land and saltland pastures, including chapters on establishment, productivity and economic value.

As a person interested in biodiversity, I am sorry that the author again did not mention aspects such as native fauna habitat and potential weeds, even if only briefly. Nevertheless, if you are hoping to use saltland for grazing, you will find this book very useful.  
Penny Hussey



## Risk Assessment for the Import and Keeping of Exotic Vertebrates in Australia

Mary Bomford  
Bureau of Rural Sciences, Canberra, 2003

- Introduced species cost Australia in excess of \$420 million a year in lost agricultural production, control and research.
- There are many examples of less than ten individuals, and sometimes even single pairs, establishing exotic populations.
- Eradication of newly established exotic vertebrates in Australia is only likely to be achievable if appropriate, adequately-resourced, contingency plans are in place.

The recent publicity over the fate of the animals in a private zoo in the Northern Territory once again raises the question - what exotic animals should be imported to or kept in this country?

Are the places where exotic animals are kept always well maintained, and guaranteed not to let the animals escape into the wild, where they may well become pests? If the animals do escape, have we a good strategic plan in place to deal with them?

This report, developed over the last 10 years, explains a risk assessment procedure that can be used for any exotic animal, whether already in captivity here or not, and assigns each to a category of risk based on standardised criteria.

If you are interested in the 'biosecurity' of Australia, and what we should do about it, you will find this report interesting.

For copies, contact: BRS Publication Sales; ph: 1800 020 157; Fax: (02) 6272 2330; email: salesbrs@brs.gov.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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