



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

# Western Wildlife



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NEWSLETTER OF THE LAND FOR WILDLIFE SCHEME

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## THE PERMO-CARBONIFEROUS GLACIATION OF GONDWANA: ITS IMPACT ON WESTERN AUSTRALIA

*Phillip Playford*

SOME 290 to 320 million years ago, during the Mid Carboniferous to Early Permian (Permo-Carboniferous), Western Australia was covered by a succession of thick continental ice sheets, comparable with those that cover Antarctica and Greenland today and covered large areas of Europe, North America, and Asia during the Pleistocene (2 million to 10,000 years ago). The Permo-Carboniferous glaciation occurred when Australia formed part of the Gondwana supercontinent. This huge landmass was made up of the present-day continents of Antarctica, Australia, South America, Africa, and India, clustered together around the south pole (Figure 1). Gondwana broke up during the Late Jurassic to Early Tertiary, some 150 to 60 million years ago, and the individual continents gradually drifted apart (Figure 2). Western Australia is still moving steadily towards the north-northeast at a rate of about 7 cm per year.



Figure 1: Map (south polar projection) of Gondwana, showing the maximum extent of the Permo-Carboniferous continental ice cap.

The Permo-Carboniferous glaciation of Gondwana was one of three major glaciations that have affected the earth, the other two being during the Late Precambrian (around 700 million years ago) and the Pleistocene. For most of the earth's history there were no major ice caps centred on the north and south poles, although a number of less extensive glaciations occurred periodically. The reasons for the development of ice ages are not fully understood, but they may be linked with changes in the sun's radiation, ocean circulation, and the positions of the earth's continents.

The great Permo-Carboniferous glaciation is evidenced in Western Australia by extensive glacial sediments and pavements. The sediments contain striated and faceted boulders, known as erratics, that were dragged along the base of the moving ice sheets for very long distances (up to several hundred kilometres). These



Figure 2: Map (south polar projection) showing the modern Antarctic ice sheet in relation to the present positions of Australia, South America, and southern Africa.

*continued on page 4*



## Greetings everyone!

IN October, Mr. Fran Logan, IMLA, presented Coogee Primary School with a certificate for becoming the 1000<sup>th</sup> LFW registration. It was a very pleasant event, attended by the A/Executive Director, Department of Conservation and Land Management<sup>1</sup>, Mr Keiran McNamara and the Mayor of the City of Cockburn, Mr Stephen Lee, as well as other distinguished guests. It was inspiring to see the enthusiasm with which the students are caring for the bushland around them, and the seriousness with which they regard environmental issues. Con-gratulations to Principal Warren Bell and all the school community.

*Land for Wildlife* has been very fortunate to receive some extra funding from the State Government out of funds from the sale of Alinta Gas. We will be using it to try to reduce the waiting time to get to your property for a visit.

We were also delighted to learn that the LFWers who applied for grants under "Australian Government Envirofund" were successful in obtaining the higher level of funding through signing an

## EDITORIAL

LFW Voluntary Management Agreement. Might you be eligible for the 2003 funding round? See back page.

Bye-bye -

It was a sad day when Bob Huston (LFW Mundaring) left the programme in November. Bob has been with us since the very beginning, and we will miss his enthusiasm and humour. However I am sure we won't lose touch, as he is now working on salinity issues from Victoria Plains to Beverley and so the matters of bush regeneration and revegetation will still be part of his agenda.

and hello! -

Bob is a hard act to follow, but Alison Dugand is doing superbly, continuing to work with LFWers in the Hills and Avon Valley. She is very knowledgeable and interested in the whole issue of sustainable land management, so, if you haven't met her yet, give her a call and say Hi!

The State Landcare Conference will be held in Katanning this year and, as usual, it promises to be a stimulating event. The various

Landcare Awards are also part of this year's agenda. We feel that many of our LFW members would qualify for nomination in several of the categories, as excellent landcarers over long periods of time. So don't be surprised if we contact you to write up an entry!

This issue contains a number of articles which refer to climate change, especially Phil Playford's comments on glaciation which remind us that climate is not constant and that it's changes can have huge effects. But with understanding and adaptability, our society and the ecosystem which supports us, will survive. Further on in this issue there is a quote from the poet Randolph Stow, whose spiritual bondage to, and understanding of, his Geraldton homeland is surely as great as any Australian's, irrespective of ethnic origins. The poem quoted, "Sleep", ends thus:

"Sleep: you are the month that will raise my pastures.

You are my firebreak. My homestead has not fallen."

From all of us at *Land for Wildlife*, to all our readers, best wishes for sustainability, best wishes for 2003.

Penny Hussey

<sup>1</sup>Note: hereinafter called 'the Department'

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# LAND FOR WILDLIFE CELEBRATES *1000th registration*

Claire Hall

ON a sunny spring day last October, students, staff and invited guests celebrated *Land for Wildlife's* 1000<sup>th</sup> registration with a presentation at Coogee Primary School by Cockburn MLA and Parliamentary Secretary for Agriculture and the Environment, Mr Fran Logan.

Mr Logan said the 1076 landowners who had registered with *Land for Wildlife* are looking after 105,385 ha of private conservation reserves - a wonderful contribution to the State's biodiversity. "The State recognises the importance of urban bushland and congratulates the school on its positive attitude and practical involvement," he said.

The Coogee Primary School staff and students' strong commitment to environmental education and landcare is reflected in their involvement in a number of projects such as: growing seedlings for revegetation projects; managing a City of Cockburn reserve adjacent to the school; revegetating nearby Water Corporation land; taking part in the Greening Australia/Alcoa Grow Us a Home project, and assisting the Department with revegetation work at Woodman Point.

In 2002 Coogee Primary School was highly commended in the Banksia Foundation Awards, and came third in the State in the Reflex Paper Habitat Program.

Chloe Lynn recited a poem written by the School Bushland Coordinator, Keith Brown.

After the presentation, guests were taken on a guided walk through the bushland by the school Environmental Ministers, following by a delicious and very enjoyable morning tea in the staff room.



Figure 1: Mr Fran Logan, MLA, presents Land for Wildlife sign 1000 to Coogee Primary School Environmental Ministers, Ashely Hockey and Rhys Smith.



Figure 2: from left - Rhys Smith (Environmental Minister), Keiran McNamara (A/Executive Director, of the Department), Lauren Taylor-Outram, Fran Logan (MLA for Cockburn), Ashely Hockey (Environmental Minister), Stephen Lee (Mayor, City of Cockburn), and Chloe Lynn.

## Our Bushland

When we came to the school, we found that we had,  
Lots of bush around the place, which made us all glad.

We learnt it was full of different plants,  
With thousands of birds and spiders and ants.

It's not like the forests of Jarrah and Karri,  
The towering giants of Tingle and Marri,

Our coastal heath sits on some sandy old dirt,  
And in spring as it flowers it won't really hurt.

If you walk through the scrub, out of pleasure or duty,  
You find you'll be struck by the colourful beauty

Of flowers and leaves some large and some small  
But only the Tuart there standing up tall.

We learn how to grow them, look after them too,  
At school there are plenty of bush things to do.

At school we can learn that the bush needs our care  
So that when we grow up, there'll be still something there.

'Cos if we keep chopping and burning - it's failure,  
We must learn to care for the bush - in Australia.

Written by Keith Brown and recited by Chloe Lynn.



## LANDFORM

Glaciation continued from page 1

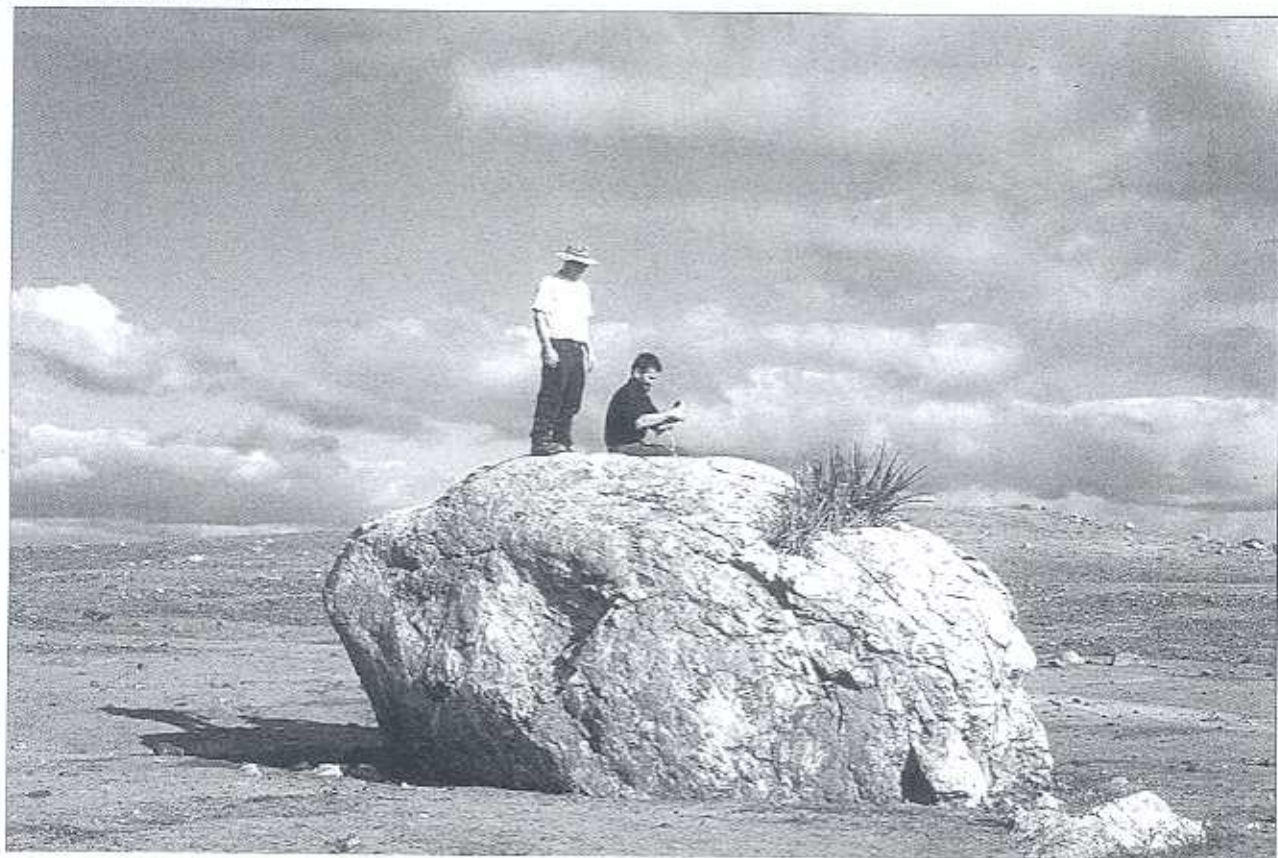


Figure 3: The 'White Horse' erratic, north of Mingenew. This block of Coomberdale Chert was transported by ice from the Moora area during the Early Permian, about 290 million years ago.

erratics are as much as several metres across, a good example being the 'White Horse' erratic, north of Mingenew (Figure 3). This is a block of Coomberdale Chert, 3 m across, that was transported by ice from the Moora area, about 200 km to the south-southeast.

Glacial pavements were formed at the base of moving ice sheets, where 'dirty' ice eroded the underlying basement. Rock debris, ranging from large boulders to fine 'rock flour', was frozen into the basal ice, and this effectively planed down the underlying rocks as the ice moved steadily away from the south pole. Some of the best examples of grooved, striated, and polished glacial pavements are in the Pilbara district, east of Marble Bar (Figure 4). They are also displayed clearly at other locations around the State, notably east of Geraldton, near Lyons River, and east of Fitzroy Crossing.

The ice sheets flowed into the surrounding oceans, where 'calving' of icebergs occurred and rock debris dropped to the sea floor as the icebergs melted. Evidence of the direction of ice movement is provided by striations (scratches), grooves, and other features on the glacial pavements. The striations and grooves formed parallel to the direction of ice movement, which, in Western Australia was overwhelmingly towards the north-northwest, averaging about 340° (Figure 5).

The modern Antarctic ice cap is up to 4.8 km thick (near the Vostok base), and it seems probable that the



Figure 4: Grooved, striated, and polished glacial pavement in chert east of Marble Bar. This pavement was sculptured by 'dirty' ice at the base of the Early Permian ice sheet, which was moving towards the north-northwest.

Permo-Carboniferous ice sheets, which covered areas at least four times that of Antarctica, reached even greater thicknesses. The Early Permian ice sheet may have been more than 5 km thick over the southern part of Western Australia, perhaps thinning to 3-4 km over the Pilbara and 2 km over the Kimberley. It is expected that the whole of Western Australia, including mountainous areas in the Pilbara and Kimberley, was periodically covered by ice. There was not just one ice cap, but a succession of ice sheets that advanced and retreated regularly across Gondwana in the Permo-Carboniferous.



## LANDFORM



Figure 5: Map of Western Australia showing the direction of Early Permian ice movement, as indicated by glacial striations and other features.

After the last major ice sheet melted in the Early Permian, about 290 million years ago, some alpine glaciers probably persisted in mountainous areas for the next 10 to 15 million years. The final continental ice sheet obliterated most of the earlier glacial pavements, putting the 'final touch' on the glacially sculptured bedrock topography. Since then Australia has never been covered by ice, although some small mountain glaciers developed in the Australian Alps and Tasmania during the Pleistocene.

The Pleistocene ice age was marked by a succession of ice sheets that advanced and retreated over Europe, North America, and Asia, with periodicities of 100,000 to 120,000 years. We are currently near the peak of an interglacial period, and it is expected that during the next few thousand years the earth will again plunge into an ice age, unless human-induced global warming is sufficient to counteract natural cooling. It must be remembered that human populations survived through the Pleistocene ice ages and associated major changes in world climates, sea levels, fauna, and flora. Aborigines have been present in Australia for at least 40,000 years, living through the peak of the last Pleistocene glacial period, only 18,000 years ago, when sea level was 130 metres lower than today. The coastline was then situated some 12 km west of Rottnest, and the climate must have been very different from that of today — probably much more arid and with stronger prevailing winds. The key to the survival of humans in the face of drastically changing climates and

environments has been their ability to adapt. During the last 6,000 years there has been relative stability in world climates and sea levels, but this situation must surely change during future centuries, partly as a result of human activities, but probably even more because of natural climatic fluctuations.

Part of the basal ice below the present Antarctic ice sheet has melted, as a consequence of geothermal heat flow radiating from the centre of the earth. This melting has resulted in thin films of water at the ice-bedrock contact in certain areas, and subglacial lakes, covering thousands of square kilometres, in others. Studies of parts of the northern hemisphere that were once covered by Pleistocene ice sheets show that subglacial meltwater drained away to the sea via networks of channels cut into the substrate or within the basal ice. Evidence of comparable Early Permian subglacial channels has been found in several areas of Western Australia. Notable topographic features that may have formed originally as subglacial channels include Windjana and Geikie Gorges in the Kimberley, and Coppins Gap, Shay Gap, and the Oakover Valley in the Pilbara. Much of the remarkable palaeoriver system that covers wide areas of inland Western Australia probably first developed as subglacial channels during the Early Permian, although they have since been modified by erosion during the Mesozoic and Cainozoic.

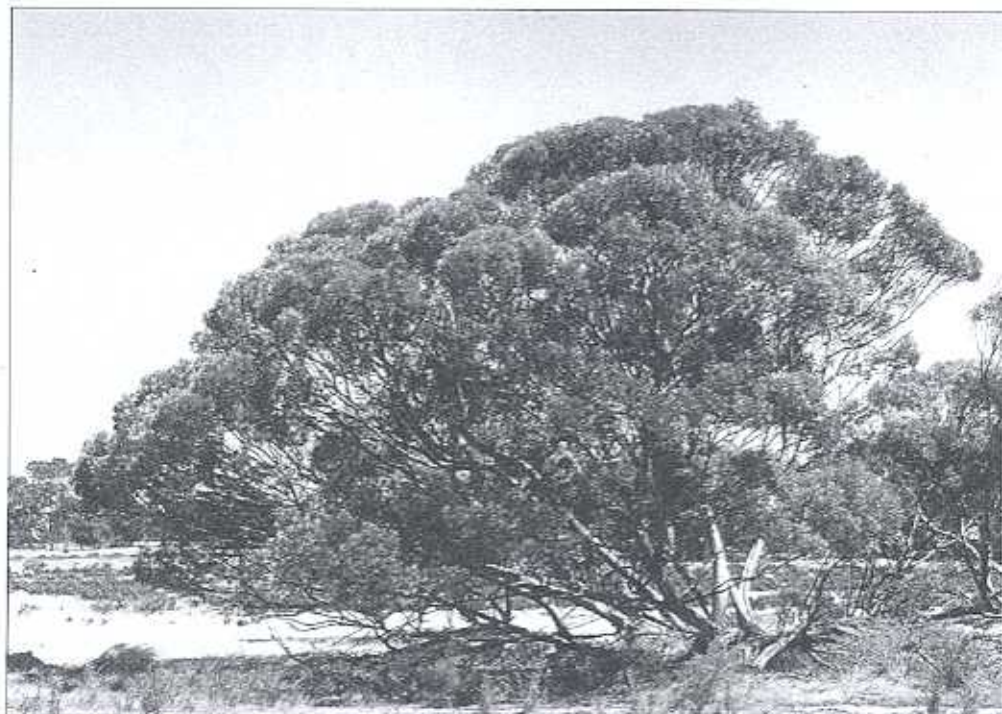
Limestones of the Devonian reef complexes in the Canning Basin (Kimberley district) were also subjected to extensive solution in Early Permian subglacial meltwater, with the development of subglacial lakes, potholes, dolines, tunnels, cave systems, and channels. Many of the present-day karst features in the limestones reflect exhumed Early Permian karst. The remarkable Mimbi Cave System, 90 km east of Fitzroy Crossing, and the tunnel of Tunnel Creek National Park, testify to the major effects of subglacial solution.

Large areas of Western Australia have experienced little faulting and folding since the last continental ice sheet withdrew, some 290 million years ago. Indeed, this State forms one of the most stable parts of the earth's crust. The present-day landscape, noted for its remarkable flatness, is a reflection of the glacially planed topography that remained after the last ice sheet melted during the Early Permian. The sediments that subsequently covered this ancient surface have since been stripped away by erosion over wide areas, exposing and degrading the underlying glacial topography. It seems clear that the flat landscape of Western Australia owes more to this ancient glaciation than to any other process.

*Dr Philip Playford is a past director of Geological Survey of Western Australia, now retired, who has strong interest not only in geology and landform, but also in Aboriginal culture and language. He can be contacted via the Geological Survey of WA.*



## REVEGETATION



*E. orthostemon*, Yanyenning Lakes

# EUCALYPTS FOR USE IN SALINE REVEGETATION

Dean Nicolle & Malcolm French

**R**EVEGETATION of areas showing secondary salinity is an important priority for many landholders, but what species should be used? We believe that there are better species of eucalypts for saline revegetation than some of those currently recommended for planting.

We have undertaken extensive field and scientific research, including trial plantings, investigating local species that have a high tolerance to salinity and waterlogging. At the same time these species have other attributes that can add value to the farm revegetation program, for example:

- ▶ shelter and wind breaks
- ▶ fire resistance with rapid and profuse recovery, plus rapid recovery from other episodic events such as strong winds and localised flooding.
- ▶ fuelwood production, from small to larger scale biomass production
- ▶ biomass for reconstituted wood products such as panel wood
- ▶ essential oils
- ▶ enhancement to the local ecosystem
- ▶ maintaining genetic integrity – there are risks of hybridization with introduced species that may not be acceptable

- ▶ maintenance of other landscape values.

The past extensive use of *Eucalyptus camaldulensis* var. *camaldulensis* (river red gum - a non native species to the agricultural regions of WA) as a salinity control species highlights our concerns. This species has been proven to have on average a lower tolerance to both salinity and drought than many other species. Poor site selection for this species is also often the reason for its poor performance.

Local saline tolerant species are generally poorly known in cultivation but are well suited to the task and are listed below for urgent consideration in all farm saline revegetation programs in agricultural WA.

The species are not ranked according to salt tolerance, rather species selection should be based on selecting local species and site attributes such as soil type, degree of salinization and other environmental effects. All species are considered to be salt tolerant under natural conditions, however, as many are little known in cultivation, their performance in cultivation will be site specific. No known eucalypt species will grow vigorously (if at all) on bare, salt-crust soils.

(Note: Several of the following species have a conservation rating and seed may not be readily obtainable. All seed collectors must hold licences from the Department and strictly follow all licence conditions.)



## Ten taxa recommended for consideration for revegetation of saline soils

We consider that the following ten species groups are the most salt tolerant re-sprouting eucalypts. Importantly, all are lignotuberous and will rapidly regenerate following fire or other destructive events. They are principally of a bushy, spreading habit, presenting good windbreak and fauna habitat qualities.

- ▶ *E. angustissima* subsp. *angustissima* and subsp. *quaerenda*  
Habit: Mallee, 2-5 m, foliage dense and to ground level.  
Distn: Subsp. *angustissima* occurs naturally on sands along saline drainage lines and salt lake edges on the Esperance plains from Lort River to Israelite Bay. Subsp. *quaerenda* occurs naturally around salt lakes in the Lake Grace to Lake King area. Associated eucalypts include *E. litorea*, *E. incrassata*, *E. leptocalyx* and *E. aff. perangusta*.  
Notes: Fast growth rate; eucalyptus oil potential; shelter/windbreak. Distinguished by the crown of very narrow (pine needle-like), erectly held leaves. On the upper Lort River on the Esperance Plains subsp. *angustissima* is known to grow to 10 m high.
- ▶ *E. sargentii* subsp. *fallens* and subsp. *onesia* ms  
Habit: Mallee, 3-8 m, foliage dense and to ground level.  
Distn: Both subspecies occur naturally along saline drainage lines and salt lake edges. Subsp. *fallens* occurs naturally in the Binu area north of Geraldton. Subsp. *onesia* occurs naturally from Piawaning south to near York.  
Notes: Fast growth rate, shelter/windbreak
- ▶ *E. orthostemon* ms (*E. orthostemon* was formally regarded as part of *E. vegrandis* with the latter now known to be restricted to the Katanning to Bremer Bay area.)  
Habit: Mallee, 3-6 m, foliage dense, though not usually to ground level.  
Distn: Occurs naturally in drainage lines, around salt lakes and in a variety of other habitats, from the Wongan Hills area south to Katanning.  
Notes: Fast growth rate, shelter/windbreak, waterlogging tolerance.
- ▶ *E. brachycorys*, *E. comitae-vallis* and *E. exigua*  
Habit: Mallees, 3-7 m, foliage dense though not usually to ground level.  
Distn: All three closely related species occur naturally in saline depressions and around salt lakes as well as on red loam plains. *E. brachycorys* occurs throughout the northern Wheatbelt and inland to the Lake Deborah area. *E. comitae-vallis* occurs further inland in the Lake Barlee to Kalgoorlie area. *E. exigua* occurs to the south of the above two species, from Varley to Lake Johnston. Associated eucalypts include *E. myriadena*, *E. alipes* and *E. salicola*.  
Notes: Moderate growth rate, shelter/windbreak.
- ▶ *E. famelica* and *E. litorea*  
Habit: Mallees, 2-6 m, foliage dense and to ground level.  
Distn: *E. famelica* occurs naturally in depressions and near salt lakes on the Esperance plains from Hopetoun to the

Stokes Inlet area. The very similar *E. litorea* occurs around salt lakes in the Israelite Bay area. Associated eucalypts include *E. angustissima* and *E. incrassata*.

Notes: Moderately fast growth rate, shelter/windbreak

### ▶ *E. halophila*

Habit: Mallee, 2-4 m, foliage dense and to ground level.  
Distn: Occurs naturally on sand around salt lakes on the Esperance plains from the Scadden area to the Mt. Beaumont area. Associated eucalypts include *E. rigens*, *E. merrickiae* and *E. leptocalyx*.

Notes: Moderately fast growth rate, shelter/windbreak

### ▶ *E. merrickiae*

Habit: Mallee, 2-4 m, foliage dense and to ground level.  
Distn: Occurs naturally around salt lakes on the Esperance plains from the Scadden area to the Mt. Ridley area. Associated eucalypts include *E. halophila*.

Notes: Fast growth rate, shelter/windbreak

### ▶ *E. rigens*

Habit: Mallee, 2-4 m, foliage dense and to ground level (bushy).

Distn: Occurs naturally bordering salt lakes on the Esperance plains from the Scadden area to the Mt. Beaumont area. Associated eucalypts include *E. halophila* and *E. leptocalyx*.

Notes: Moderately fast growth rate, shelter/windbreak

### ▶ *E. foliosa*

Habit: Mallee, 2-5 m, foliage dense and to ground level.  
Distn: Occurs naturally bordering salt lakes and in saline depressions on the Esperance plains in the Scadden area. Associated eucalypts include the tree form of *E. uncinata*.

Notes: Moderate growth rate; shelter/windbreak

### ▶ *E. hypochlamydea*

Habit: Mallee, 4-8 m, foliage restricted to upper part of the plant.

Distn: Occurs around salt lakes and in saline areas as well as occurring on red loam plains, from north of Geraldton east to Balladonia and south to the south-central Wheatbelt. Associated eucalypts include *E. alipes*, *E. exigua*, *E. celastroides* ssp. *virella*, *E. concinna*, *E. cylindrocarpa*, *E. yilgarnensis*, *E. grasbyi*, *E. brachycorys*, and *E. myriadena*.

Notes: Moderately fast growth rate. The closely related *E. salicola*, a tree that grows around salt lakes and drainage lines, may also be useful in the revegetation mix.

## Non-sprouting taxa for saline soils

The following species groups are considered to be the most salt tolerant non-sprouting eucalypts. All are non-lignotuberous and killed by fire or other destructive events. They are rapid growing and several are well known to perform in saline areas. We recommend these species in the revegetation mix in salt affected soils particularly to provide a good range of habitats and for their sustainability in water logged conditions. *Casuarina*, *Melaleuca*, *Acacia*, *Callistemon* etc (non eucalypt species), should also be considered to provide a good species balance.



## REVEGETATION

continued from page 7

- ▶ *E. alipes* ms, *E. mimica* subsp. *mimica* and subsp. *continens*

Habit: Mallets, 3-8 m, foliage dense, restricted to the upper crown.

Distn: All three taxa occur typically in drainage lines and around salt lakes. *E. alipes* occurs from north-east of Hyden and south to Pingaring and to the Lake King area. *E. mimica* occurs in the Newdegate area. Associated species include *E. sargentii* subsp. *sargentii*, *E. exigua*, *E. salicola* and *E. myriadena*.

Notes: Fast growth rate

- ▶ *E. eremophila* and *E. goniocarpa*

Habit: Mallets, 4-8 m, foliage dense, restricted mainly to the upper crown.

Distn: *E. eremophila* occurs on a variety of soils and occurs around (and in) salt lakes on the Esperance plains. It is distributed from Zanthus south to near Esperance and west to Lake Chinokup. *E. goniocarpa* occurs in depressions and on slight rises in the Lake King area.

Notes: Fast growth rate. The mallee form of *E. eremophila* that has a wide distribution throughout the wheatbelt has been published as *E. tenera* and is not considered for saline revegetation.

- ▶ *E. kondininensis*

Habit: Mallet, 8-18 m, foliage dense, restricted mainly to the upper crown.

Distn: Occurs around salt lakes and in saline depressions from Yealering east to Lake Johnson. Associated species include *E. orthostemon* and *E. celastroides* ssp. *virella*.

Notes: Moderately fast growth rate; shade; windbreaks. Proven degree of saline tolerance, however, may not withstand the same waterlogging as other species. Lignotuberous (sprouting) variants are known in some areas and may be particularly useful for reclamation of saline areas. Hill-dwelling variants are also known, their performance in saline soils is unknown. *E. kondininensis* is a common nursery standard.

- ▶ *E. sargentii* subsp. *sargentii*

Habit: Mallet, 5-12 m, foliage dense, restricted to the upper crown.

Distn: Occurs in saline depressions and around salt lakes from Cadoux south to Lake Grace and east to near Hyden. Associated species include *E. mimica* ssp. *mimica* and *continens* and *E. celastroides* ssp. *virella*.

Notes: Moderate growth rate, past performer in saline soils. Commonly used.

- ▶ *E. spathulata*

Habit: Mallet, 7-12 m, foliage dense, restricted mainly to the upper crown.

Distn: Occurs in saline depressions and around salt lakes from Mt Stirling south to Ongerup. Associated species



*E. rigens*. Mt Ney track, Esperance Plains



*E. sargentii* subsp. *onesia* ms. north-east of Calingiri.

include *E. extensa*, *E. occidentalis*, *E. vegrandis* and *E. orthostemon* ms.

Notes: Fast growth rate, very versatile and commonly used.

### Acknowledgements

Thanks to Peter White from the Department and Nathan McQuoid of Greening Australia Western Australia for their valued comments and input.

Dean Nicolle has Australia's largest and most complete eucalypt arboretum – Currency Creek Arboretum in South Australia. You can find out more on <http://www.chariot.net.au/~vo/cca/html> Malcolm French, author of "The Special Eucalypts of Perth and the South West" is a eucalypt enthusiast with dedication to enhancing agricultural production and the environment simultaneously for the benefit of all. Phone: 0408 990 988



MY fascination with *Verticordia* began in the early 1970s after my family moved to Perth. When trying to establish our garden in the hills I was assisted by Les Norton, who was passionate about Western Australia's magnificent flora. He had a special interest in verticordias and after a very short time, I found myself so intrigued that I also wanted to learn more about them.

The small amount of information that was available at that time seemed to be just fragments in a few different publications, not necessarily accurate and frequently not up-to-date. I decided to put together a personal reference collection of pressed specimens, to help me learn more about them. Fifty three species had been described at the time.

When I embarked on the much larger project that resulted in the *Verticordia* Reference Collection (VRC), I asked Margaret Pieroni if she would consider painting each of the species for me as they became available. Having seen some of Margaret's beautiful and accurate artwork, I thought that her life-sized paintings of the different verticordias would provide me with a wonderful aid to identification.

The idea of publishing a book arose out of my frustration at the extreme difficulty for amateur enthusiasts, such as me, to access information about the genus. A substantial number of the botanical descriptions of species that were known had not even been translated from the authors' original, Latinised language. I had also suggested to Margaret that if the project ever resulted in the publication of a book, her paintings could probably be reproduced in it.

As collecting for the VRC progressed, it soon became evident that we were expanding the accepted knowledge about *Verticordia*. Even after the VRC was completed, the information contained in it was limited and only available to people who could actually visit the Western Australian Herbarium. When it was presented to the Herbarium in Dec 1988, I gave an undertaking to all the wonderful voluntary collectors and enthusiasts who contributed, that

## FLORA

### HOW I CAME TO PRODUCE A BOOK

Elizabeth George



*Verticordia picta*

I would do my best to bring a book to fruition (isn't there a saying that ignorance is bliss?).

Before I had begun to do any writing, it was suggested that I should contact a publisher to find out whether there would be interest, and possibly get some guidelines on how it should be prepared. So in 1989, with Margaret's assistance, a copy of the proposed format (which at that stage was fairly basic) and samples of Margaret's artwork were presented for approval.

The result was that the publisher was very interested but he suggested that the colour separations and printing should be carried out in Asia. They also wanted to reduce the size of the book, which would mean that the paintings would not be reproduced life-sized (and thus negate their main purpose!). It was also suggested that the publisher might somehow superimpose the subspecies and varieties onto their relevant species.

Apart from our horror at that prospect, the number of paintings had by then increased to more than 140. We also realised that this was probably the first time all the described taxa of a substantial genus had been painted and, if this was so, it was an invaluable collection which, for security reasons, should be kept

together in Western Australia. Apart from this, several people had suggested and requested particular inclusions for the book and by this time new details were constantly evolving so ideas for the content were expanding. I decided not to do any more about publication until I was in possession of a written manuscript.

Collating the material was somewhat daunting and time consuming but writing it up was worse, especially as the first drafts were hand written. The book was written for people such as I was when I began, who would like to know more about verticordias, and others who are not even aware of them. It was not intended to be a scientific publication, although, of necessity, it contains botanical information based on Alex George's review of the genus. Because people have differing interests, it contains known details about various aspects of the genus.

Margaret's beautiful and accurate watercolour paintings with black and white line drawings were achieved over a period of 18 years, mainly due to the fact that each one had to be painted from a fresh specimen which only became available when someone happened to be where the plant was flowering at the right time.

The paintings are a wonderful aid to identification but it is also necessary to check the text for other identifying details. A great deal of variation occurs within *Verticordia*, also within species, subspecies and varieties and, even within some populations ... and there are also an increasing number of hybrids occurring in the wild.

It is important to remember that each painting is of a particular specimen from a particular location, and may not be exactly the same as another plant of the same taxon from a different area, or even sometimes the same locality. For that reason a caption has been included for each painting providing the locality and date of that collection.

So, after some 20 years of effort, my hope is that people will enjoy reading *Verticordia: The turner of hearts* and find it useful.



**T**HE burning question - how frequently should bushland be burnt?

This question was asked for the shrublands of the Fitzgerald River National Park (FRNP) about 10 years ago. The bushland of the south-west survived the climatic fluctuations of the glacial periods of the Quaternary period which covers roughly the last 2 million years, most of it well before Aboriginal Man entered the continent about 50,000 to 60,000 years ago. The fire regime (which covers frequency, scale, seasonal timing and intensity of firing) before Aboriginals were present could be called the 'natural fire regime'.

After Aboriginals entered the south-west the fire regime in the areas they habitually used changed to a composite of Aboriginal-set and lightning induced fires. The greater use they made of an area, the more the Aboriginal fire regime of many smaller fires at frequent intervals (2-10 years) dominated. Conversely, the less use made of an area, the more the natural lightning induced fire regime continued. Semi-arid FRNP was identified from historical documents as an area little used by Aboriginals as it had virtually no permanent fresh water. The first European visitors such as Eyre and Roe in the 1840s found the shrublands extremely thick and difficult to penetrate and all the normal signs of Aboriginal presence found in adjacent areas were missing.

How do we find out how frequent fires were in the past? One way it can be done is by documenting how long after a fire seeder species (plants killed by fire) take to mature, set seed and build up a seed bank that will survive the next fire. The inference is that if the seeder species exist in an area, the fire frequency must have been such that the time to build up a seed bank was shorter than the fire frequency. If a species takes 12-15 years to set its first seed and 20 years to build up a seed bank, most fires must have been more than 20 years apart. Similarly with the mammal and bird fauna, if the species that live in an area require long unburnt bush areas (say

## RESEARCH

### PAST FIRE INTERVALS IN FITZGERALD RIVER NATIONAL PARK

*Cleve W. Hassell*

unburnt for 50 years or more), some areas at least must have provided this habitat.

Another method to estimate fire frequency is to examine the charcoal content of a dated sediment core. If sediments suitable to preserve charcoal can be found, and deposition appears continuous, by examining successive layers a picture of charcoal deposition should reflect charcoal production by fire in the surrounding area. If fires are seldom, of large extent, and intense, a large amount of charcoal will be produced at one time. Some of this charcoal will be washed from the burnt area by the next heavy rain and be incorporated in the upper sediment layer. If subsequently no fires occur for a long time, the charcoal included in successive layers of sediment will decrease markedly. A graph of this pattern will show high charcoal peaks followed by a reduction over a long period to low charcoal levels.

What were the results for the FRNP? Recovery of a number of species in marked plots after a fire in 1989 shows that nearly 10% are seeder species that require considerable time to build up a seed bank and suggest fires should be at least 20 years apart, preferably longer. A well-known example of a slow maturing seeder species is

Baxter's *Banksia*. A number of rare bird and mammal species occur in FRNP and most need vegetation for feeding and breeding that has not been burnt for at least 10-20 years, with optimal conditions 20-50 years or more. Such species include the Bristle-bird, Whip-bird, Ground Parrot and Malleefowl, and the mammals Tammar, Woylie, Dibbler, Heath Rat and Honey Possum.

The pattern of charcoal deposition in an estuarine core from Gordon Inlet indicated over the period about 4,600 to 2,700 years before present, that initially fires were infrequent with periods between major fires over 100 years. The charcoal pattern later in the period was more even, but still with major fires not closer than 30 years apart.

The different methods of inferring fire intervals thus agree that fires in this area were not in the range of 5-10 years apart but were considerably longer, probably in the region of 20-50 years apart, with some areas on a considerably longer rotation. The results apply to the area of FRNP and may be considered close to the natural fire frequency of this area of southern shrubland. Similar extended fire frequencies are found on off-shore islands which were not inhabited or visited by Aboriginals. The occurrence of rare plant, bird and mammal species in FRNP suggests that fire frequencies of 2-10 years elsewhere in the south-west may have wiped out many species of both plant and animal life that existed before Aboriginal occupation of Australia.

The results from this study provide basic information on which to base a fire policy for FRNP that will ensure survival of its many spectacular and rare species.

*Cleve Hassell has a background in geology as well as recently completing a PhD in Botany at UWA, and spends part of his time at Quaalup, adjacent to the FRNP. He can be contacted by email: clevhass@cyllene.uwa.edu.au*

*Ref: Hassell, C.W. (2000). Fire Ecology Studies in Fitzgerald River National Park, Western Australia. PhD thesis, Botany Dept., UWA, Crawley.*



*Mt Barron, Dempster Inlet.*



## RESEARCH

### USING OUR NATIVE TREES AND SHRUBS TO SUPPLY NEW INDUSTRIES

*Don Cooper*

The SEARCH project aims to identify a range of large-scale profitable woody perennial crops and associated products, suited to the different climatic regions and soil types in the WA Wheatbelt. The Department's Farm Forestry Unit is coordinating the project, with funding from the NHT.

SEARCH consists of three components:

- ▶ systematic selection of species and products;
- ▶ demonstration plantings of likely prospects; and
- ▶ large scale planting of early candidates.

SEARCH has examined the WA flora to select species with promising attributes for large scale planting on farmland. Simultaneously, potential products were examined to identify those best suited to the type of material that could be produced on wheatbelt farms. The products chosen were panel boards, pulp and paper, and energy. SEARCH is now testing the wood attributes of the most promising species to determine which are suitable for these products.

Why were the products chosen?

Wheatbelt growers may be able to produce large volumes of small timber at a very low cost of production. Products that are best suited to this type of raw material are panel boards and pulp and paper. These industries have very large markets with strong growth, both domestically and internationally. The wood they use makes up a significant share of their total production cost, which gives low-cost wood producers a competitive advantage.

Energy is an ideal third product group to look at, because it can be produced from any plant material. Residues from other manufacturing processes can provide a cheap, convenient and reliable supply of raw material, leading to multi-product industries. For example a panel board plant may use the leaf, bark and lower quality wood to generate electricity to supply its own needs and feed any surplus into the grid. Waste process heat may also be used for other purposes, for example water desalination. Because electricity and water are transmitted long distances to most wheatbelt towns, the cost of supply can be higher than the price paid by wheatbelt consumers. A cheaper option may be to generate electricity and desalinate water locally.

How are the species being matched with the products?

Matching WA species to products has been a multi-stage process:

1. Coarse screening: Approximately 250 species native to the WA Wheatbelt were selected for investigation, based on their height, growth form and distribution. Wood samples were collected from each of these species by extracting a core from their trunks. The wood cores were tested for density and colour, two important

criteria for panel board and paper production. For species with other potentially commercial attributes, samples of other plant parts were collected. For example: 3g leaf for leaf oil analysis, 200g leaf for fodder analysis, and 10g bark for tannin extraction.

2. Intermediate screening: From the species tested in stage 1, approximately 100 were selected for more intense screening, based on their favourable density and wood colour.
3. Laboratory testing: Based on wood density and colour, and an assessment of their growth potential, approximately 50 species were selected for more intensive laboratory investigations. Ten kg of wood was collected from each of these species, for measurement of fibre characteristics, pH, buffering capacity and extractives content.
4. Sample products: The most realistic test for each new species is to make sample products and test their quality. All of the 10kg wood samples will be tested for pulping and paper manufacture. Panel board manufacture is more complex and expensive, and requires a minimum of 150 kg of dry wood. At the time of writing, wood from seven species has been collected for panel board testing; results, we hope, by April 2003.

Which species were chosen?

As SEARCH has progressed, the range of species suitable has steadily diminished. However, the results have been pleasingly diverse. Twenty-five genera are represented in the lab testing phase, and thus far seven species have been selected for sample panel board testing. They include the fast-growing disturbance opportunists.

What is the expected end point of this project?

The manufacture of the test products will represent the end of the "SEARCH" phase of the project, but the results should lead to planting of trial plots of the most promising species and further R&D by the Department and the Cooperative Research Centre for Plant Based Management of Salinity.

*Don Cooper is a Project Officer with the Department's Farm Forestry Unit. He can be contacted on 9334 0184.*

#### More melaleucas (eucs etc) anybody?

Many people took advantage of the opportunity to plant trial areas of melaleucas last season - well, more species are available this year. There is quite a large range of melaleucas, eucalypts, sheoaks, etc, all at 5.5c each. You prepare and manage the site. For more information contact Don Huxtable: 9334 0186.



## PRACTICALITIES

# TYPHA AT LAKE MEALUP

Jan Knight and Peter Wilmot

THIS report summarises our experience in typha (*Typha orientalis*) control at Lake Mealup, our 120 ha property southwest of Pinjarra. The Lake Mealup Preservation Society Inc. (LMPS) is an incorporated community-based organisation that purchased three blocks in and around Lake Mealup from 1986 to 1988 with funds donated or loaned by members. There is an adjoining Department of Conservation and Land Management reserve in the centre of the lake, which was enlarged by a departmental purchase around the same time as LMPS purchased its land.

We have tried six control methods, described below and summarised in the table. We decided to undertake this work because of concern about the spread of *Typha* across the lake, especially in the recent years of low water levels, which greatly reduced the areas of open water.

### The *Typha* problem at Lake Mealup

Lake Mealup is a large freshwater wetland. It reaches a maximum depth of typically 0.6 to 1.4 m in late spring, but dries out over most summers. The lake presently has approximately 50% cover of *Typha*, which is almost certainly all *T. orientalis*. There is a relative absence of non-target species, apart from small patches of emergents such as *Baumea articulata*, and excellent fringing stands of *Melaleucas*.

### Method 1: Slashing dense stands in shallow water or damp ground

Slashing in itself will not control the plants. We use it to clear access into green regrowth patches because it is much easier to apply herbicide to emergent growth or to slash green stems underwater if they are emerging from a bed of slashed brown material, rather than trying to force your way through dense stands of old dry stems.

This is hard physical work. A brushcutter with a metal blade is the best, and it works better on brown foliage than on green. A sickle is good on green growth.

### Method 2: Covering with plastic

Low stands or stands that have been slashed can be covered with heavy black plastic to kill it by the combined effects of light exclusion and heat. This method works OK, but dragging large sheets of plastic around is hard work. Because it requires lots of plastic, it is better for small areas. We used tyres to hold the sheets down, which was only partly successful as they tended to float off as the water rose.

### Method 3: Cutting stems under water

If the plant is cut deep enough below the water (at least 30 cm underwater) it should drown – that's the theory anyway! The plants must remain submerged for weeks, so this method does not work on a falling water level. Peak water levels usually occur in late winter and spring. The best tool is a sickle, which cuts well unless there are tangles of old dead material. There will be some regrowth, and the area will probably need two recuts to eliminate survivors.

It may be that this method works best in coloured or turbid water, but we are not sure about this.

### Method 4: Wiping with glyphosate

A solution of 1 part glyphosate (360 g/L) to 2 parts water is wiped onto the leaves, using a PVC elbow-length glove which has pieces of kitchen sponge glued to the fingers. One needs only to wipe 10-20 cm on a few leaves. We added a dye to the mixture to mark the treated plants, but we didn't find it effective. A stronger dye may work but generally one can see damp areas on treated plants for long enough while moving through the stands.

This method appears 100% effective on treated plants. Survivors are those missed in the first treatment. It takes two to three weeks to show any effect. The best time of year is said to be late spring through summer. At Mealup we found it effective through to May on green plants which are growing vigorously. It is not recommended if plants are standing in water that is deeper than 30% of their height. Also, don't slash plants and apply herbicide to the cut stems as the herbicide works by being translocated to the roots.

### Method 5: Spraying with glyphosate

A solution of 100 mL glyphosate (360 g/L) plus 140 mL Liquid Ammo per 7 L is used in a spraypack with hand pump action. The operator must thoroughly wet the plants. The spraying is easy – carrying the large volumes of water to the spraying sites to reload the spraypack is the difficulty at Lake Mealup. Because of the potential harm to aquatic animals or non-target plants, we only use this method at Lake Mealup when the lake is dry.

### Method 6: Hand weeding

We have grubbed out small seedlings (typically to maximum of 30 cm tall, preferably less). This works for small areas. We have covered larger areas by having a group of members walk in a line across the dry lake bed, dealing with plants as they find them.



# PRACTICALITIES

continued from page 12

Method		Best time to control based on water level	Non-target plants nearby	Water quality
Method 1:	Slashing	Dry or very low	OK	NA
Method 2:	Plastic	Dry or very low	OK	NA
Method 3:	Cut under water	Must cut at least 30 cm below water surface; do not cut in rapidly falling water levels.	OK	May work better if water is turbid or coloured
Method 4:	Wipe with glyphosate	Dry or very low; plants no more than 30% immersed	OK but care needed	NA
Method 5:	Spray with glyphosate	Preferably dry	Not suited	NA
Method 6:	Hand weeding	Dry or very low	OK	NA

## Glyphosate toxicity issues

Read the instructions and safety information provided with the herbicide. Wear gloves, goggles, a long-sleeve shirt and long pants. Have water nearby to wash splashes off your skin. Wear eye protection, for example safety goggles, as the dead *Typha* spikes can seriously damage your eyes if you walk into them.

The surfactant in some formulations is toxic to frogs, up to ten times more toxic than the herbicide itself (Mann and Bidwell, 1999). There are formulations which are less toxic to aquatic life, and these should be used. Whatever the formulation used, it is best to avoid contamination of water. Therefore, do not let herbicide come into contact with the water of the lake or river.

Because our part of Mealup adjoins a nature reserve, we discussed the use of herbicide with the Department. Agreement for application of herbicide should be first sought from the owner or manager of the wetland.

### A caveat

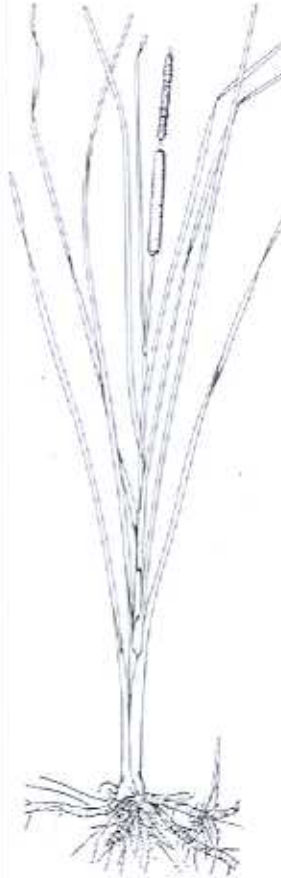
These notes represent our experience at Lake Mealup where the varying water levels and the location of non-target plants influence our choices of control methods. Some of these methods will not be practical elsewhere.

We are definitely not experts! We have learned by trial and error, by reading and by seeking advice from, and sharing experience with, others. We hope to continue to optimise our methods and get the best results for our efforts.

### Reference

Mann, RM and Bidwell, JR (1999) *The Toxicity of Glyphosate and Several Glyphosate Formulations to Four Species of Southwestern Australian Frogs*. Arch. Environ. Contam. Toxicol. 36, 193-199.

Jan Knight and Peter Wilmot are founder members of the Lake Mealup Preservation Society Inc. For more information about typha control or to arrange a visit to Lake Mealup, contact them on 08 9244 3015 or email: jan\_edit@omen.com.au



### Bullrush and Yanget

Freshwater areas, including sandplain seeps, often contain populations of *Typha* species, tall aquatic perennials with stiff, strap-like leaves and cylindrical flowering spikes. They do provide some fauna habitat and help, by shading the water surface, to slow down evaporation, but they grow so vigorously that they can quickly form dense masses which may totally cover a wetland or block a drain, leading to loss of more desirable species, and to changed water flow. In industrial areas, however, that same fast growth rate can be very useful to strip nutrients from polluted waterbodies. The plants burn fiercely in dry summers.

*Typha* is a worldwide genus (called Bullrushes in England and Cattails in America) and one of the two species in WA, *T. orientalis*, is introduced. The other, *T. domingensis*, is native.

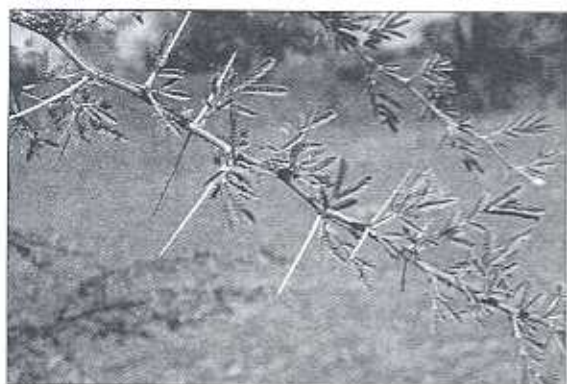
The Nyongar people used it as a food source and called it Yanget - hence place names like Yanchep and Yangebup. The best way to tell the two species apart is to measure the leaf width, if most of the leaves are wider than 8mm, it is probably *T. orientalis*, but be warned - intermediates exist! When ripe, *Typha* spikes produce a vast quantity of light fluffy seed - up to 200 000 seeds per spike - nearly all viable, so they can quickly reach new sites.

Your decision about whether, and how much, to control *Typha* in your wetland will depend on which species it is, but it won't be an easy job!



## WEED ALERT

### ACACIA NILOTICA HAS REACHED THE KIMBERLEY!



ONE of pastoral Australia's worst weeds, *Acacia nilotica* (Prickly Acacia), has been discovered growing just inside WA, on the border with the Northern Territory. It forms an umbrella-shaped small tree, and has pairs of thorns up to 10 cm long.

*A. nilotica* was promoted extensively in Queensland in the 1890s as a shade and ornamental tree, especially to be planted around water points, where heavy cattle grazing pressure had eliminated the local shrubs. No-one seemed to appreciate that a plant grown because its foliage is not eaten by stock is likely to eventually become a weed! Currently it is estimated to infest more than 7 million ha, mostly in Qld but also in the NT.

The plant does produce protein-rich pods, eaten by cattle in drought situations, and viable seeds are dispersed in cattle manure. Perhaps this is how it has reached WA, in the droppings falling off a stock transporter?

Whether you live in the Kimberley, or are just visiting, keep an eye out for this plant. There is only one native it could be confused with, *A. farnesiana*, and plants in undisturbed sites are likely to be this. But to be sure, collect a specimen of anything suspicious and take it to an AgWA or the Department's office for ID. Specific contact: Noel Wilson, AgWA Kununurra, 9166 4047.

### UTE GUIDE "SOUTHERN WEEDS AND THEIR CONTROL"

SOUTH COAST readers - if you haven't already got a copy of this booklet, reach for your phone now! Written by weed researcher John Moore (AgWA) and taxonomist Judy Wheeler (the Department) it gives clear and practical ID and control advice for weeds in both agricultural and environmental situations.

John recently was awarded the Council of Australian Weed Science Societies medal for leadership, for his outstanding contribution to weed management and research over the past 25 years. A well-deserved award - ask him, eg. about his computer programmes to help farm weed management!

Contact: John Moore on 9892 8476.

### SUPPORT FOR COMMUNITY WEED AND PEST CONTROL

Theo Nabban

THE Department of Agriculture manages an NHT project called *Integration and Coordination of Weed and Pest Control* (ends June 2003) which supports and facilitates the formation and function of community groups leading to on-ground action in managing pests and weeds. The project assists both formal (LCDCs, Shire-based groups, Bushcarers etc) and informal groups (landholders and their neighbours) in the following ways:

- ▶ sources information and technical expertise on weed management i.e. local contacts, experts, results of weed trials, methods of weed control etc.,
- ▶ brokers training in weed control and management practices,
- ▶ provides information on simple and effective equipment to use in weed control, possible loan of equipment,
- ▶ networks with other local groups or neighbouring weed action groups,
- ▶ advises on weed mapping,
- ▶ assists groups move from planning to action (prioritising weeds for action, facilitating action plans),
- ▶ point of contact to involve other stakeholders (Shires, government agencies etc).

This project supports community/group action for both declared (agricultural) and environmental weeds & pests. It does not provide individual or one-to-one support. Regional coordinators have a role within the project to assist communities to set up Action Groups or to use existing structures (LCDCs, Shires, Regional NRM Groups) to manage weed and pest control, planning and action. They act as the avenue that groups would use for facilitation, information and the bringing in of additional expertise and resources that they require to get the results they want.

Contact details for Regional Community Weed and Pest Coordinators:

- for **Peel & South West & State wide** project manager. Theo Nabban, AgWA, Bunbury. Ph: 97 806 270; Fax: 97 806 136; email: [tnabban@agric.wa.gov.au](mailto:tnabban@agric.wa.gov.au)
- for **Kimberley & Northern Rangelands** - Noel Wilson, AgWA, Kununurra. Ph: 9166 4047; Fax: 9166 4067; email: [nwilson@agric.wa.gov.au](mailto:nwilson@agric.wa.gov.au)
- for **Central Agricultural & for Northern Agricultural** (includes most of the central Wheatbelt, including Gingin), Sam Giles, AgWA, Northam. Ph: 9690 2144; Fax: 9622 1902; email: [sgiles@agric.wa.gov.au](mailto:sgiles@agric.wa.gov.au)
- for **Great Southern & Esperance** - Graham Blacklock, Community Agricultural Centre, Kojonup. Ph: 9831 1997; Fax: 9831 1990; email: [gblacklock@agric.wa.gov.au](mailto:gblacklock@agric.wa.gov.au)



## ECONOMIC VALUE OF BIODIVERSITY

### SHIRE OF BUSSELTON OFFERS RATE REBATES ON LFW SITES.

Carolyn Switzer and Cherie Kemp

**R**ATEPAYERS in Busselton Shire can benefit from a partnership arrangement between *Land for Wildlife* and the Shire's Biodiversity Incentive Program which came into action in April 2002.

The incentive program offers two rate rebate options to landowners with bush which meets certain criteria. One option is conditional on signing a ten-year management agreement with the Shire and being a member of *Land for Wildlife*. The other is conditional on taking out a conservation covenant with a body offering stewardship arrangements (currently either the Department or the National Trust). The rebate offered is proportional to the area of bushland set aside and is 35% for a management agreement with the Shire, and 50% for a conservation covenant.

The *LFW* management agreement option has proved popular. It is designed to limit the following activities:

- ▶ clearing, removal or damage to vegetation;
- ▶ the removal of timber, including fallen timber (unless specifically negotiated for limited personal use);
- ▶ any act that may adversely affect local indigenous flora or fauna;
- ▶ the grazing of remnant vegetation by any non-native animal, except in parkland cleared areas that are isolated by fences where crash grazing may be required to reduce fuel loads;
- ▶ burning except in accordance with approved fire management recommendations contained in the management plan;
- ▶ wildflower picking;



- ▶ any act that may affect the natural state, flow supply, quantity or quality of any water body (unless required to do so by law).

The advantages for the Shire and property owners are manifold! The *LFW* Officer already has personal contact with landowners and offers an extensive range of information to assist them manage their bushland. If needed, the Shire has some funds to help with fencing or rehabilitation of land that otherwise would meet the criteria. In the future this funding pool is likely to be topped up.

*LFW* property owners have been keen to take advantage of this offer of rate rebate as many have been active bush managers for quite some time. Being involved in *LFW* has given them a network to work within and a support system to assist them in their management and conservation, and now the Shire has come forward with a further reward for their efforts.

When a landholder applies, a Shire Biodiversity Officer and the *LFWO* visit the property (a revisit for the *LFWO*); the Biodiversity Officer will write a bushland criteria assessment report for the rate rebate scheme and the *LFWO* will write a Management Plan for the property owners, based on the *LFW* Report.

The two programs reinforce each other – receiving a rate rebate rewards the *LFWer* for valuing their bush and the Shire is able to conserve some of the area's biodiversity. The Shire of Busselton has only 35% of its remnant vegetation left and only 10% of the Abba Plains vegetation communities.

The Shire of Augusta/Margaret River is moving towards having a similar Biodiversity Strategy, and other Shires in WA have made enquiries as to how the scheme works. Having a Biodiversity Incentive Scheme in place in almost every Shire in WA would give large benefits to Shires, property owners and the biodiversity of our State.

For more information regarding the Shire of Busselton's Biodiversity Incentive Scheme contact Carolyn Switzer or Kirrilly White on 9781 0444, or Cherie Kemp, LFWO Busselton, on 9752 5533

*Did you know?*

That some *Calothamnus* (One-sided Bottlebrush) species exude resin from their roots, which glues together soil and sand particles to make a tube around the root. This effectively protects the plant against attack by root parasites such as Sandalwood and Quandong.

From: Grant Woodall, AgWA Sandalwood project.



## MEMBER'S PAGE

### THE FIRST HARVEST - OIL MALLEES ON 'SUN VALLEY'

ONE paddock on our property, 'Sun Valley' at Beacon, has a sloping area of poor, gravelly soil that was hardly worth while cropping. Once it would have carried a natural stand of mallees, so we decided to put in a trial of oil mallees. 25,000 seedlings of *Eucalyptus plenissima* were planted in 1998, on the contour, in single lines at 10 metre spacings. The area between the rows was left to revert to native grasses, everlastings and shrubs. By 2002, after one very wet and two very dry years, the mallees were ready for harvesting. The average height was less than a metre, but they were bushy, ideal for oil production.

Kalannie Distillers arrived with the equipment in July. First, a forage harvester cut the plants, then the bin of chopped leaf and stem material was steam distilled. It was exciting to see the pale golden oil begin to collect! This plantation produced 600 litres of high quality oil. As yet, it is not certain what will happen to the organic residue.

We were horrified at the appearance of the plants after the forage harvester had gone through -

surely they would never recover? But, despite being in the second year of one of the worst droughts on record, by October it is clear that the mallees are regenerating well. If this rate of growth continues we should be able to harvest every two years. At the moment the financial returns are not very great, but they

do exist, and every little bit helps. In addition the area is developing into a very attractive wildflower and bush bird corner, as well, of course, as helping to control groundwater. We are pleased with this trial, and are considering whether we might set up other areas.

*Peta and Gerry Kirby*



Harvesting



Distilling



The oil



After harvest in July.



Regrowth, October.



ON 22<sup>nd</sup> April 2002 a Field Day and Workshop was held in York on the initiative of the York LCDC with the support of the York Shire. It was held because of concern about the serious and growing problem of Wandoo Crown Decline. The day was attended by upwards of 60 people representing various interests from the locality and neighboring districts such as Beverley and Toodyay.

In the morning damage to wandoo forest and roadsides was inspected. In the afternoon workshop, we were regaled with explanations of work done so far, none of which seemed to come near the root of the problem. It does seem that sporadic attempts have been made over the past twenty years to pin the problem down but in cold hard facts no one has come up with anything better than to say the trees are suffering from the effects of various environmental stresses.

So many of the 'theories' about environmental stresses being the cause of the problem can be disproved by the perfect health of trees which have suffered all the same environmental stresses and yet remain unaffected and in beautiful condition. Should these trees finally become infected by transition of the condition, this argument would disappear, so locations should be noted now.

The wandoo forest flanking the road from York to Perth is an illustration of the problem. All across the forest, as far as the eye can see, all the upper branches are bare and dead. This is where the flowers happen. So there will be no flowering, or fruiting, or nectar, or pollen. All creatures large and small who rely on this productivity have lost their living and cannot be expected to survive. Many forest inhabitants are endemic in their own trees or plants or even their own piece of ground litter. The number of extinctions that are a likely result make a mind boggling scenario - the ecosystem, or large parts of it, must die.

## FLORA

### WANDOO WORRIES

Joanna Seabrook



#### The future

It is too soon to say what will happen to these trees in the future until we can discover what has happened to trees that have been examined in the past. Is there recovery, is the problem cyclical and if so does it remain to attack again? A huge amount of research is needed to answer these sorts of questions.

I can say that in my journeyings up and down the road I can notice that there is quite a lot of releafing going on but there are also damaged trees showing no sign of any recovery, so at this stage it is impossible to quantify anything. I would like to rule out drought as I think Australian plants are built to survive such conditions. I am convinced that we must look for a pathogen and a vector.

Professors Jonathon Majer and Harry Recher have studied the relationship between trees, invertebrates and birds, showing how interlinked everything is. The work clearly shows that many of the

myriad inhabitants of trees (arthropods eg) are exclusive to the trees they live on so that the loss of tree cover in any one place means the loss of all this invertebrate life which carries through to be the loss of the birds that feed on them and the pollinators amongst them, etc.

Besides problems with Wandoo, we know the Tuart, Flooded Gums and other trees are also subject to severe decline. How can we understand the enormity of the potential consequences of the loss of canopy we may be faced with, unless somebody does some research now?

There is a great resistance to taking the possibility of disaster seriously enough to do something about it. No one likes to be thought an alarmist, including me. One of the great needs I see right now is to collect and safely store seed of the native species of plants. We should examine all of the species under threat be it of disease, drought, salt or insect predation, and collect seed from those individual trees which seem most able to resist the particular threat. Not just a little but bushels of it. Why aren't we doing it already?

Ref: "One Humble Gum Tree" J. Majer and H. Recher. *Geo*, December 1996

Joanna Seabrook, noted conservationist and author, now lives in York. She can be contacted by email on:

[joannaseabrook@westnet.com.au](mailto:joannaseabrook@westnet.com.au)

#### Wandoo decline survey

Ecologist Jack Mercer, who is based in Albany, has recently conducted a survey across the wandoo belt, to attempt to establish whether there is a pattern in the expression of Wandoo decline. His analysis should be completed soon, and we hope to bring a precis of his conclusions to you in a future issue of *Western Wildlife*.

Nb: LFW understands that UWA has recently received some funding to study Wandoo decline - Ed.

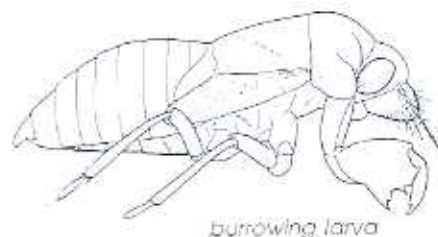


# FAUNA

## CICADAS



Sandgrinder  
*Arenopsaltria fulva*



burrowing larva

SUMMER days in a hot climate - what sound defines it? Surf on the beach? The soft call of a Peaceful Dove? No, all over the world, it is the incessant, day-long, rasping call of cicadas which defines summer! Deafening and unmelodious, for some people the noise contributes to the process which used to be called "going troppo"!

But what are cicadas? They are a world-wide family of insects, with some 250 species found in Australia, principally in the tropics and down the east coast - Cairns is the centre of diversity. They vary in size, the Tick-tock, which is common around Perth, has a wingspan of about 4cm; the Sandgrinder, which sounds like a buzz-saw in coastal plain sandy banksia woodlands, is 6cm across, while the Golden Drummer which deafens Carnarvon's residents at certain times of year, has a wingspan of 8cm. The insects lance into a branch to feed on the sap, and many other insects, including ants, often take advantage of the overspill.

Female cicadas make a series of small tears in the bark of a twig and lay an egg into each hollow. When the larvae hatch, they drop to the ground and burrow down to find a root where they can feed on sap - remaining underground and increasing in size, often for years. One American species has been known to spend 17 years in this underground stage! But eventually, the final stage nymph breaks through to the surface and climbs up a tree,

or a fence post or something, fixes its claws into the bark and sheds its skin. The outer shell often remains hanging there for months.

Different species of cicada have different calls. The sound is made by two vibrating drum-like membranes called timbals, held in the abdomen, which in some species is almost hollow, so acting as an amplifying air-chamber. Why do they make the noise? Probably it is for sexual attraction, but in some species, both males and females drum. Perhaps it also deters predators? It can certainly deter humans! John Lort Stokes, when exploring the Bonaparte Archipelago in the Beagle in 1838, noted that "...the trees swarmed with large locusts [cicadas - Ed], quite deafening us with their shrill buzzing noise." Even Shakespeare has Falstaff mention the noise as a "damnable iteration" - though whether Shakespeare himself would ever have heard it is doubtful.

Cicadas' five eyes give them excellent vision, but they do not react to all sounds. The French entomologist and essayist, Henri Fabre, once experimented by borrowing the "local artillery", guns which were fired on feast-days in the village. He had them crammed with powder and exploded beneath a cicada-filled tree. The resultant bang considerably disturbed the village's human inhabitants, but the cicadas continued their drumming without a pause or a change in

rhythm! Quite a resounding experiment!

Like most of Australia's insects, we know little about the specific natural history of most cicadas, so that every observation made will contribute to our understanding. How long does the nymph spend underground? Which plant roots do they prefer? What is their effect on the plants? Which birds eat them? The parasitic fungus *Cordyceps* (sometimes called a vegetable caterpillar) is often found growing from the mummified body of a cicada grub, as well as of other soil-dwelling insect larvae. How important is this in regulating numbers? Have cicadas increased in numbers since the grub-eating marsupials such as bandicoots and potoroos have decreased?

Have you any information that can add to our slender store of knowledge?

In the meantime, cicadas are a sign of home! WA poet Randolph Stow uses their sound to typify his 'country':

"So far, so sweet, I know I shall one day love them,

the warchants of cicadas trill in my caverns"

Love them or hate them, in many parts of WA the one thing you can't do to cicadas is ignore them!

Penny Hussey

Ref: "Australian Cicadas"  
M.S.Moulds. 1990. NSW University Press.



## REVEGETATION

### THE GREAT NAMBLING SALT FLAT WHEELBARROW MUSTER

Barrie Oldfield



FOUR years ago Men of the Trees (MOTT) set their sights on doing something about dry land salinity. We wanted to take on a severely degraded piece of land, the kind that most people would regard as being well beyond economic recovery, and see if we could learn by actually applying treatments and processes and observing the outcomes. The land selected is at Nambling, 5 km west of Dowerin on the Goomalling road. It covers about 11 ha.

The first thought was drainage. Parts of this land are scalded bare and in winter some inundation occurs. Two piezometers at the eastern end show the water table to be within 20-40 cm of the surface. We settled for "microdrainage" - raising the planting sites above the water table by putting in a series of raised beds, varying in height from 30-70cm. This had the effect not only of giving us a little more depth to water table but also aerating the soil which, over a period of several years, had become quite anaerobic.

The next idea was to incorporate organic material, not just compost but material that would persist in a dry soil through a succession of long arid summers. (Gilles Lemieux, of Laval University, Canada, has written about this; ref: <http://forestgeomat.for.ulaval.ca/>

brf). For three years we have received loads of mulch from various sources, which a dedicated team of volunteers has spread over the mounds.

Into beds so prepared and top dressed we planted our trees, selected for their tolerance to saline soils. One source of seed is right there at Nambling; *Eucalyptus sargentii* and *E. spathulata* trees growing as healthy sentinels all around the back of the site. We also planted *Melaleuca cuticularis*, *Casuarina obesa* and several other known salt tolerant species. In growing our seedlings at St. Barbe Grove Nursery we also took heed of the mycorrhiza work done by Inez Tommerup at CSIRO. Top soil scrapings were taken from under flourishing trees around the site, and even a few puff balls were made into slurry to inoculate the pots.

Details of this trial are being recorded. However, probably our major enemy at the moment is the consistent low rainfall. Its not just the farmers who are having a hard time!

Barrie Oldfield is President of MOTT. Contact MOTT Nursery on: 9250 1888.

Photo: M. Brooker

### SALT ANYONE...?

ELEVEN ha of grey-white salt, pitted with stubby greenish growth, was the stark unwelcoming outlook for about 250 volunteers who converged on the 'Great Nambling Salt Flat Wheelbarrow Muster' in June last year. Once again Men of the Trees was doing something a bit different, spreading mulch over planting mounds in a salt flat.

The volunteers were armed with shovels, rakes and wheelbarrows plus a strong desire to help nature restore the major nutrients so vital for the future growth of trees and perennials reclaiming their rightful place on the now embattled terrain of this area. This happy gathering of people young and old included myself and my wife Pam, who, I may add, did not come to any harm in this project as she did last year on a similar outing, and only because she was placed in a 'protective bubble' throughout the working day; allowed out only for sustenance and physical relief. Well, that was the theory!

Five years ago about 1000 trees were planted in the same salt-infested area. Today, they proudly stand vigorously spreading their leafy arms to heaven, and this one hectare has been dedicated as a 'Tree Park Memorial'.

Vic Ferreira

(It will be interesting to find out whether this costly and labour-intensive process does lead to a high establishment rate ... in other words, is it worth the effort? Keep an eye out, as you drive past the site. Ed.)



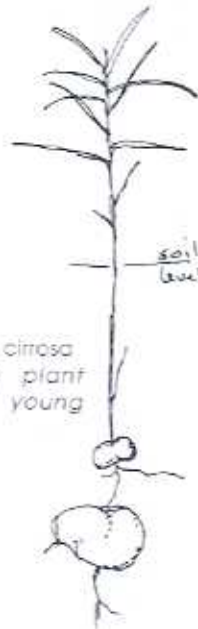
**U**NDER old York Gum or Wandoo trees there is often a lot of leaf litter and it may seem as though there are few plants growing there - but look closely. In autumn, an inconspicuous spindly upright plant with dark green leaves, will be in flower. It's in the carrot family, and it carries an umbel of small cream flowers on a long stalk. Its scientific name is *Platysace cirrosa*.

I was first shown this plant many years ago by an elderly gentleman from York, who told me he learnt about it from the aboriginal kids he went to school with. "We used to dig up the tubers on our way home from school on a summer afternoon" he said, "it was like eating a crunchy ice cream!" Well, I'm not sure I agree with the comparison, but maybe it's an acquired taste!

The plant is found throughout the Wandoo and York Gum woodlands, always growing in the leaf litter beneath the crown of mature trees. An old plant may have half a dozen tubers, some of them quite large. It was an important food source for the Nyoongar people, who called it Kanna (various

## FLORA

### KANNA



*Platysace cirrosa*  
Seedling plant  
showing young  
tubers.

spellings - even given it's name to a townsite in the northern wheatbelt). Noel Nannup, of the Department's Indigenous Heritage Unit, said that the tuber contains a lot of moisture, so if eaten raw would be a good thirst

quencher. Alternatively it could be roasted in the camp fire, when, like a roast potato, you get a crisp skin around a fluffy inside. I wonder how it would taste when roasted in aluminium foil with a dab of butter?

Kanna survives well, even in remnants that have been lightly grazed. Its presence is an indicator of good understorey condition in remnant woodlands. Why not have a look for it in your woodlands? If you can find several plants, you could dig one up to find the tubers. Then, that evening, "throw a Kanna on the barbie!" Not only a new taste sensation, but a living link to past land use.

At the same time, you could do a little experiment to help increase our knowledge. Carefully replace the small tubers and, because we do not know if they will survive this treatment, please mark the place with a stick, and check it a year later for regrowth. We presume that Aboriginal people did this, and it worked, but no-one is sure - so, could someone find out please?

*Penny Hussey*

## Southlands - enthusiasm and energy!

**A**LBANY'S Southlands Christian College has joined the *Land For Wildlife* scheme and dedicated 'Monday afternoons' to managing their 5 ha school grounds. Every Monday afternoon the grade 4, 5, 6 & 7 students can be observed carrying out some form of 'bush care' activity. The students have so far identified 68 native plant species in their bushland and have pressed samples for their school herbarium collection. They have enthusiastically tackled the large invasion of weeds like Sydney wattle and Victorian tea tree with pruning saws and secateurs. They have also done seed collection from the bushland, seed propagation, path building and planting of seedlings. They have taken on the rejuvenation of the school grounds as part of their school science programme on the environment. On the rainy days when the students have been 'stuck' indoors they have spent some time learning about some of the unique fauna of the region and some of their habitat requirements. Some of the high school students volunteer to assist in supervising the younger children during the 'weed attack' sessions. The high school aged students also went on a nature walk with the *Land For Wildlife*



The hard working students from Southlands School standing in front of the spot where they cut down a large Sydney Wattle. They will replant to this with a local provenance Jarrah tree.

Officer out to Torndirrup Peninsular and looked at some of the local coastal landscape features. The students also plan to visit Two Peoples Bay Nature Reserve to look at one of the regions biodiversity 'hotspots'.

*Sylvia Leighton*



## Gilbert's Potoroo Action Group formed



**G**ILBERT'S Potoroo is the most endangered mammal in Australia, and one of the rarest mammals in the world. It was thought to be extinct until rediscovered in 1994 at Two Peoples Bay near Albany. It is believed that there are less than 40 animals in the wild.

Gilbert's Potoroo lives in small groups in dense, long-unburnt scrub and feeds on underground fungi. The potoroos are vulnerable to fire, introduced predators and the spread of dieback disease which leads to the loss of habitat. GPAG members work with the Department staff on monitoring and captive breeding programmes (including radio tracking) and are also developing educational and sponsorship packages.

To find out more, phone Val Hack on 9841 3096 or a/h 9844 3312.

## Climate Change

**A** report produced by the Perth-based Indian Ocean Climate Initiative in Sept 2002 has been written specifically to interpret work on climate variability for the benefit of decision makers in climate-affected industries and in natural resource management in the south-west of WA. The summary leaflet is inserted in this issue.

It documents changes in rainfall and temperature over the last century, discusses why these changes have occurred, and goes on to predict future climatic scenarios. It should be required reading for every land manager in WA.

Get your copy of the full report from: Water and Rivers Commission, Hyatt Centre, 3 Plain Street East Perth.

## IN BRIEF

### Purchase of Land for a Conservation Reserve

**T**HE Friends of the Porongurup Range have been given the opportunity to purchase a 511ha property, of which 75% is remnant bushland, to manage as a conservation reserve. The property is an important link in the bush corridor chain around the Porongurup National Park and also has many vegetation types not represented in the NP or the surrounding region, some of which are at the extreme edge of their range.

The soils vary from granite to laterite, white sand, sandstone, clay and flooded ironstone. Preliminary surveys indicate over 500 species of flora, 60+ birds and many species of other fauna including brush wallabies. Two rare and six priority plant species have so far been discovered and the flooded ironstone plain is a threatened ecological community. The property lies between the Porongurups and the Stirlings, and provides some fantastic views of both.

It is extremely rare to find such a large piece of uncleared bush still in private ownership in this busy farming area. The Friends are asking for your help to protect it, so that it's diversity can be enjoyed for all the years to come. They are applying for funding from NHT, but they still need to raise about \$150,000. They are in the process of registering as a public fund for tax deductibility, so they ask you not to send anything now, but please, give them a pledge for the 2002/2003 financial year!

For more information, contact: Ann Burchell, President, Friends of the Porongurup Range Inc, Phone 9853 1153 email: burchell@wn.com.au

## Fitzgerald Fire Symposium CDs now available

**I**F you wish to obtain copies of these, which contain the speakers presentations and forum sessions of the symposia held at Ravensthorpe and Gairdner in Feb 2002, contact: Gillian Craig on 9838 1071 or email: ripicasa@wn.com.au

## New clearing legislation

**A**MENDMENTS to the Environmental Protection Act are being considered in Parliament. One of the matters dealt with by these amendments is the protection of native vegetation. Under the proposed new laws, clearing native vegetation will require a clearing permit unless the clearing is for an exempt purpose.

For further information, contact the Department of Environmental Protection, Native Vegetation Protection Group, on:

Freecall: 1800 061 025

Or visit the web site at [www.environ.wa.gov.au](http://www.environ.wa.gov.au)

## Honeyeaters benefit from nectar-producing native plants in Albany gardens



**V**ICTOR SMITH recently documented the results of 18 years of bird banding at Goode Beach near Albany. He shows how bird populations change as development proceeds. For the full story, read: Victor W. Smith, "Avian population changes in a developing urban area in Western Australia over an eighteen year period". 2002. Corella, 26(3): 79-84



## LFW NEWS



At the LFW workshop, November 2002  
L-R, Back row: Rosemary, Sylvia  
Centre row: Heather, Steve, Avril, Penny  
Front row: Claire, Fiona, Jenny, Cherie

## Congratulations

Two schools registered with Land for Wildlife have been successful in winning awards for creating wildlife habitat at their schools.

Baldivils Primary School won first prize in the WA section of the Reflex Habitat Program for their Living Classroom project. The prize has enabled the students to create a frog pond complete with boardwalk, native wetland species and nest boxes. The students were very clever and invented a "possum pooper scooper" for cleaning the pond after visits by brush-tail possums.

Coogee Primary School won third prize in the Reflex Habitat Awards for their Bushland Project and was highly commended in the Banksia Foundation Awards.

## INTERSTATE LFW

### The value of shelterbelts (NT)

Judy Le Mesurier

WHEN we took up our property "Tarrimoor" at Berry Springs, in Litchfield Shire (NT) we cleared much of the savannah woodland to plant mangoes. However, we left broad shelter belts of native bush around the crop areas. Some neighbours were surprised that we didn't maximise the area of production by clearing the whole block, but we like the native plants and animals that live in the bushland, and wanted to retain habitat for them. A couple of years ago, a violent storm ripped through our area, and as we listened to branches cracking we were really concerned for the crop - our livelihood. But the shelterbelts had



proved their worth! Our crop showed no effects of the storm, whereas our neighbours sustained big losses.

We believe that 'land for wildlife' and production can complement each other!

Want to find out more about LFW in the NT? Contact LFW Coordinator, Sally Jacka, phone (08) 8983 1912 or email [sally.jacka@lsc.nt.gov.au](mailto:sally.jacka@lsc.nt.gov.au)





## NEW BOOKS

### Verticordia: the Turner of Hearts

Elizabeth A. (Berni) George with paintings by Margaret Pleroni

Uni WA Press 2002

Cost: \$94.90

It's out! The long-awaited 'Verticordia book' has finally been released. Both as a work of art and as a work of scholarship, this book is outstanding.

The genus *Verticordia*, named for Venus, the 'turner of hearts', is very nearly synonymous with WA, though some species do extend into the NT. It exemplifies why south west WA is considered a world biodiversity hotspot.

Written and laid out in a clear, easy-to-read fashion, the book starts with interesting sections including ones on discovery and naming, conservation status and use in art, then progresses to a detailed section on propagation and horticulture.

The key is not easy to use - but perhaps given the minute differences which separate the taxa, this is not surprising. However, I do tend to give up with a sigh when the very first alternative is the number of ovules (in an ovary often less than 1mm in size!) - a binocular microscope is essential. But probably the general reader (i.e. me!) can get close enough by looking through the detailed species descriptions and studying Margaret Pleroni's meticulous and beautiful illustrations. It's worth buying the book for these alone, as the stunning beauty of this genus really will 'turn your heart'.

Sadly, it is becoming harder to see the plants in the wild, as the effects of incremental clearing along roadsides, spraydrift and inappropriate fire regimes take their toll. The author sounds a warning about conservation, quoting a description of the road between Dowerin and Goomalling in 1929 "... then the sandplain, with its wealth of flowers, each in its season, right on the wheel tracks, vivid blues pinks and yellows massed together, smokebush, cauliflower and other colours of marston in every direction ..." Have you driven that road lately? The blue is Paterson's Curse, the yellow Capeweed or Turnip ... If you are fortunate to have some verticordias in your remnants, or on roadsides near you, treasure them like the jewels they are.

What more can I say? It's a superb book - enjoy!

Penny Hussey

### Samphires in Western Australia: A field guide to Chenopodiaceae tribe Salicornieae

Bindy Datson

Department of Conservation and Land Management, Perth

Cost: \$25.95 p&h \$4.00

You may remember Paul Wilson's article (WW5/2, April 2001) which introduced the samphires, those squishy plants growing in salt country. Now a new book will tell you even more about them. It has lots of photographs and the line drawings that accompany the species descriptions are extremely

clear. Nevertheless, since much of the identification depends on seed shape, you will still need access to a binocular microscope if you wish to seriously try to put a name on your plants.

Most of the book consists of species descriptions (which would have benefited from having a distribution map included) though a few more general issues are touched on. The section on habitats has nice diagrams of transects showing where the samphires grow in relation to the height above water table and distance from lake edge. However I was disappointed in most of the other general sections. For example, the one on seed collection is very brief. If I was wanting to collect seed to use in revegetation, there is not enough guidance here. Also, how do you grow samphires? In pots in a nursery? Will direct seeding work? If so when and where? Can you use brushing (cutting whole pieces of plant and then throwing them out onto the site you wish to revegetate)? A photo on p. 19 shows a revegetation site at Tammin: it has been mounded, yet most of the samphire plants are growing in the furrows. Was this area, in fact, planted to something else, which failed, and the samphires merely volunteered in? At the very least the technique used here could have been detailed, or a reference given to where the reader could find out more.

A short comment mentions grazing value and recommends a limited period of stock access, implying, though not stating, that samphire areas need to be fenced if they are to be maintained in good condition. Greater detail here would have been useful.

Unfortunately this book suffers from a severe disadvantage, especially for anyone wishing to use it in the agricultural area. The title leads you to expect that it will cover the whole of WA but it neither describes nor keys all the species in the State.

The author does say that it is taken from her work in the eastern goldfields, and that she is not describing anything north of Onslow, fair enough - but - what about the five extra *Halosarcia* species and one extra *Sclerostegia* that occur in the wheatbelt? How would you know, if you find something that doesn't fit the key or a species description, whether you have simply made a mess of using the key, have collected a known species that has been left out, or perhaps have collected something totally new?

It's not just rare things like *Halosarcia kaobabbiensis* which are omitted (Alison Doley referred to this one in the last issue of 'Western Wildlife', in her article on the values of salt areas) but it also misses out *Halosarcia leptoclada*, which occurs on the Coastal Plain between Mandurah and Busseton, is widespread in the wheatbelt, and also in the Gascoyne. At the very least the key should have included the known species, even if they weren't given detailed species descriptions. As it stands, this book would better be titled 'Samphires in Western Australia: A field guide to selected Chenopodiaceae tribe Salicornieae'.

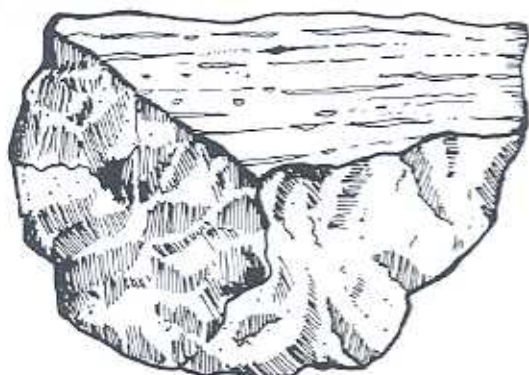
Given that limitation, it certainly is clearer than anything yet produced, and anyone seriously interested in saltland ecology will probably find it useful.

Penny Hussey



## BUSH DETECTIVE

### Facetted rocks



In the big wide valley north of Mingenew which you drive through to get to Mullewa or to Coalseam, some of the rocks are odd shapes. They have one or more flattened sides, often with parallel scratchings along those flattened portions. The official term for this appearance is 'facetted'.

Flat faces can be caused when sedimentary rocks split along layers, like slate, or sandstone. Sometimes flat faces may be caused by the presence of particular crystal structure like mica or feldspar in the original mix, but these flattened rock faces are clearly not part of the original rock structure, they have been made after the rock was formed. So, how were they created? (Hint: read the lead article!)

*Ans: They were formed when ice dragged a boulder along a hard rock surface, wearing away part of the boulder. If there's more than one face, the boulder has been pulled around by more than one ice sheet. More evidence of that Remian glaciation!*

## FUNDING

### Australian Government Envirofund

Last year, this programme under the NHT 2 allocated small grants (up to \$30,000) to groups and individuals. It offered fencing grants at three levels (a) no promises, \$600/km; (b) voluntary management agreement (VMA), \$1600 / km and (c) covenant, \$2000+ / km.

After much negotiation with the Commonwealth, it was agreed that a VMA with *Land for Wildlife* qualified for the middle level of funding, and I am delighted to announce that, as far as I know, all the LFWers that applied under this scheme have received their grants!

This gives you a real monetary reward for all the work you put in to your property to manage biodiversity - for the future of all of us.

So - Envirofund is due to happen again 'early in 2003'. Do you have some remnants that have been assessed by LFW as 'good' or higher (NOT degraded creeklines) and want to fence them? Long narrow breakaways or mallet hills would be ideal candidates. So would genuine bush corridors, eg strips around paddock edges. That middle level of grant is pretty good! And if you are working to your LFW Report, you will find the VMA to be not in the least threatening, in fact it is what you are already doing.

**If you think you might be eligible for this grant scheme, contact your LFW Officer NOW** to discuss your ideas, so that it will be quick to write up an application once the new call for projects is announced.

I really would like to see the extra dollars going to people who have already demonstrated their willingness to care for our biodiversity! Good luck!

### NHT 2

At the time of going to press, the way NHT 2 will be delivered to the community for on-ground works is unclear. Contact your Community Landcare Coordinator for up-to-date advice.

## STOP PRESS

In late December, the Commonwealth Government announced a 'Drought Recovery Round' of Envirofund.

If you are in an 'Exceptional Circumstance Area' you might like to consider an application - closes 14th February 2003.

Contact your LFW Officer for more detail.