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DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Western Wildlife

NEWSLETTER OF THE *LAND FOR WILDLIFE* SCHEME

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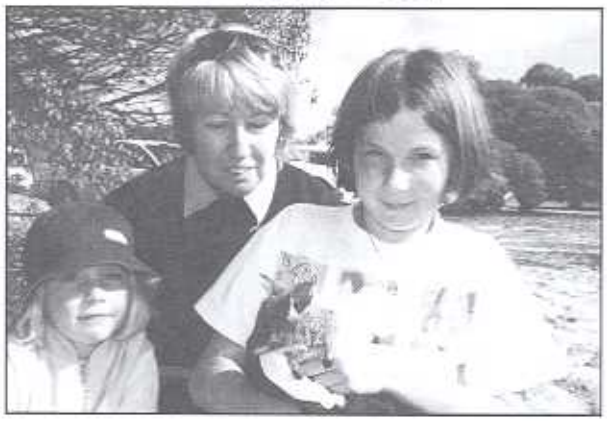
PRESENTATION OF THE 600TH SIGN

IT was a great occasion when the Dwarlaking Catchment Group in East Pingelly played host to Dr Judy Edwards, the Minister for the Environment and Heritage, as she presented '*LFW* sign No 600' to the Gardner Family. In fact, since the whole Catchment Group has joined *LFW*, there were lots of signs to hand out! The Minister said that she was delighted to find that farmers were incorporating nature conservation actions into their property management and complimented the group on their initiative and enthusiasm.

Three generations of Gardners - Noeline, Darren, Chad, Brian, Dot and Gil - with Environment and Heritage Minister Dr Judy Edwards and their sign.

There were about 40 people present and among the other visitors were Keiran McNamara, the A/ Executive Director of CALM, and the President and CEO of Pingelly Shire, who are keen to incorporate biodiversity conservation into their Shire works programme. Ray Rigby talked about birds in the area, past and present. Peter Mawson explained about predator control and native fauna, and later the group decided to undertake coordinated fox baiting. To demonstrate what fauna could be expected to return to the Catchment, Howard Robinson of Pingelly Wildlife Retreat brought some of the animals that he currently has in care. The children were fascinated!



Tara Edwards holds a baby Tammar, supervised by Bev Giles of Pingelly Wildlife Retreat, while Bronte Marshall waits her turn. ▶

On the Gardner's property are several fenced patches of bushland in excellent condition - including a superb stand of Silver Mallet - so, to walk off the huge lunch, everyone went for a ramble. There was tremendous excitement when Tammar tracks were seen! Give them the right conditions and native fauna will return!

More pictures on page 20

EDITORIAL

Greetings everyone!

January 2002 will be the start of the sixth year of Western Wildlife. We'd like to make it a bit of a celebration of what YOU have done.

Can you send us a pic of something that's happened on your place since you first registered with *LFW*? For example: regeneration in fenced bushland; how the new bush corridor is growing; a native animal not seen before on the property; a plant you particulary like; weed control activities; local school excursion to bushland; habitat island established, etc. We'd like to make up a 'centrefold spread'!

I am sorry to report that Volker Mischker has moved to the tree-planting area of CALM, and is no longer working with *Land for Wildlife*. In the six months that he was with us, he has done a lot to raise the profile of flora and fauna conservation in the Esperance area, and hopefully we will find someone else to carry on the work. I am sure that all *Land for Wildlifers* will join with me in wishing Volker every success in his new position.

Included in this issue you will find two new Wildlife Notes: No. 8, "Living with Echidnas" and No. 9, "Photographic Monitoring of Vegetation". I apologise for the latter - one of the photos on p4 is incorrect. The printers put in one from each of two different sites, and I, as editor, should have picked it up in the proof. Apologies! Still, the principle of how to set out a monitoring photo remains correct.

Best wishes for an ending to the season that is much better than it looked as though it would be earlier in the year!

Penny Hussey

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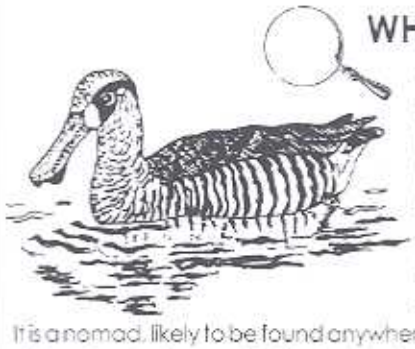
BUSH DETECTIVE

WHICH WATERBIRD IS THIS?



When rains fill the claypans and shallow ephemeral lakes, numerous waterbirds arrive to feast on the abundant microscopic life. One of the most spectacular-looking is a smallish duck with a heavy bill, dark brown back, buff undertail, pink patch behind the eye and a zebra-striped underside.

It is a nomad, likely to be found anywhere where there are shallow open expanses of floodwater, from which it sieves microscopic organisms through a filter system in its oddly-shaped bill. It breeds opportunistically, making a downy nest in a clump of vegetation, always above the water. Sometimes it may re-use an old Coot or Little Cormorant's nest.

Primarily a bird of the inland, it is increasing in the south-west of WA. It reached the Swan Coastal Plain in the 1950s and the Esperance area in the late 1970s, and was commonly seen on secondary saline areas in the N and NE Wheatbelt after heavy summer rains a few years back.

It is a ????

Pink-eared Duck (Malacorhynchus membranaceus)

LANDFORM

IRON-STONE GRAVELS AND NATIVE VEGETATION

Jim Barrow

IN a previous article in *Western Wildlife*, Vol. 5 No.3, "How South-west WA's Landscapes Formed" we noted that much of the South West is very sandy. That is true but there is another important characteristic. There is also a lot of iron-stone gravel, sometimes cemented into massive horizons we call break-aways. So why so much iron?

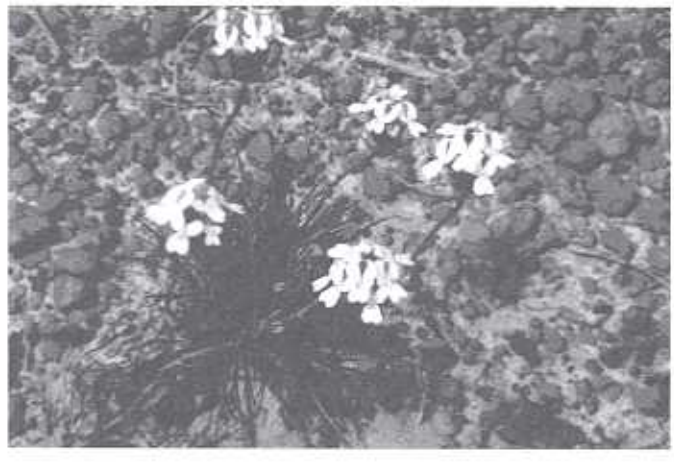
Iron metal loves oxygen. That is why our cars keep rusting. Once iron has grabbed enough oxygen, it is very stable. That is why soils are usually reddish brown. The colour is largely due to iron oxides and these are so stable that they get left behind as other materials weather away. The colour depends partly on the kind of oxide: warm conditions are more likely to produce an oxide called haematite and hence reddish colours; cooler conditions are more likely to produce an oxide called goethite (yes, it is named for the German poet - who was also a mineralogist) and hence yellow-brown colours. This is why soil colour tends to be redder as we move north. The colour is modified by organic matter - low amounts of organic matter explains why many soils of the inland are so bright.

However, iron can become mobile under some conditions. One of these is if you can pinch some of the oxygen from the iron metal - that is you can 'reduce' the iron a bit. You can do this under waterlogged conditions as the decomposition of organic matter uses up the oxygen. The iron can then move around with the water and if the water comes back to the surface the iron will get re-oxidised to the stable form. This is probably the origin of the iron-stone soils on the Western Australian coastal plain.

If you break up some of the iron-stone gravel and look at it with a lens you can see that the round particles consist of concentric layers. The rounded particles are often further cemented together by more material. The standard explanation is that this was due to alternating periods of wet and dry. During the wet periods, the iron was reduced and moved around. During the dry periods it was re-oxidised and stabilized. By this argument, the whole of the south west was at one stage covered by a blanket of this material and by implication the climate must have been pretty extreme at that time with alternating wet and dry seasons. The break-aways are then supposed to be the remnants of this material left behind as the rejuvenated streams cut back.

This widely-accepted picture has recently been questioned. There is another way iron could become mobile. Many of our native plants secrete large amounts of citrate from their roots. Dryandras and banksias are very good at this. The citrate dissolves iron oxides and this releases some of the phosphate locked up by the oxides - one reason why these plants can grow in such low-P soils. Citrate doesn't last very long in soils. It gets eaten by the soil bugs. So you have another mechanism by which soil iron can have alternating cycles of mobility and stability: mobile while the citrate is there, fixed when the bugs have eaten it. According to this theory, the break-aways are not remnants of a previous blanket of iron oxides but faces that are exposed to air so the bugs can thrive and oxidise the citrate there. They are not remnants but are forming still. They too exist because of Gondwana. The upheavals associated with its formation injected lines of more-basic rocks (called dykes) into the granite. These dykes are richer in iron. It is on them that the break-aways form. We have always argued that banksias and dryandras grow on these soils because they can survive the pretty tough conditions. That is still true, but the extra dimension is that maybe the plants cause the tough conditions.

So the overall picture of a flat, boring, sandy landscape becomes much more complex when we look at it in detail. Both on a large, and on a small scale there is a great deal of complexity. This complexity is one reason for the extraordinary diversity in the flora as each species finds its own niche within the complexity. The ancient nutrient-deficient soils have forced plants to come up with different strategies to cope thus producing further diversity. Further, there has been a very long period without major catastrophe to bring the vegetation back to a few species. Contrast northern Europe - the standard against which we have tended to compare ourselves. There the ice age scraped everything clean and the Alps provided a barrier to subsequent invasions. Consequently, the whole of Britain has only about the same number of plant species as the Fitzgerald River National Park. There have, however, been great stresses as the climate waxed and waned and this caused species ranges to expand and contract. This was another factor in increasing diversity as separation permitted species to diverge.



Ironstone gravel is common to many wildflower photos. Did the ability of many native plants to excrete citrate contribute to the formation of this gravel?

Jim Barrow is a "semi-retired" CSIRO scientist.
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FLORA

THE GREAT GREVILLEA HUNT

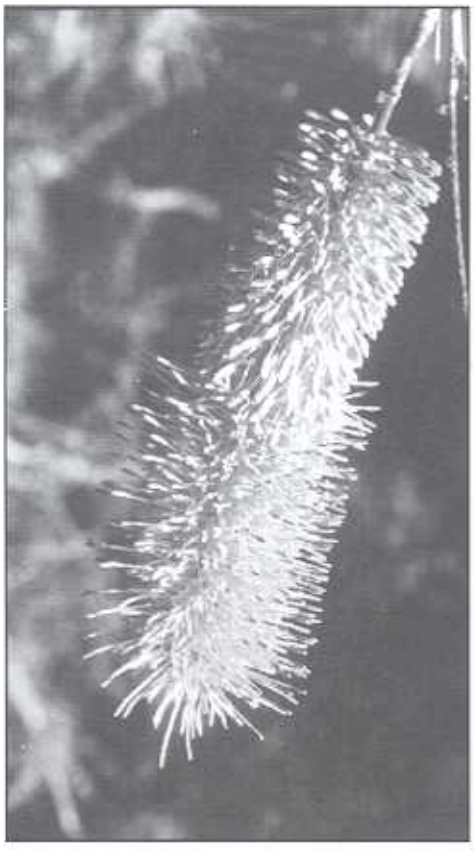
Neil R Marriott

HAVING had the fortune to study, in the wild, nearly every Australian Grevillea for the production of our three Grevillea Books, co-author Peter Olde and myself realised that there was still much research required into the genus. Close liaison with the Perth Herbarium confirmed this. As a result Peter and I make an annual pilgrimage to the West, spending weeks in the field tracking down new or unusual species, as well as those requiring further study. Last year's trip must rate as one of the most memorable we have ever undertaken.

The wonderful Mary Squires from Mukinbudin has an indigenous nursery growing thousands of the local plants. While showing Peter around the district the week before I arrived, Mary noticed a lovely red flowered Grevillea growing along a backroad. Examination revealed it to be a new species, never before collected!!

With this in mind we decided that we had better get back into this most easterly part of the central wheatbelt to have a closer look and to collect herbarium specimens. Heading out east we travelled through the tragically degraded heart of Western Australia's wheat bowl. Practically all the native vegetation was swamped by exotic annual grasses! In addition, salinity has already destroyed all the low-lying areas and is spreading rapidly.

Fortunately the further east we went, the better the natural environment became. Just to the southeast of Mukinbudin, in an area where granite comes to the surface, we found the rare *Grevillea minutiflora* and the even rarer *Acacia denticulosa*, a beautiful plant with huge golden rods and "leaves" like sandpaper. Not surprising that they are rare when you look around



Grevillea magnifica.

and see what has been cleared!

We took a quick look around Mary's magnificent natural wildflower garden. The block had previously been rolled for cropping - not once but twice!! Still it has come back with massed displays of the region's flora. Dominant in many areas was the spectacular large rich cream Woolly Flower Grevillea *G. eriobotrya*. This is a rare Priority 1 species, but is abundant here. Other Grevilleas we found included free flowering specimens of Flame Grevillea *G. excelsior* with its fiery orange flowers, *G. eremophila*, *G. didymobotrya*, *G. apiciloba*, *G. huegelii*, *G. shuttleworthiana*, *G. eryngioides* and on occasional granite rises *G. magnifica* and *G. levis*. As well there was a wealth of other spectacular sandplain flora - *Boronia adamsiana* with showy pink flowers, Hakeas, Banksias, Isopogon, Persoonia, pink Thryptomenes and many more. It is a credit to Mary and her husband that they have set aside this area for the environment.

From the Squire's bush block we headed off to survey the new species discovered by Mary the week before. As it turned out it was just one of the many new species and subspecies we would find on this amazing trip! Mary's new Grevillea has quite long pendulous burgundy red flowers, set amongst deeply divided, slightly prickly grey-green leaves. It grows to around 1m x 1m and sadly is confined to a small population along ONE roadside. Had the adjoining farmer or the Shire decided to "tidy" the roadside, we would never know that this new species ever existed! Just how many plants have been lost like this in the west we will never know!

From Mukinbudin we headed south to Karalee, a pumping station town on the Perth-Kalgoorlie pipeline. We were looking for another rare Grevillea, without luck, but we did find several unusual new red flowered grevilleas. "Another new species" we thought at first, however closer examination showed them to be beautiful natural hybrids between *G. oncogyne* and *G. huegelii* that were both growing nearby.

Heading on to Yellowdine on the Great Eastern Highway, we turned due south of the town on the Mt Palmer Rd. We had not gone far before we came upon a lovely area of flat outcropping granite. Here we found the typical "echidna like" prickly low plants of *G. tetrapleura* as well as *G. acacioides*, *G. levis*, and a beautiful low pale yellow flowered Verticordia with long styles.

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Continuing south we came upon an area of woodland with *G. oncogyne* plants growing to several metres in height – this is a hardy and attractive species, and one specimen we found was a spectacular display of bright red flowers. West of Mt Palmer the vegetation opened out to sandplain or kwongan. There was a massed display of heathland plants including the most beautiful *G. ceratocarpa* specimens Peter and I had ever seen. These were silver-grey soft foliaged shrubs to 2m, with showy erect spikes of white flowers twice the length of any we have seen previously. It most likely warrants recognition as a new subspecies.

This region is one vast botanic paradise – only the inroads of the mining industry mar the beauty of an area where rare and unusual plants abound in a land that remains the same as it was before white man arrived. We headed down to the Parker Range, where we found the distinct "Parker Range form" of *G. obliquistigma*. It forms a showy green shrub to 1m with massed spikes of cream flowers that turn a most attractive pinky red on maturity. Nearby the rare and beautiful *Hakea pendans* with its weeping pink and white flowers also occurs. Here we also found a wonderful new subspecies of Huegell's Grevillea *G. huegelii* that formed glaucous blue-grey mats of thorny foliage beset with bright yellow flowerheads. In the sparsely vegetated woodland they stood out in spectacular fashion on the red-brown stony soil.

Just south of Mt Parker we re-located *G. lissopleura*. This must surely be one of the most elusive Grevilleas in the west. It took Peter and I at least four trips to the area in the 1980s before we "discovered" it. This is its only known location, recorded in the early 1970s by the late Ken Newbey, and only noted because it was in full flower as he drove past!! On a small ridge stand a handful of mounded green shrubs. It makes you wonder about the complexities of evolution when you see plants with such limited natural distribution.

FLORA

We then headed on to Mt Holland, to try and relocate *G. marriottii* where I had originally discovered it while searching for *G. lissopleura* a decade earlier. At the type location for *G. marriottii* most plants found were old and half dead. Rather disturbing, for this is also a rare species. However on the southern slopes of Mt Holland we found a wonderfully healthy colony growing in a gravel pit. Many of the plants at this site had quite attractive broad leaves and massed flower buds.

At a place called "Digger Rocks" (where are the rocks??) we found the rare *G. lullfitzii* growing in coarse laterite. This plant, like so many in the region, has never been recorded at any other location. Also here we found specimens of the beautiful holly leaf *G. insignis* ssp. *elliotii* with pure white flowers that aged to a rose pink (their normal colour is red). Unfortunately cuttings from this unusual form failed to strike. In the dense scrub at this site we also found the rare and beautiful *Dryandra viscida*, so named from its sticky seed capsules.

Sadly in this area, large tracts of this unique flora are rapidly being destroyed by mining activities. Evidence of this came with a shock when we headed west along a pipeline track in search of a beautiful new yellow flowered Grevillea that I found here the year before. The roadside where the plants had originally been located was now considerably widened, and with the widening went the new Grevilleas!! Despite thorough searches of the bush in the area and along the track in both directions no further plants were to be found. Fortunately material collected the year before was successfully grafted and the plant, about to be published as a new species by Peter and I, is at least surviving in cultivation!!

From Digger Rocks we headed west towards Varley, where we found an unusual form of the rare *G. prostrata* with larger than normal leaves and pinkish-white flowers. Here also was the extremely widespread *G. eryngioides* with its beautiful glaucous blue-grey lobed leaves and wonderful suckering habit. What a pity it doesn't have showier flowers.

Continuing west we stopped to admire the spectacularly large specimens of the Granite Plume Grevillea *G. magnifica* growing on and around Holt Rock. Many had leafless flowering racemes to 5m in height. Superficially similar to *G. petrophiloides*, the Granite Plume Grevillea has far larger flower racemes and is always found on granite intrusions. The rapid growth rate and large plumes of showy pinky-red flowers make this one of our very best garden plants. Native birds love it.

To be continued next issue.

Neil Marriott is an ecologist who works with the Victorian 'Trust for Nature'.

REVEGETATION

REVEGETATION - FROM PLANS TO IMPLEMENTATION

Jenny Dewing

NATALEE KUSER and David Singe bought a property on the Blackwood River in Boyup Brook at the end of 1998. In just over two years they are well underway on an ambitious program of fencing and revegetation to protect and create wildlife habitat. Thoughtful design, sound technical advice and staged implementation exemplify this practical project.

David and Natalee said *"We wanted to place a basic nature framework over the land, making the most of existing bush remnants and the river corridor. This allowed us to define the areas in which we would concentrate our immediate vegetation restoration and re-introduction efforts, and provided a backdrop for other future activities on the property."*

Previous Landuse.

The Lodge Road property was originally a large farm subdivided to create a number of medium sized rural holdings, of one to two hundred acres. Prior to subdivision the river flat country provided rough grazing for sheep and was occasionally cropped.

The property stretches for two and a half kilometres along the Blackwood River, with a number of river habitats including old paperbark thickets, seasonal wetlands and long river pools. Sections of the foreshore are well vegetated. Soils are mainly of the Blackwood Valley System ranging from sandy duplexes to gravelly sands to shallow rocky soils with granite outcrops on the highest sites.

Small remnants of the Jarrah - Marri -Wandoo woodland persist on the rocky outcrops as elsewhere, but grazing appeared to have removed the entire understorey.

Creating the Plan

When David and Natalee bought the property at the end of 1998, they carried out an initial assessment of the soil and vegetation types, the condition of the river foreshore and upland remnants, potential weed problems and looked for signs of rabbit activity.

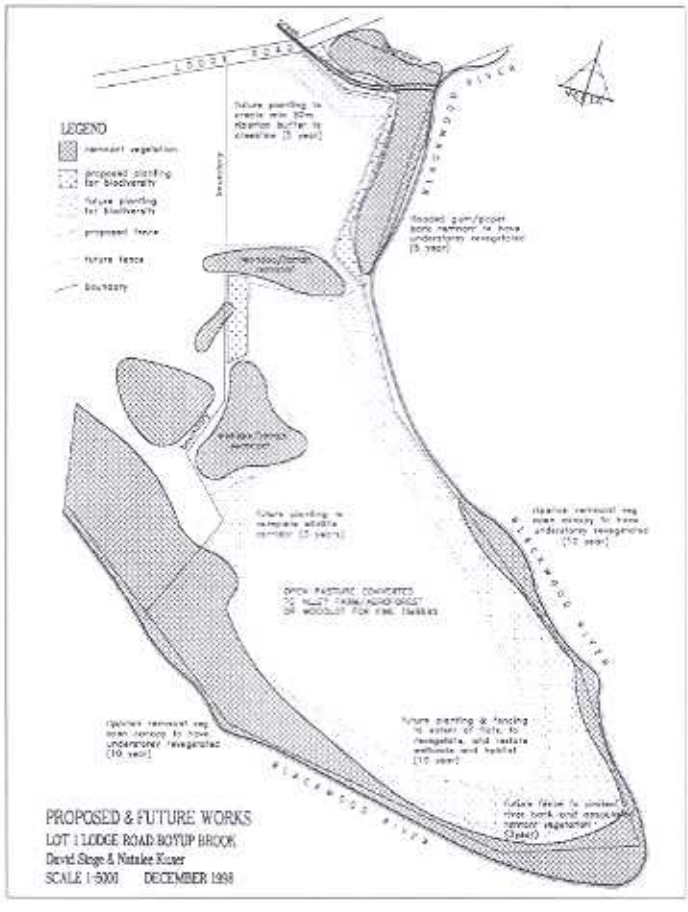
With this information they set out to create a property landcare plan with the work to be staged over a number of years. The plan included fencing to protect the vegetation remnants and the Blackwood River foreshore, revegetation of the foreshore and creekline and connection of the bush patches to create functional wildlife corridors.

This plan has steered them through two successful grant applications and has clearly set out the stages by which the extensive rehabilitation task is tackled.

One of the first steps in this program was to obtain advice on revegetation and the creation of wildlife habitats. They joined *Land for Wildlife* in December 1998, at about the time that they were preparing an application for incentive funding from the Blackwood Basin Community Startup Scheme. *Land for Wildlife* provided site-specific revegetation lists for hand planting and direct sowing and technical support for revegetation and assisted natural regeneration techniques, as well as information on creating habitat for wildlife. As the river flats had been grazed continuously for a long time, an adjacent property's river flat site in good condition was used to compile the species list. David and Natalee became interim members in the *Land for Wildlife* Scheme, with the prospect of full registration when the rehabilitation program was well underway.

Seeking Funding

Incentive funding received in 1999 from the Blackwood Basin Group provided a kick-start to the project. Then in 2001 funding from the Blackwood Valley Landcare Zone provided another boost, subsidising and expanding their program of work for that year.



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Trial and Error

In 1999 the first section of river foreshore, the rocky ridges and creekline were fenced - some two kms - creating a corridor of varying width, not less than forty-five metres.

Two and a half thousand local native seedlings were planted, with the help of the local Green Corps team, on 2.5 hectares of creekline and upland ridge. Cheryl Hamence (Bridgetown Community Nursery Manager) together with Natalee raised these seedlings from locally collected seed, particularly understorey species. Extra seed was collected for direct sowing trials on the rocky ridge areas.

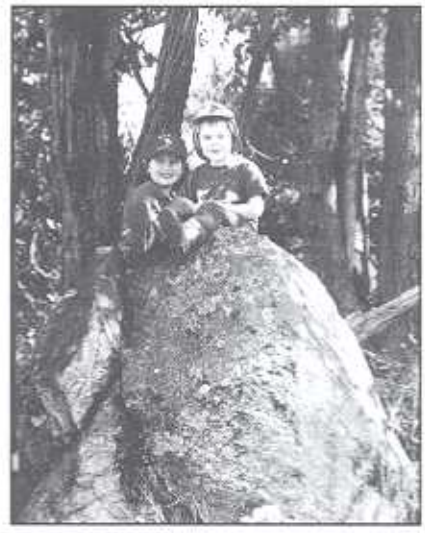
Some valuable lessons were learnt from this first revegetation effort. Although about 70% successful, seedlings were lost because of poor species to site selection, rabbit damage and using some smaller less vigorous seedlings. Site preparation was adequate but plants that were planted in the wrong position on sandy banks, or in areas where they were inundated for a prolonged time, did not survive. The value of tree guards was highlighted for good seedling establishment in all situations and where rabbit control was not adequate.

In 2000, Natalee collected seed and raised another thousand seedlings. These were used as infill in the less successful areas from the previous year. Bare rooted Melaleucas were also trialled. A soil wetting agent was added to the non-wetting sandy areas on the upper bank of the foreshore. Tree guards were reused from the previous year. Despite the poor season due to the abrupt early finish, about 50 % of the seedlings successfully established.

Natural Regeneration

By December 2000 natural regeneration on the fenced river flats was becoming noticeable. *Eucalyptus rudis* volunteered readily together with an excellent crop of paperbarks in one particular site and native lobelia along the water's edge. Rushes and sedges bulked up, particularly *Baumea preissii*, a common plant on wet flats along the Blackwood River and tributaries in this area.

REVEGETATION



Scarlette (8) and Isobel (5) in a rocky remnant

Direct sowing was trialled the previous year but failed because of weed competition. However, seed that was scattered opportunistically into suitable niches along the seasonal lagoons germinated quite well. Gradually the foreshore understorey is returning and a healthy population of native grasses is spreading. Evidence of recovery of understorey on the rocky ridges in the fenced areas is apparent. Previously non-visible species (due to grazing pressure) making some impact such as Hibbertias, seedling grass trees (with no parent plant in the vicinity), native grasses and ferns and more!

In early 2001, *LFW* invited David and Natalee to fully register the property. Their new sign proudly stands amongst the recently established understorey of the Flooded Gum woodland. It is eye-catching from the road.

Next Steps

Natalee and David plan to continue this year with another section of the river to be fenced in 2001, bringing the total river fencing to two thirds of the foreshore length.

They want to concentrate on increasing structural diversity in areas that they have previously fenced and planted, adding ground covers and native grasses to the established Wattles, Rock Sheoak and Lemon-scented Myrtle.

They are keen to try small heap burns, further direct sowing and techniques such as smoked water. In the future they are looking at connecting the rocky ridges to the river by stepping-stones of vegetation. The low-lying swampy areas of the river flats will be fenced and revegetated to create habitat for local water birds.

It is too early to assess the impact of this new vegetation on wildlife numbers but there has already been a noticeable increase in the number of small birds. Monitoring bird species and numbers, spotlighting for small mammals and recording frog calls are all useful monitoring techniques, together with photo monitoring points for vegetation.

David is researching long term high value timber trees such as those grown for the craft wood market. Possibilities for this area include Rock Sheoak and River Banksia.

The bigger picture

There are a number of similar properties along the Blackwood River near to this one. Several other landholders have joined the *Land for Wildlife* program and are in the early stages of the same process as Natalee and David. There is an opportunity for these landholders to work together. Already David and Natalee have shared their experience with nearby *LFW* neighbours.

Management actions such as weed and feral animal control and creation of wildlife corridors are much more effective if carried out at a landscape level.

The Blackwood River in this part of the Blackwood Valley has sections of good vegetation remaining, is wide and offers a variety of habitats including deep pools and broad seasonally inundated flats. It is already a significant wildlife corridor that deserves to be protected, enhanced and managed for its conservation value.

Jenny Dewing is the Land for Wildlife Officer in Bridgetown. She can be contacted on 9761 2318.

FLORA

ARMILLARIA ROOT DISEASE

Richard Robinson

IN Western Australia, Armillaria root disease is caused by the pathogenic fungus *Armillaria luteobubalina*. It is an indigenous pathogen and is widespread in wandoo, tuart, jarrah and karri forests as well as in the coastal heath vegetation. The pathogen attacks and kills the roots of susceptible trees and shrubs and spreads from host to host by root contact. The list of susceptible hosts is extensive and is likely to include all native shrub and tree species as well as all introduced species. In undisturbed native forests and woodlands, however, Armillaria root disease is normally only associated with the death of trees weakened due to competition, age-related decline or environmental stress. Generally it is not the primary cause of death in healthy forest trees.

In recent years, reports of Armillaria root disease killing trees in backyard gardens and in remnant bushland on farms (*Fig. 1*) have increased. This increase is likely due to two reasons. Trees in remnant bushland are under increased physiological stress, due to exposure

Figure 5. *Mushrooms produced by Armillaria at the base of an infected tree*

(which increases transpiration rates) and a rising water table, making them susceptible to disease. Trees and shrubs in backyards are succumbing to infection spreading from stumps or infected tree roots left following clearing of the bush when towns or new suburbs are established.

DISEASE SYMPTOMS

Trees are generally tolerant of Armillaria infection and do not usually show symptoms of the disease until it spreads all the way along the root to the root collar. When the pathogen spreads from the root into the bark at the base of the tree, an inverted V-shaped lesion, that is very similar in appearance to a fire-caused scar, may form at the base of the tree (*Fig. 2*). Even at this stage the tree crown may still appear healthy or normal. If or when the pathogen spreads to completely girdle the base of the tree, the tree then dies quite suddenly. Removing the bark from infected wood exposes a characteristic white fungal material (*Fig. 3*), often forming fan-shaped mats on the surface of the wood (*Fig. 4*). Armillaria also produces a light yellow to white stringy rot in infected wood. In the winter, rotted wood around the base of an infected tree is characteristically very wet and "mushy", and in the summer it is usually dry and "crunchy".

In the autumn, the fungus may

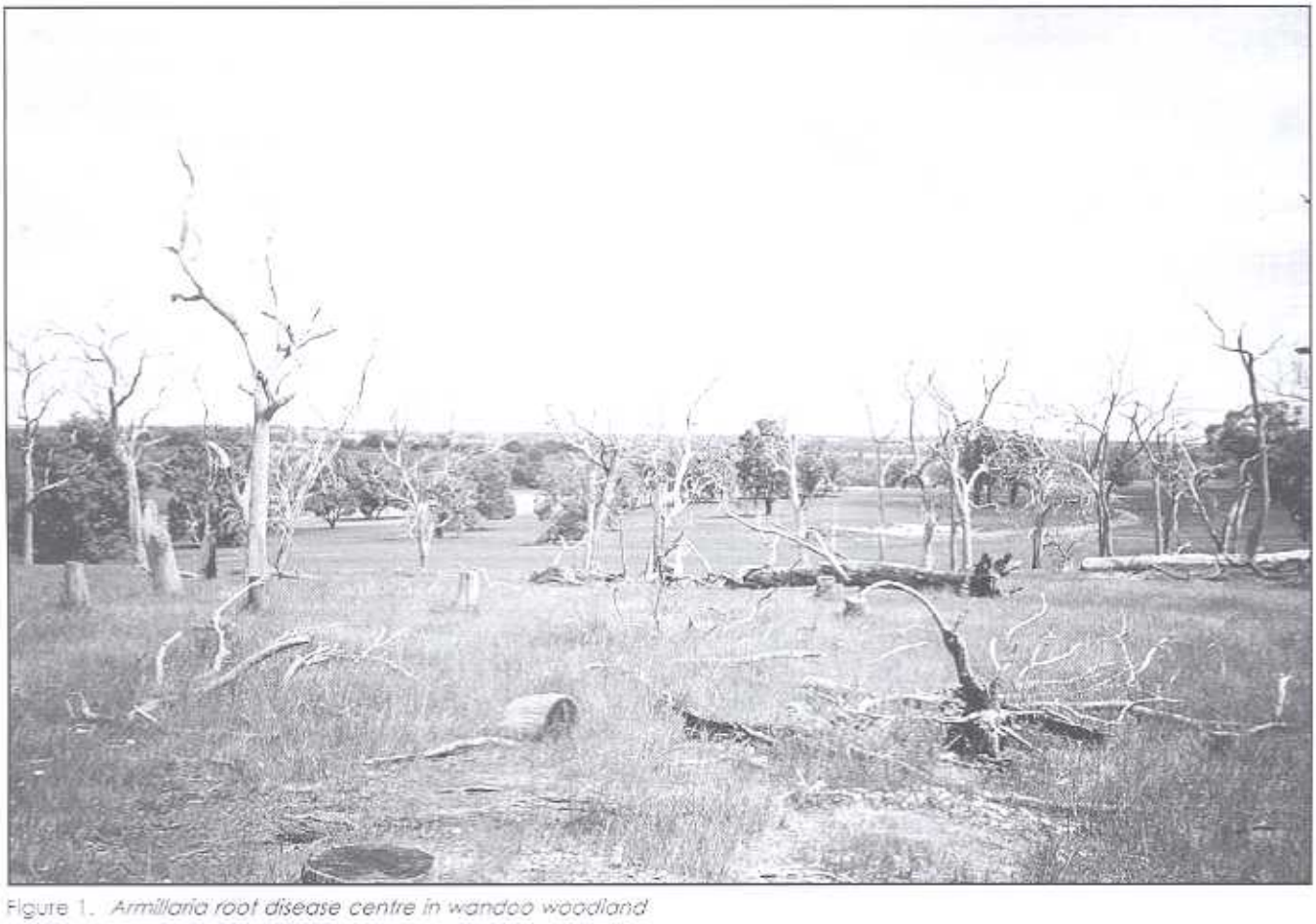


Figure 1. *Armillaria root disease centre in wandoo woodland*

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Figure 2. Armillaria scar at the base of a tree

Figure 3. White fungal mats under the bark of an infected tree

Figure 4. Fan-shaped fungal mats on the surface of infected wood under the bark

FLORA

form a cluster of yellow mushrooms on the base of the tree or on the ground close to the tree (*Fig. 5*). The mushrooms on the ground originate from an infected root. There are several species of fungi that look similar, but the dry cap surface of *Armillaria luteobubalina* is covered in the centre with tiny black scales that give it a characteristic sandpaper-like texture.

INFECTION AND SPREAD

In wet forests, Armillaria may survive for decades in the stump of a large tree. It spreads when the roots of a healthy tree encounter the infected roots of a stump or neighbouring tree. Healthy vigorous trees usually confine the infection to a discrete lesion on the surface of the root. However, if the tree becomes stressed or weakened the infection can rapidly spread from the lesion. If the health of the tree improves it may check the spread of the pathogen once again, but if it does not the pathogen can quickly spread through the whole root system and eventually girdle and kill the tree. When healthy trees within an infested stand are felled, Armillaria can rapidly spread into the resulting stumps. These stumps provide an increased infection source and are responsible for initiating new disease centres.

MANAGEMENT

Because *Armillaria luteobubalina* is a native pathogen it is not feasible to expect complete eradication. Management should thus be directed towards limiting buildup of inoculum and reducing disease impact. The most efficient method of achieving this is through removal of all infected material from the soil.

In backyard gardens where infection is limited, maintaining vigorous growth and minimising stress may provide adequate management options. In the dry Western Australian environment, mulching may help prevent moisture stress. If or when plants are killed, be sure to remove all infected material from the soil before planting replacement shrubs or trees.

In remnant bushland on farms, the trees are generally over-mature and have little regeneration under them. Check the roots and base of standing trees that have been dead for many years and old stumps for symptoms of infection. If there is no sign of Armillaria-caused rot in the wood there may be no reason to remove them. Although Armillaria can survive for decades on large stumps in wet forests the survival time in hotter, drier environments is likely much shorter. However, the stumps of recently killed trees should be uprooted and removed. It is expensive to remove large stumps, unless landowners own their own heavy machinery, but it is the best option. Stump removal should be followed up with raking the area to remove infected roots. Isolated stands should be fenced off to allow natural or planted regeneration to grow and an understorey to develop. This will help alleviate environmental and grazing induced stress. If the infested area is adequately prepared and managed then there should be sufficient survival of regeneration to replace the trees lost to disease.

Sometimes other factors may be more significant than Armillaria. Before embarking on a management option, be sure to make a thorough evaluation of the situation and rule out the possibility of site and stand characteristics that may be contributing to your trees being susceptible to Armillaria root disease. Planting and protecting regeneration, to improve site quality and the health and vigour of your remnant stand, will go a long way to increasing the resistance of the trees not only to disease but also to insect pest attack.

Richard Robinson is a Research Scientist in Forest Pathology and Fungal Ecology, at the Department of Conservation and Land Management, Manjimup. He can be contacted on 9771 7993 or e-mail: richardr@calm.wa.gov.au

PRACTICALITIES

ELECTRIC FENCING TO PROTECT REMNANT VEGETATION

Bill Ladyman

WE purchased our 350 hectare Wandering property "Knockmealdown" in 1997. In the winter and spring of 1999 we fenced all our remnant vegetation (RV) which was in beautiful condition and contained well over a million trees and shrubs in about 25 linked areas and adjoins a State Forest. The fencing logistics:

- 34 kilometres around 160 hectares of RV
- 44 gateways with non electric wire gates
- 600 bends because of a desire to fence tightly so as not to include pasture.
- The terrain is "breakaway country" ie steep and rocky.

The decision was made to use ***permanent electric fencing*** because:

- Electric fencing is a proven system over many years.
- Highly effective control of any type of livestock.
- Ability to negotiate the most difficult terrain.
- Ease of monitoring the entire fence condition from the homestead and the shed.
- Inexpensive to purchase and install the fence.
- Good support from Gallaghers the principal supplier with visits and advice.
- This particular fence design does not inhibit the movement of native (or feral) fauna.
- The fence can be built of long lasting materials.
- Less environmental impact
- Our ability to complete the whole project in less than 120 man days including part time inexperienced assistance (one capable but bemused Registered Nurse!)

A great feature of the decision to use electric fencing is that as well as protecting RV on one side of the fence is the opportunity to power a ***strip grazing system*** on the other side, which would allow the use of deep rooted perennials. These sort of pastures can then complement the RV's control of watertables, while providing greater pasture productivity, particularly with the prospect of greater seasonal variations because of climate change.

Another significant attribute of an electric fence system is that it is much less of a physical structure and instead is a ***mental barrier***. Livestock do not lean, rub, hug or touch the fence. They learn overnight not to handle it. The best way to describe it is that it feels like being hit hard with a cricket bat. The mains powered energiser draws 15 watts (like the dimmest of light bulbs) and costs about $20-25 per annum to run. Energisers are regulated by law in their output and frequency.

The system is not for ***boundary fences***. They require:

- A physical and mutually acceptable division whether the owners or tenants are resident or not.
- Ideally, in time, a fully vermin proof barrier (which can include electric components) and systems designed for the passage of particular fauna.

Bend structure.

Gateway detail.

The machinery involved was the use of a tractor with post hole digger for the 88 strainer posts of the 44 gateways. The rest of the fencing required a 4 WD utility and 4 wheel trailer which carried our ***home made 4 coil spinning jenny*** to run all 4 wires of the fence together while we placed out posts and droppers.

The project also required us to develop two other components not available commercially.

- A stable ***bend structure*** made of one-and-a-half galvanised steel posts that could be driven into any location.
- Porcelain insulators mounted as ***insulator pulleys*** in galvanised stirrups that would allow wires to be strained easily around a number of bends. These were bolted to the bend structures.

Costs:

Because we were happy to place our RV in a conservation covenant we succeeded in obtaining funding at the rate of $1200 / kilometre. This amount covered all materials, labour, energiser, voltmeter, etc and also covered specialised assistance for the development of

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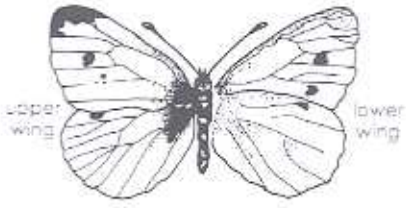
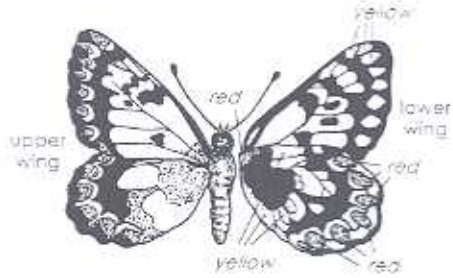
FAUNA

THE WHITE BUTTERFLIES



Cabbage White
Colour - cream with black patches.

Generalised White pupa



Wood White
Upper - cream and black
Lower - cream and black with some red and yellow infill.

HAVE Cabbage White butterflies increased in numbers since canola started to be widely planted? Anne Rick, *LFWO* at Newdegate asked this question after she noticed a large number of them taking nectar from a *Scaevola spinescens*. The answer is, no-one knows. The caterpillars will attack canola, but only in its younger stages, and crop spraying would control most of them. But the canola now increasingly prevalent on road verges is a possible weedy host ...

The Cabbage White (*Pieris rapae*) is native to Europe and the Mediterranean. The butterfly is nomadic, and a good flier, but its spread has undoubtedly been helped by humans carting vegies around. It first appeared in North America in 1860 and had spread across the continent by 1883. From there it reached Hawaii in 1898, and New Zealand by 1930. In Australia it was first observed in Victoria in 1939 (presumably having come from NZ), and by 1943 had reached Perth - this despite a ban on importing brassicas from the eastern States.

The pale yellow eggs are laid singly on the underside of the leaves of a food plant, preferably cultivated brassicas - cabbage, cauliflower, sprouts and broccoli - but they will eat almost any member of the cabbage family (*Cruciferae*) including the weedy radish and turnip. It is unlikely that they could have spread across Australia so quickly if the introduced weeds hadn't already preceded them. The velvety-green caterpillar is difficult to see, but the results of its voracious eating are not - a few can easily totally demolish a backyard cabbage patch. The caterpillar eats, grows and moults five times before leaving the host to seek a vertical structure such as a fence or tree, where it will pupate. Adults appear in spring.

Although they prefer crucifers, the caterpillars will live on some plants from other families, notably nasturtiums and mignonette. Australian crucifers are small and inconspicuous, without much leaf area, so are unlikely to be utilised by this butterfly, however, as Anne's observation demonstrates, the adults are clearly using native plants to fuel up as they search for new host plants.

The Wood White (*Delias aganippe*) is WA's only native close relative White butterfly. It's a beautiful animal, slightly larger than the Cabbage White, with its wings intricately patterned in black and white with red and yellow patches added to the underside. The caterpillars are dark brown with white spots and are somewhat hairy. They feed on mistletoes, or occasionally Sandalwood or Quandong. Pupae can be found on the twigs or branches of the food plant. It is possible that the adults can no longer locate mistletoes on isolated paddock trees or in roadside groups, and so the loss of this particular herbivore could be another reason why mistletoe infestations seem to be on the increase.

Penny Hussey

Electric Fencing continued from page 10

the spinning jenny and bend structure and porcelain insulator pulleys.

Other details:

- The treated pine strainer posts are 2.1 metres long and sunk up to 1 metre into the soil and braced with a treated pine ***backlog*** of 0.9 metres just below the surface.
- All inline posts are galvanised or black steel with black UV stable polythene insulators.
- Droppers are of black UV stable polythene and slotted every 25 mm.
- Gateways have double insulated cabling underground by-passing the gate for live and earth wires.
- The entire fence grid is broken into switchable sectors and fault tracing is straightforward and diagnosable from the mains powered 15 watt energiser.
- A ***livelight*** is installed near our house and we can tell at-a-glance the fence condition.
- Contrary to common belief electric fences do not start fires.

Believe me, it works!

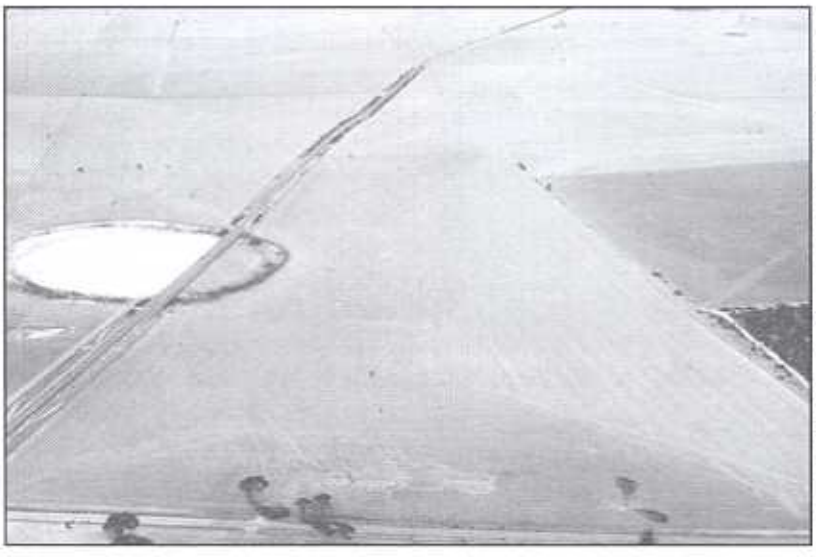
This is an ideal fencing system for hilly landscapes or blocks with many patches of remnant vegetation. To discuss in more detail, contact Bill on email: ladyman@treko.net.au

RESEARCH

VIABILITY AND PERSISTENCE OF SMALL ISOLATED POPULATIONS OF RARE AND THREATENED FLORA. IS THERE HOPE?

David Coates and Colin Yates

THE capacity for flora to survive and persist in small isolated populations, particularly narrow road reserves and in small vegetation remnants is generally viewed pessimistically, given theoretical ecological and genetic predictions and current documented declines in so many of these populations. Present data indicates that 25% of WA threatened flora populations are on road reserves and that the vast majority of these populations are small and declining. Yet recent genetic and ecological studies suggest that these small populations are reproductively viable and potentially capable of persisting if provided with appropriate conditions for seedling recruitment such as soil disturbance or fire and most importantly that they are free from competition with environmental weeds. Studies also suggest that a moderate increase in population size may place these populations over size thresholds that may allow for longer term persistence. Following are two examples of threatened flora that have populations on road reserves where genetic (*Banksia cuneata*, matchstick banksia) and ecological (*Verticordia fimbrilepis*, shy featherflower) studies provide some encouraging signs for the survival of small roadside populations.



Banksia cuneata site, Bruce Rock Road, Quairading.

Banksia cuneata is a rare and endangered species found in 10 small isolated populations covering a range of about 100km in the central wheatbelt. Several populations are subject to habitat degradation and loss associated with weed invasion and rising water tables. One of these populations east of Quairading occurs as a narrow linear strip along a road reserve and currently totals 65 plants. Genetic studies carried out on this population in 1989 showed significant levels of inbreeding compared with other *B. cuneata* populations. Theoretical and empirical studies of small plant populations indicate that increased inbreeding in normally outcrossing species can have significant negative effects on the viability and persistence of small plant populations. Thus the initial diagnosis for this population in 1989 was not promising. From 1989 to 1996 the population was increased in size by the planting and establishment of plants from seed collected on site. This work was coordinated by the *Banksia cuneata* Recovery Team and was carried out with the help of volunteers from the Quairading area.

Subsequent genetic studies in 1996 revealed that the increase in population size from 31 to 61 was associated with a significant reduction in inbreeding in the population (Fig 1). In conjunction with this genetic study an investigation was also carried out on the activity of bird and insect pollinators. Although bird and insect pollinator activity was low in this population, compared with the other *B. cuneata* populations, there were still reasonable levels of activity over the flowering period. It was speculated at that time that, apart from the increase in plant numbers, reduced inbreeding may be due to improved, albeit still low, bird pollinator activity.

In 2000 genetic and pollination studies were again carried out on this and other *B. cuneata* populations with preliminary findings encouraging. There was a significant increase in bird pollinator activity compared with 1996 and initial results suggest a marked reduction in the level of inbreeding to a level comparable to other larger and less disturbed *B. cuneata* populations.

The increased pollinator activity over the last few years is probably not only due to the increase in plant numbers in the road reserve (now 69) but perhaps more importantly to the establishment of a further 123 plants (Fig 1), using the road reserve population seed, on land adjacent to the road reserve. Associated with the establishment of this new sub-population was also the planting of

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RESEARCH

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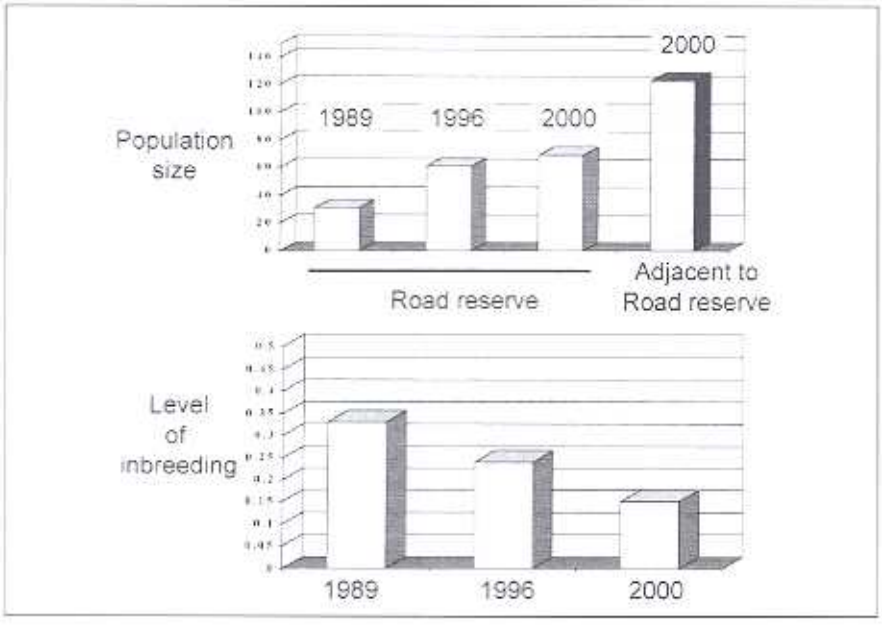

Fig 1. Population size and levels of inbreeding from 1989 to 2000 in a *Banksia cuneata* road reserve population

local native species.

Although we are still investigating this population's capacity to survive on the road reserve it is encouraging to see that, by artificially increasing population size both on the road reserve and on adjacent land, there appears to be a significant improvement in genetic factors that may be important in population persistence.

Verticordia fimbrilepis ssp. *fimbrilepis* is another rare and endangered plant that occurs in a number of small isolated populations on road reserves and in larger remnants of native vegetation vested for conservation in the Brookton- Narrogin-Katanning districts. Research being undertaken into the relative importance of factors which constrain population growth has revealed that these small isolated populations on road verges show equal or greater diversity of insect flower visitors, rates of pollination and seed production compared to larger populations in conservation reserves.

Contrary to what is often thought to be the case, pollinator abundance and diversity, rates of pollination and seed production appear to be independent of population size and landscape context. In relation to pollinator activity this seems to contrast somewhat with the findings for *Banksia cuneata*. A significant outcome of this is that seed production in small road reserve populations of *Verticordia fimbrilepis* ssp. *fimbrilepis* is unlikely to be limiting population growth and therefore responsible for population decline. A more likely explanation is the availability of regeneration niche and competition with environmental weeds. Ongoing studies suggest that the taxon may undergo cyclical fluctuations with time since fire. The taxon forms a persistent soil seed reserve and seeds are smoke responsive. Plants are killed by fire but mass recruitment from soil stored seed reserves occurs in the first winter following fire. Some seedling recruitment occurs between fires but whether this is enough to replace older plants as they die, and thereby sustain stable populations is unknown and probably varies with landscape context. In road verge populations where environmental weeds are abundant, competition with the invasive plants almost certainly will result in death of the Verticordia seedlings. However survival rates of inter-fire recruits in populations where weeds are not abundant are probably higher.

Experiments in a roadside population have shown that massive recruitment of *V. fimbrilepis* spp. *fimbrilepis* and co-occurring common Verticordia species can be initiated through the application of aqueous smoke solution and control of invasive weeds.

Both these studies indicate that management regimes which could involve planting seedlings to increase numbers of the target species, controlling weeds and the use of seed germination stimulants such as aqueous smoke solution can lead to the longer term persistence of small isolated plant populations.

David Coates and Colin Yates work on threatened flora at the Perth Herbarium (ph 9334 0500)

Taxon

Nb: 'taxon' (plural 'taxa') = a term used to denote any scientifically-named group of organisms, eg subspecies, species, genus. It has been derived from the word 'taxonomy', the science of classifying organisms.

Found

You may remember that in April this year we noted that LFW sign no. 346 had gone walkabout. Well, it has reappeared! A CALM staffer working on the Bibbulmun Track found it on the roof of the sleeping hut in the Nullaki Peninsula! Amazing! Its now been returned to its original owners.

REVEGETATION

TREE PLANTING IN WESTERN AUSTRALIA: ENHANCING THE OPPORTUNITIES FOR CONSERVATION OF BIODIVERSITY

Jonathan Majer and Harry Recher

A planted area of mixed, local eucalypt species – a combination that should guarantee the food resource for insectivorous birds.

Rebecca Graham tools up to sample the canopy invertebrates on trees along the Great Eastern Highway.

MOST of the natural vegetation in the Western Australian wheatbelt has been cleared for agriculture. Throughout the wheatbelt, native trees remain only in isolated, often small, and frequently degraded remnants of native vegetation, as single trees in paddocks, and in narrow, discontinuous strips along roads and drainage lines. Now, there are extensive revegetation programs in the wheatbelt. Revegetation has many objectives, including lowering water tables to combat waterlogging and soil salinisation, improving agricultural productivity, and producing a commercial crop of trees for harvesting. Tree planting is also carried out by farmers, conservation groups and government authorities to rehabilitate, beautify and manage degraded agricultural land, parks and road verges. In addition to improving plant diversity and restoring ecosystem functions, revegetation is an opportunity to provide food and habitat for wildlife and to conserve regional biodiversity. In 1999, the Gordon Reid Foundation made a grant to the Northam Land Conservation District Committee (LCDC) to investigate how effective the trees planted in the Northam District were in supporting invertebrates, an important food resource of insectivorous birds and the most important part of biodiversity. The Northam LCDC contracted the project to Jonathan Majer (Curtin University of Technology) and Harry Recher (Edith Cowan University).

The objective of the study was to investigate whether the tree species planted in the wheatbelt are being colonised by insects and spiders and whether the abundance and variety of invertebrates on planted trees differs between tree species and between revegetation and remnant native vegetation. The study also investigated the use of revegetation by birds and compared this to bird communities in remnant vegetation. Invertebrates were sampled on trees planted along the Great Eastern Highway as part of the Main Roads Department 'Ribbons of Green' program, as well as trees planted by community groups and Greening Australia W.A. The question asked was whether the best species of trees were being planted to restore and enhance regional biodiversity.

A team, led by Rebecca Graham, was assembled to sample the invertebrates, and Alexander Watson designed and carried out the bird surveys. The canopy invertebrate fauna of 10 trees of each of eight species of Eucalyptus and jam wattle (*Acacia acuminata*) was sampled by chemical knockdown. Jam wattle and three of the eucalypts, including wandoo (*E. wandoo*), were indigenous to the Northam District. Three of the eucalypts were indigenous to the south coast of Western Australia, one to northwestern Western Australia, and the eighth was indigenous to coastal South Australia. Wandoo was sampled in both revegetation and remnant natural vegetation. In addition to sampling invertebrates, leaf toughness and levels of foliar

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nutrients (NPK) were measured for all tree species. Leaf toughness and foliar nutrients were measured as other studies had found relationships between toughness and nutrients, with the abundance and variety of canopy invertebrates.

Moderate to high invertebrate densities were found on all tree species. Indigenous trees tended to support the most diverse and abundant invertebrate faunas: species originating from southern coastal regions and northwestern Western Australia supported the least. Wandoo trees in revegetation tended to have higher populations of some insects than wandoo growing in remnant vegetation. Leaf toughness appeared to affect the size of invertebrate populations on some eucalypt species, but the effects of foliar nutrients were inconsistent, possibly because nutrient levels were elevated as a result of fertiliser applications.

During winter (June), three patches of remnant vegetation and seven replanted areas were surveyed for birds. Twenty-five species of birds were recorded of which three were found only in remnant vegetation and six were found only on the replanted areas. However, all species recorded are widely distributed throughout the Western Australian wheatbelt and, with the possible exception of the White-browed Babbler (*Pomatostomus super-cilosus*), no significance can be attributed to the differences in bird species composition between remnant and replanted areas: at least in winter, birds are as likely to use revegetated areas as remnant vegetation. The absence of the babbler from revegetated areas is possibly due to the lack of logs and woody debris on the planted sites. Sixteen of the 25 bird species are predominantly insectivorous, four are nectar feeders, four are seed-eaters, and one is a frugivore, which feeds mainly on mistletoe fruits. This suggests that a similar range of foraging resources are available in both remnant vegetation and revegetation.

To restore and enhance regional biodiversity, the study team recommended that revegetation programs, including commercial plantings, should use a variety of tree species and emphasise regional species. Where this is not possible, species from nearby regions should be used. Planted areas should also be diversified by using a variety of indigenous shrubs and herbs as well as trees, and by adding logs and coarse woody debris to the area planted. Provision of nest boxes would accelerate the colonization of revegetated areas by hole-nesting birds.

The full report of this study can be read in the following publication:

Majer, J. D., Recher, H. F., Graham, R. and Watson, A. (2001). The potential of revegetation programs to encourage invertebrates and insectivorous birds. Curtin University of Technology School of Environmental Biology Bulletin *No. 20. 32pp.*

Jonathan Majer is Head of the School of Chemical and Biological Sciences at Curtin University of Technology and Harry Recher is Professor of Environmental Management at Edith Cowan University.

STOP PRESS - LANDCARE AWARDS!

Congratulations Jenny!

Jenny Dewing, *Land for Wildlife* Officer at Bridgetown, was 'runner-up' in the inaugural Soil and Land Conservation Council 'Landcare Professional Award'.

The Minister for the Environment, Dr. Judy Edwards, presented her with a certificate at the State Landcare Conference Gala Dinner in Mandurah on 13th Sept. 2001.

Jenny is an outstanding officer but then, so are all the rest of the *LFW* team of highly professional people - and we are all delighted that she was adjudged so highly.

We won! 'Western Wildlife' wins WA section of the Sigma Landcare Media Award!

Ben Toric, Organiser, Landcare Awards; Penny Hussey, Editor, 'Western Wildlife'; Elmo de Alwiss, Managing Director, Sigma Pharmaceuticals.

We received a certificate, a cheque for $500 and a trophy - a beautiful glass artwork, made by Suzi Rowley of Trengarrin Stained Glass in Narrogin. It's very appropriate that the sponsor should be a Pharmaceutical company, since WA is a world hot-spot of biodiversity - with who knows what phamaceutical uses? More about the sponsors next issue.

Now for the national competition at the National Landcare Conference in Canberra next March - wish us luck!

IN BRIEF

SALINITY: ITS EFFECT ON ROADS

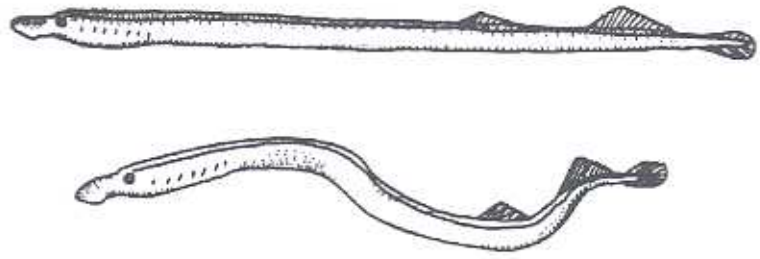
THE link between, the loss of native vegetation and rising water tables and salinity have been identified on countless occasions. However it has now been shown that as well as rendering vast tracts of arable farmland useless it is having a severe effect on buildings and roads in some areas of rural WA. In a report released by Agriculture WA in January 2001, it was estimated that the rising saline water table would cost WA $500 million per year to repair salinity damage to roads and its associated infrastructure. The salinity has a corrosive effect on concrete structures such as bridge footings, culverts and drain headwalls.

The retention of roadside vegetation can play a major role in mitigating against the effects of salinity. If we were to consider a "typical shire" where salinity has been identified as a problem, with roadside remnants along say 841 kilometres of unsealed roads, and these are the standard 20 m road reserve and the road and drains utilise the standard 14 m of the reserve, these unused roadsides would provide the "typical shire" with an extra 504 ha of native vegetation to draw down on the water table.

Its worth protecting the roadside remnants isn't it !!!

David Lamont

LAMPREY GUIDES



LAMPREYS are primitive eel-like fish which which have no jaws. They feed by sucking onto another fish and rasping away flesh. The Pouched Lamprey (*Geotria australis*) breeds upstream in freshwater rivers between Margaret River and Denmark. Dams and weirs hinder their migration, but you can build 'lamprey guides' to get them round the obstruction (for an example, see the one on the Lefroy Brook Gauging Weir near Pemberton).

If you have a dam on a freshwater stream in this area, you can find out more by ringing the Water and Rivers Commission 9278 0300. Ask for the publication: "Lamprey Guides" Water Note No 14.

Congratulations

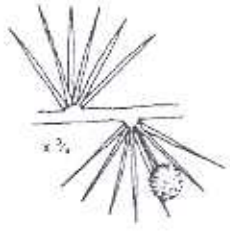
to everyone at the Blackwood Basin Group for winning the 2001 Thiess Services International Riverprize, becoming the first Australian organisation to win this most prestigious environmental award. Well deserved, too! Would you like some ideas of how to spend the $100,000 prize?!

FUNGIMAP CONFERENCE REPORT

THE 5-day Fungimap Conference at Denmark was a huge success, with over 150 attendees from Australia and overseas. Each speaker and group leader inspired the conference participants with their passion for fungi and their willingness to share their knowledge and experiences. The conference helped us recognise another level of biodiversity in our local ecological systems and opened our eyes to the world at root level which now encompasses a wonderful array of fruiting body shapes, colours, textures and smells. As Dr. Richard Robinson said "Roots are equal in importance to leaves as they support life systems for plants and thus for all life in terrestrial ecosystems."

For more detail, or to view the Fungimap CD, contact Sylvia Leighton, on 9842 4500.

Did you know ... ?



..... that Aboriginal people used Kurara (*Acacia tetragonophylla*) to get rid of warts? Apparently, you take one of the prickly needles and poke it through the wart. After a couple of days, the wart will fall off. Well, so it is said!

From Kirsten Wickens, Curtin Uni.

(If you live in the drier farming zones, Kurara is important to use in reveg as it forms superb habitat for birds' nests. Easy to grow, too.)

WEED ALERT

WEEDS, ARE *YOU* THE PROBLEM?

Rod Randall

REGARDLESS of the supposed virtues of any plant be they medicinal, utility, pasture, crop or just plain nice to look at, the concept of 'weediness' still seems to elude most people. Commonly, a species can be one person's 'pride and joy' whilst being another's 'worst nightmare', the cause of many an internecine neighborhood battle.

Many people do not understand that what can be a devastating weed in one place is a non event in other parts of the world because it is chewed or chopped into submission by browsers or firewood collectors.

Amazingly there are many people who cannot appreciate that this is the case because of the vast differences in the flora and fauna between countries, bioregions, ecosystems, i.e:

BIODIVERSITY

These same people often believe that to introduce more and more species from differing climates and ecosystems will improve biodiversity! No thought at all is given to the consequences of a new species' introduction even though these same people will immediately recognise the potential damage that a new insect or pathogen may inflict if released into a new environment.

Why do people consider plants to be any different to diseases or insects? Plants introduced into the environment do interact with other species, they leave traces, make changes and slowly alter the original environment. All this unnoticed by most people until the new arrival has been around for some time and eventually becomes accepted, and sadly any changes made rarely noticed or appreciated.

Of course many species make no impact other than their rotting corpse, not competitive enough maybe or just the wrong

Woody Weed says "Don't spread weeds on your tyres".

environment. Most introduced plants fail miserably without someone to look after them. The real problem here is of course, people.

Now we all understand diseases, and most people understand what a vector is: a disease carrier. Well, people are the very best plant vector locally, regionally and internationally.

No other class of organisms is transported around the world in such variety and quantity as plants are. Millions of tonnes of bulbs and seeds every year comprising thousands of species are spread all over the planet, and so few people appreciate the enormous potential impacts of all this movement.

Mention 'foot and mouth' and you'll have millions of dollars thrown at you to eradicate it before you can finish the sentence. But say 'salvinia' and people look at you wondering what you're on about.

Its a quantum leap in peoples' mind to start considering weedy plant species in the same light as infectious pathogens but it has to happen or we will eventually end up with a global flora no more diverse than your favourite nursery.

Rod Randall works in AgWA's Weed Science section.
He can be contacted by email: rprandall@agric.wa.gov.au

A tide of Gazanias moving out from Salmon Gums townsite.

PRACTICALITIES

EROSION CONTROL ON KINGS PARK SCARP

Bob Dixon and Peter Moonie

EVER wondered what is going on in Kings Park bushland when you drive along the freeway or Mounts Bay Road and see large bare areas covered in grey and brown? As part of a 3 year research project funded by WMC, trials were carried out to establish a process to stabilise slopes greater than 45 degrees after exotic plants were removed. This research led to the present situation where large areas are covered in jute and coconut fibre matting.

The intention when using the matting was to provide an organic material that allows rainfall to penetrate as well as a stable surface you can walk on that will hold the soil together for at least 2 years, thus allowing easy access for maintenance without erosion problems. Though some grades of matting help to suppress weeds the cheaper grades used in Kings Park do not. The grey looking matting is made of jute and is supposed to last 2 years, in reality it often only lasts for 1 year before it starts breaking down, this may in part be due to its use on wet shady sites. This material is originally brown in colour but quickly fades to grey, spraying with green vegetable dye was tried but the colour faded within 3 weeks. The brown material is coconut fibre which is more expensive but retains its colour for at least 2 years and takes longer to break down. Some of these materials are made locally and others are sourced from the eastern States. Costs vary according to brand, weight (thickness), quantity purchased and materials used.

The main aim of the restoration program on the limestone scarp is to remove most exotic species including large sugar gums and pines, some heritage plants are retained, and revegetate with indigenous plants whilst protecting the indigenous fauna in particular rare snail and trapdoor spider populations. These populations are located and marked on the ground as well as using a global positioning system for future reference. Kings Park takes a holistic approach regarding managing natural ecosystems, you cannot in the long term have a self sustaining ecosystem without both plants and fauna.

The pines in particular, many were leaning precariously towards pathways and roads, destabilise the scarp as their roots fissure the rocks adding to rock falls. Research has indicated that the naturally occurring tuarts do not destabilise the soil with their deep root system. Some other indigenous species such as Conostylis or cottonheads which have high tensile roots should help to hold the soil together and are therefore extensively used in the restoration areas.

The implementation process

Stabilisation begins with cranes up to 400 tonne removing the large trees. To reduce erosion and to protect indigenous plants and fauna, all contractors have to submit a works and fauna protection plan. All other environmental weeds are then removed taking care to protect the indigenous species. Timing of the removal of weeds is important in this situation to avoid periods of high rainfall in steep situations where it is likely to cause severe erosion.

Fibre matting is then laid in spring to autumn in preparation for the winter planting season. The matting is laid out following the lay of the land running downhill, it is much easier this way, and pinned with 300 and 600 mm steel pins to get the material as tight as possible. Long pins are preferred as they hold the matting far better, shorter pins are used where the limestone is close to the surface. Always make sure you have a good overlap when using another roll and make sure any edges are dug into the soil at least 15 cm deep. All indigenous plants are left in place as holes and slits are cut in the matting to accommodate them.

Now it is ready for planting when the soil is moist enough. Where appropriate we blanket spray, avoiding any indigenous plants, with glyphosate about a week before planting to control any weeds that are present. Slits are made with a knife at the appropriate spots to accommodate the plants. When you need correct species diversity and are being assisted by volunteers, (though we now also do it for experienced staff because it is more cost effective), we make sure we prepare the day before planting and lay the appropriate plant species beside the slit.

No. 2 Rotunda planting day. DEP, Perth Zoo, BodyShop, Works Team, Work for the Dole Team.

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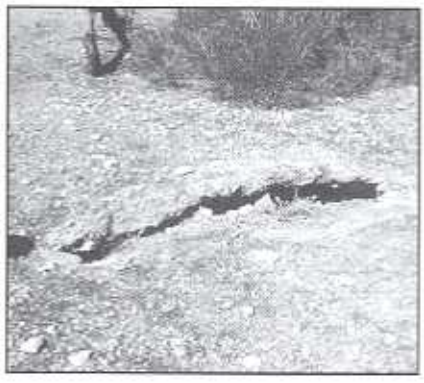
MEMBER'S PAGE

BOODIES IN THE RANGELANDS



GORDON WYRE, CALM's A/ Director Nature Conservation, was recently inspecting additions to the Kennedy Range National Park, in the Gascoyne, when he noticed signs of Boodies and sent us a pic. In the pastoral area, Boodies burrowed down below the calcrete layer, thus keeping themselves cool and conserving moisture during the summer. Of course, there are no Boodies left there now, but perhaps, in the future ...?

(Ref: "Relict Bettong Warrens in Western Australia's Pastoral Land" WW 5/1)

BUSH RANGERS AT ALBANY

Albany Senior High School Bush Rangers get ready to erect their *Land for Wildlife* sign!

ALBANY SENIOR HIGH SCHOOL'S 'Bush Rangers' have reached their first goal, they have officially opened a *Land for Wildlife* site. It's a natural bush area, 1.5 ha in size, near the school, which the students have volunteered to manage. Teacher Val Davies will incorporate CALM's Bush Ranger programme through her Integrated Learning Class. Val said "Managing this bushland is a great chance for students to gain hands on environmental work experience, especially if they are interested in pursuing a career in the conservation field". Keep up the good work, folks!

Kings Park continued from page 18

New materials and methods are being trialled all the time to improve efficiency and reduce costs. We are now trying new anchor pegs that are made of starch, they are more expensive than the steel pins but have a large head and are easier to hammer in. They vary in length from 150-300mm, are strong but will shatter when you hit rock, but are good on sand as they break down. They are new on the market and the manufacturers estimate they last at least 12 months and cost about half as much again as metal pins.

The jute matting is also being used in dune restoration and is working well. However, be aware when using metal pins they quickly rust leaving rusty ends sticking up just below the sand, therefore make sure the area is fenced off to prevent people with bare feet entering and injuring themselves.

Take note that the cost of using these materials is very high. In Kings Park we use 1000 gram per square metre coconut fibre at a cost of about $185 for 50 square metres, the same weight of jute matting costs around $160 though we sometimes go for the 1200 gram material. There are a number of mesh backings (scrim); we use hessian, avoiding plastics which take much longer to break down and may also cause problems with fauna getting caught in the mesh. The cost of the pins is also very high for each 50 square metres we use 250 to 300 pins at a cost of about 30 cents each for 300 mm and 35 cents for 600mm. The cost of laying the materials is also expensive, in easy sites on the scarp it takes 2 people 2 hours to lay 50 square metres, but can take four times as long in difficult areas.

For more information on the restoration of the scarp, research findings etc., refer to Mt Eliza escarpment restoration plan, pub. WMC Resources Ltd, written by Dr Kathy Meney, available for $25 from Kings Park and Botanic Garden.

Bob Dixon is Manager Biodiversity and Extensions, and Peter Moonie is Kings Park Bushland Manager.

NEW BOOKS

Reflections on the Avon

Compiled by Sue Moore

Environmental Report Series 00-3, Murdoch University, 2000.

Free.

Contact Noella Ross on 9369 6076
or email: nross@essun1.murdoch.edu.au

This little book brings together comments and photographs by landholders from Northam, York and Beverley about the 'special places' (especially the Avon River) on their land, and what they mean to each individual in creating a 'sense of place'. The result is an appreciation of the depth of feeling that long-term residents have for the river, coupled with regret for past activities and loss of river quality. If you know the Avon, you'll appreciate this book.

Wattle: Acacias of Australia

Interactive identification CD, coordinated by Bruce Maslin
$110.00

There are more than 1000 wattles in Australia - this CD is magic for working out which ones you've got! It's so much easier than using text! All you need is a piece of the plant, a ruler, and the ability to push buttons. It's actually fun! (Note, it doesn't work on Mac computers.)

Flora of Australia. Volumes 11A and 11B: Acacia

$195.00 hardback, $145.00 paperback
These tomes are all you ever wanted to know about wattles - and then some. For serious plant people only!
Contact: CSIRO publishing, ph: (03) 9662 7666; email: sales@publish.csiro.au
(Wildflower Society members - the society is offering its usual discounts, ring Barbara Backhouse at the Herbarium 9334 0500.)

PRESENTATION OF THE 600TH SIGN

Lucy Turner helping Dr Edwards give out a sign.

The Minister for the Environment and Heritage, Dr. Judy Edwards, with the whole group.

Bronte Marshall, Dillon Marshall, Paige Turner and Tara Edwards watching an echidna dig.

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