April 1998
Vol. 2, Number 2

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Western Wildlife

LAND FOR WILDLIFE

NEWSLETTER OF THE *LAND FOR WILDLIFE* SCHEME

Registered by Australia Post Print Post: 606811/00007

STUDY OF BIRDS IN TREE BELTS THROUGH FARMLAND AT FRANKLAND, WESTERN AUSTRALIA

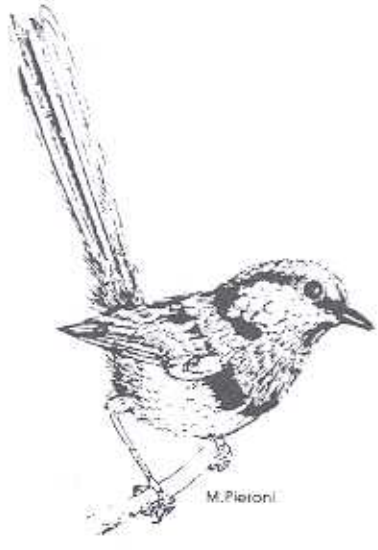
by Rita Watkins

Since July 1989, Rita has been recording birds using tree belts on her nephew, Ron Watkins' farm, "Payneham" at Frankland. Her full results are of great interest, and will be published in a scientific journal. However, they are summarised here to show just how valuable such tree belts are to birdlife.

THE aim of my study was to document the numbers and diversity of birds using tree belts through farmland.

I worked on "Payneham", at Frankland in Cranbrook Shire. It is owned by Ron and Sue Watkins who took over the management in 1973. As some salt became evident, they looked at methods to ameliorate the problem and developed an Integrated Whole Farm Plan, whose main elements are:

- ▷ survey the property to ascertain significant landscape features
- ▷ drains put in to clay on gradient, to move water into a catchment eg dam or creek
- ▷ water stored in dams for irrigation or aquaculture, surplus into waterways
- ▷ tree belts planted below drains for shelter, windbreak, fauna habitat, as groundwater pumps and eventually, timber crop.



Ron has gained many awards for the work he has done on "Payneham", the most prestigious being the United Nations Global 500 Award.

Systematic surveys of birds using the tree belts would give an indication of the 'health' of the farm as the system developed. At the time, my husband and I were living on the property that adjoined the tree belts, and Ron enthusiastically supported my idea of a bird survey. I started in July 1989 and have continued, with some interuptions, until autumn 1997.

The survey was done four times a year, once in each season. The study area consisted of four tree belts, each approx 1.6 km long, three small remnant vegetation areas which are connected to the tree belts, and several dams and other water features. I walked each tree belt counting all birds, seen or heard, taking about 60-75 mins for each belt. The birds were recorded as being either in the tree belt, in the paddock adjacent to the drain, or in remnant bush through which the drain passed, taking in about 100 m on either side of the drain. Separate tallies were made for each tree belt, so that a comparison could be made between them. Water birds on dams were also recorded.

Have you thought of doing bird recording in your own reveg areas? It's pretty simple, you just walk a set course, at a set time, four times a year. And record all you see. To understand whether reveg is helping maintain biodiversity, we need this sort of data!

continued on page 5

EDITORIAL

Greetings everyone!

I hope you managed to get all your next year's Bushcare applications in without any hassles and that this year's projects are proceeding on target!

This issue features a suberb article about fungi. These organisms are essential for nutrient recycling and nutrient uptake in plants, but are often overlooked. May and June are good months for a 'fungal foray' - buy Katie's new book, and see how many kinds you can discover in your bushland! We also highlight birds, as well as giving reports of some on-going projects.

There are some animals for which I would find it very difficult to support a conservation program - mosquitos are one, bush flies another! So raise a cheer for the humble dung beetle, eating away at the bush fly maggots' food source. Those of us in Perth may even have forgotten what 'the great Aussie salute' used to be like!

So far this year *LFW* has been represented at a couple of rural shows; Bob took a display to Gidgegannup; Emma to the 'Sun and Stars Festival' at Yanchep, while Avril was at Wagin Woolorama. Apparently the display there - complete with a sign on a farm gate and the haunting call of a Bush Thick-knee - attracted a lot of interest, including some people who registered months ago and have still not had a Visit - promise, it will be soon!

Nationally, *LFW* is going well - Victoria now has over 4300 properties . registered, SE Queensland and Tasmania are getting under way. A national coordination agreement between the States and the Commonwealth has been signed, and a working strategy document is almost finished. In April I will be attending a meeting in Sydney to discuss matters further. Remember, if you are travelling interstate, we can put you in touch with *LFW* people ...

Talking of travel, I am off for a spot of leave (going to Europe), so Emma will be editing the next two issues of *'Western Wildlife'*. Please help her by keeping those interesting articles coming in!

Best wishes for the coming season,

Penny Hussey

LETTERS

Scavenging Bobtails

Dear Editor

I had often wondered what happened to the dead birds on our block, apart from the ants cleaning up, of course.

I was filling bird baths this morning (we have five, one of which is on the ground), when I had this long-standing query answered. I noticed a Bobtail drinking at the bath on the ground, and he moved when I approached. Then I saw there was a dead New Holland Honeyeater on the ground near the bird bath, and I went to get a shovel to bury it. When I returned the Bobtail had come back, and was carrying the dead bird to the shelter of a nearby shrub. I watched fascinated as the Bobtail whacked the bird on the ground until bits came off, which he proceeded to swallow, albeit with some difficulty!

We have huge numbers of New Holland Honeyeaters and this is the first dead one I've seen. I have decided I won't bury any others I might find, as they are probably an important source of food for other animals.

Jenny Mackintosh
Mt Helena
21/12/97

Has anyone else noticed anything similar? - Ed.

Birds on Farms - Update

by Brenda Newbey

In our very first issue, Feb 1997, Western Wildlife had an article from Brenda about the 'Birds on Farms' project (we know of at least 6 LFW members who are taking part). Here she provides an update:

Birds on Farms is a national project of Birds Australia with over 100 WA farms participating. Just over one third of the surveyors are farmers doing the surveys on their own property. The other farms are being surveyed by bird-watching relatives or friends, or by volunteers from Birds Australia. No-one has finished the survey program yet but some have already completed six of their eight surveys.

The focus is especially on revegetation. Main Roads WA (MR) has put a major effort into revegetation work along road verges over the last 13 or so years. When one of their revegetation planners became aware of this project, she was enthusiastic about its potential for finding out more about what use birds were making of the MR plantings and how the plantings compared with remnants and with each other by shape, structure and species composition. So now 160 0.5 ha road verge sites are being surveyed by volunteers (131 sites) and the Birds on Farms Coordinator (29 sites), in the same format as one of the two types of on-farm site. The verge sites will thus be able to be compared with farm sites.

It is expected that there will be a practical outcome for both farms and verges. A national report is to be prepared, as well as WA reports in various formats.

It is too late to join in now, and too early for any useful results to be available, but if you are interested in receiving any of the results in due course, let me know.

Brenda Newbey is WA Coordinator for the Birds on Farms Project, and can be contacted through Birds Australia, 71 Oceanic Drive, Floreat.

FLORA

THE LARGER FUNGI

by Katrina Syme

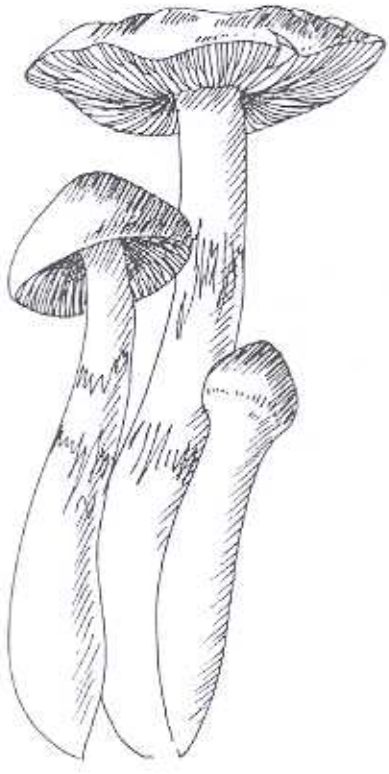
AUSTRALIA has more fungi than plants, yet less than 5% of Australian fungi have been named, and only one State Herbarium in all Australia employs a mycologist.

More than 20 years ago, I lived on a farm in the north-eastern Wheatbelt. Having always been interested in natural history, I fully appreciated the glorious trees, shrubs, wildflowers and orchids growing in patches of bush on the farm and nearby nature reserves. After opening rains we would scour the paddocks for the plentiful crop of mushrooms, but I cannot recall noticing any other fungi. But in the autumn of 1982 the scales fell from my eyes when we went to Tasmania for a holiday and I was enchanted by the colours and forms of the mushrooms and toadstools we saw. Since then, I have discovered that fungi grow everywhere in Australia, even in the Wheatbelt and the desert - they play a vital role in the ecosystem and life on earth could not exist without them. They form an integral link in the great chain of life and healthy ecosystems depend on a diverse fungal flora.

Most fungi are microscopic and include yeasts, penicillin, and fungi familiar to farmers such as Take All, Rust and Smut, which damage cereal crops. The larger fungi have fruiting bodies clearly visible to the naked human eye and we probably have about 5000 species in Australia.

The bulk of the fungus lies within the soil (or substrate such as wood, or living host) and consists of minute fungal threads called hyphae (which form the mycelium) that take in nutrients. Fungi are neither plants nor animals; they do not contain chlorophyll but obtain food by digesting organic matter. They can be broadly divided into three groups: saprophytic, mycorrhizal and parasitic.

Parasitic fungi feed on living organisms and include microfungi such as Ringworm and Tinea which live on humans and other animals.



Dermocybe splendida
Brown cap, yellow stem and fiery orange gills.
A mycorrhizal fungus of the Karri forest.

In this group are some fascinating, gruesome species which parasitise insects, such as the 'caterpillar fungi', *Cordiceps* spp. In the karri forest on our property, I have found the largest one I have seen. Protruding above the leaf litter I noticed a grey, 7 cm pencil-like structure - which I fortunately recognised, because there was a further 19 cm buried in the soil and this required some careful digging to keep in one piece. The very base is a perfect caterpillar shape. I was not so fortunate with another one I found in an area peppered with conglomerate rock. I just couldn't get to the base, but on the same day I collected *Cordyceps militaris*, which has a bright orange fruit body (in the form of short, club-like structures) and was growing from a cocoon lying on top of the ground.

The largest group are the saprotrophs. They utilise dead organic matter, both plant and animal, and are great recyclers. Huge fallen trunks of karri trees in the forest are covered with a myriad of fungi, ranging in size from the large yellow-orange shelf fungus, Curry Punk, *Piptoporus australiensis*, to groups of minuscule species such as Mycena. In undisturbed bush, the rate of build-up of leaf litter and other debris is equalled by the rate at which it is broken down by fungi and other organisms. Saprophytic fungi also include commercially-grown species such as the oyster fungus, *Pleuroyus ostreatus*, and the common cultivated mushroom, *Agaricus bisporus*. Ephemeral ink caps, *Coprinus* spp., bird's nest fungi, *Nidula* spp., and tiny orange discs with a fine fringe of black hairs around the rim - the eyelash fungi, *Scutellinia* spp. - are all included in this group. There are even entire books devoted to the dung fungi!

Mycorrhizal fungi are those which form a symbiotic, or mutually beneficial, relationship with plants. As a rule, neither of them can grow successfully without the other. (It is of interest to note that the seeds of Australian orchids will not germinate without the help of microscopic symbiotic fungi.) The role of mycorrhizal fungi is of vital importance in our nutrient-poor soils.

Prepare for your Fungal Foray this June, buy a fungi book!
see page 16

continued on page 4

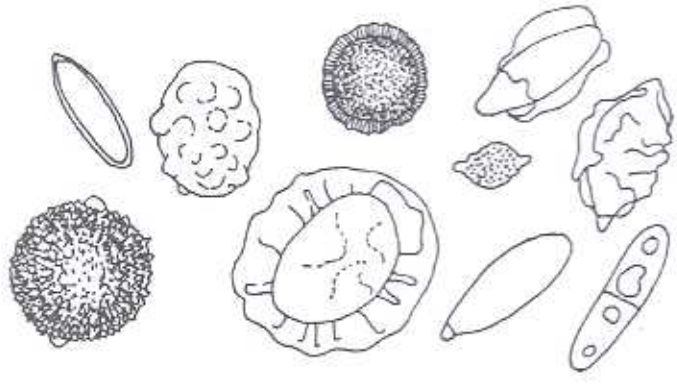
FLORA

continued from page 3

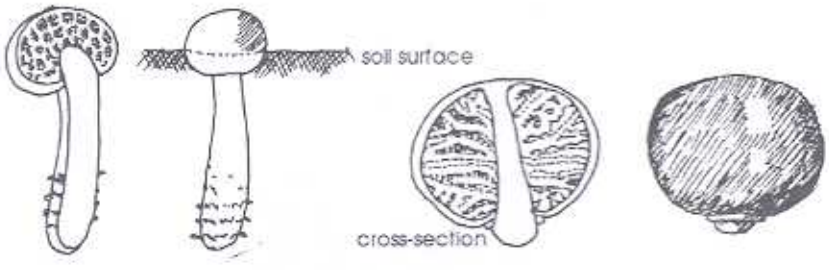
Their hyphae form a sheath around the rootlets of trees and woody plants. Fungal threads then grow throughout the surrounding soil, taking up nutrients such as nitrogen and phosphorus and passing them on to the plant associate. The plant, in return, passes carbohydrate to the fungus. A great deal of research is being expended on this group and Australian fungi are currently being introduced to the vast eucalypt plantations in China.

Many of the larger fungi lie hidden under the leaf litter or just below the soil surface, and their role is very interesting indeed. A three-way relationship is at work, involving fungi, plants and small native mammals such as Potoroos and Woylies. In order to colonise new areas, these fungi must be eaten and the spores spread by the animals.

Once thought to be extinct, Gilbert's Potoroo was recently rediscovered in the Two People's Bay Nature Reserve. I managed to obtain some Potoroo scats and examined a minute part of one under the microscope - lo and behold! the spores of many different types of fungi were revealed! Potoroos and Woylies live almost exclusively on underground fungi, but other small marsupials such as native rats and bandicoots also eat them. These fungi must have some sort of a smell which is not necessarily noticeable to humans, however, many do have a very strong perfume. A group of bright yellow underground fungi, *Stephanospora* sp., which I found near Lake Gardiner at Two People's Bay, smelt gorgeous - just like a sweet shop. These 'truffles' are mostly quite small, on an average only 1 - 2 cm across. The Native Truffle, *Choiromyces aboriginum*, is well-documented as food in Central Australia, but there are no historical records of the use of truffle-like fungi by the Nyoongar people. They did, however, eat the Beefsteak Fungus, *Fistulina hepatica*, which grows on trees and Native Bread, *Polyporus mylittae*, which produces a large underground sclerotium, and a few others.



Some of the fungi spores seen in Potoroo scats.



Torrendia arenaria
a truffle-like fungus.
Two Peoples Bay Nature Reserve

Thaxterogaster sp.
a truffle-like fungus found underground.
Two Peoples Bay Nature Reserve

Katrina Syme is a consultant mycologist and talented artist. She has carried out a comprehensive survey of fungi in Two Peoples Bay Nature Reserve during 1991-92. During this survey, 441 different species of larger fungi were collected, many of which are new to science. In conjunction with CSIRO, she is currently carrying out further studies on fungal ecology in the southern jarrah forest and writing/ illustrating a book on fungi. She also teaches natural history painting through UWA Extension and is a member of the Botanical Artists' Group. She can be contacted at: RMB 1020, South Coast Highway, Denmark, WA 6333.

Would you like to help increase our knowledge of Australian fungi?

Fifty species of fungi are being targeted by the Australian Fungi Mapping Scheme, or FUNGIMAP, which is centred in Victoria. All these species are illustrated in Bruce Fuhrer's 'Field Companion to Australian Fungi'. This project aims to improve knowledge of the distribution of fungal species in Australia.

For more information, contact
FUNGIMAP,
National Herbarium
of Victoria,
Birdwood Avenue,
SOUTH YARRA, VIC 3141.

continued from page 1 *BIRDS IN TREE BELTS*

Species used and year of planting

Species	tree belt			
	1	2	3	4
Acacia baileyana		1986		
A. microbotrya		1986	1987	
Chamaecytisus palmensis	1985	1986	1987	1985
Eucalyptus camaldulensis	1985			
E. globulus	1985		1984	1985
E. maculata	1985		1987	1985
E. melliodora		1986		
E. muelleriana	1985			
E. resinifera	1985			
E. saligna				1985
E. wandoo	1985	1986	1987	

The trees used were chosen for their timber and windbreak potential; each belt is four rows wide and fenced to prevent stock access. Most of the plants used are not native to WA.

In the time of my study, a total of 8510 birds have been recorded, from 79 different species. This is a high diversity. The fact that patches of native bush remain in the area would contribute to this diversity. There is 25% of remveg left on "Payneham" and also 25% on the property to the north, including an area of 37 ha. An estimated 15% of bush remains in a 5 km radius of the study site. Most of this bush has been denuded of understorey to a large extent by grazing sheep, making it less suitable for birds requiring a thick understorey. In the tree belts, this habitat was provided to some extent by dense growth of tagasaste seedlings.

Birds use the tree belts in the following ways:

▷ Food source

Nectar provided by flowering eucalypts and tagasaste is used by 8 species of honeyeater, plus silvereye and probably parrots, thornbill, gerygone and pardalote. Eucalypt, acacia and tagasaste fruit is available for parrots, pigeon and quail. Insects are eaten by most birds, but especially thornbills, robins and flycatchers.

▷ Home territory

Some species have established territories, such as Splendid Wren, Grey Fantail, Willie Wagtail and Thornbills.

▷ Nesting

The small birds with home territories nest in the tree belts. A Shining Bronze-cuckoo fledgeling has been seen being fed by Inland Thornbill. Probably some of the honeyeaters nest in the belts, but nests haven't been observed. Juvenile birds of sedentary species have been seen, eg Scarlet Robin, Grey Fantail, Splendid Wren.

▷ Rest and shelter

▷ Corridors

The tree belts provide corridors between areas of bush and between revegetated areas. Parrots, honeyeaters and Yellow-rumped Thornbill move up and down the belts.

Many birds using the tree belts for shelter and foraging would not find them suitable for nesting, eg. parrots, which require nest holes in older, larger trees remaining in the native bush. Being able to move between the native bush and tree belt is an enormous advantage for most birds and at the junction of the two habitats was often where many birds were recorded.

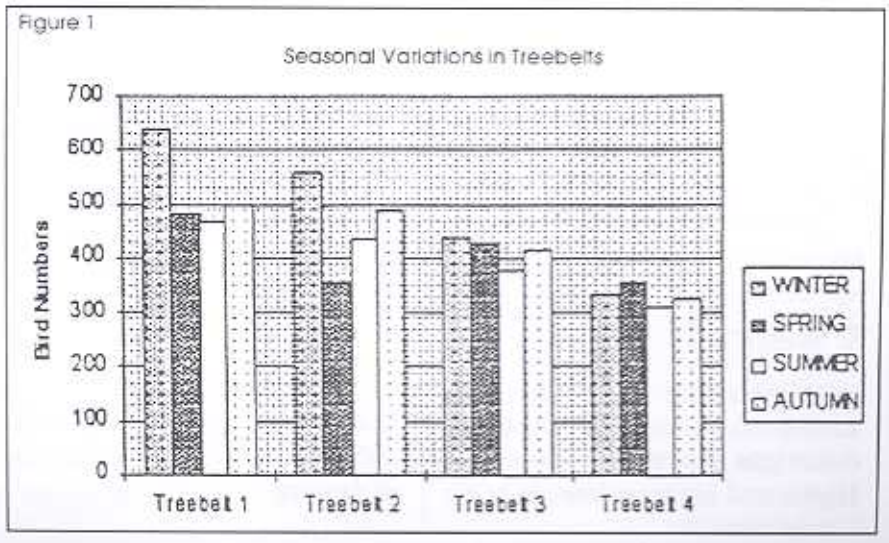
All birds recorded in remnant bush have been seen in tree belts, even, very occasionally, the Rufous Treecreeper and the Western Yellow Robin, which are normally only seen in bushland.

Seasonal variations are interesting. Figure 1 shows the variation in numbers of birds between the seasons and the tree belts. Winter counts are substantially higher in all belts except 4, due to the flowering of Tagasaste, which brings in large numbers of Brown Honeyeaters and Silvereye, with smaller numbers of Red Wattlebird, Singing, Brown-headed, White-naped and Yellow-plumed Honeyeaters. Parrots are more abundant in winter.

This study shows that the tree belts have provided valuable habitat which supports a high number and diversity of birds.

Rita Watkins is a member of Birds Australia and the Western Banders Assn. She has now retired to Leschenault, and can be contacted on 08 9725 8405.

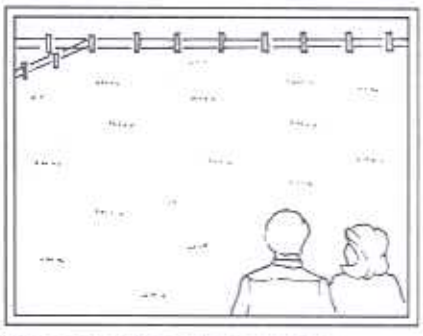
Figure 1



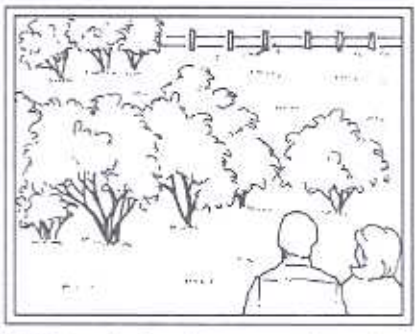
ECONOMIC BENEFITS OF VEGETATION

SOCIAL BENEFITS OF TREES ON FARMS

by Brian Moulton



You can see the other boundary.



With trees in the foreground, the other boundary will appear further away.

Framing can make the picture look a lot better.

Trees on farmland increase its resale value! This talk, given at the Capel LCDC 'Revegetation Field Day' in March 1997, is of interest to all landholders.

BENEFIT - the dictionary meaning is 'advantage'. The advantage of having trees on your farm - be it pockets of trees, timber trees or shelter belts - is huge, both in value and in capital growth.

Firstly, they will make your land more valuable. There is no doubt about this. If your land becomes more valuable then your capital growth is better, your lifestyle is better and you are happy within yourself with your achievement.

After all, we like to think that our properties are desireable and increasing in value. Plant trees and you will achieve this. In all my dealings with land, I have found that if you spend say, $10,000, on planting trees I can guarantee that your initial investment will multiply 3-5 times. Not a bad return, is it?

The increase in value can be attributed to different areas.

1 Aesthetic

More and more these days the aesthetic value of a property outweighs the production value. Higher and higher prices are being achieved because of the purchasers' perceived beauty of a property.

I can assure you that when a purchaser is trying to decide on two similar properties, the one with aesthetic value will win over every time. As every decade goes by, new younger generations are purchasing land and the respect and appreciation for trees is becoming stronger and a much larger issue. Often my clients will walk up to a tree and touch, feel or hug it. This is called 'the wow factor' in the real estate industry. When a purchaser starts saying 'wow' in body language, it's a real give-away - the salesman thinks 'I've got 'em!'

2 Commercial trees

Obviously there is value-adding to your property with commercial plantings of trees.

3 Shade and shelter

Properties with good stands of trees planted for shade and shelter also make the land more valuable. In the Busselton and Margaret River areas properties with soil types suitable for horticulture and viticulture with shelter belts are much sought after. This would also follow for dairying and other types of farming.

What purchasers like

- Not being able to see the opposite boundary of a property, makes it appear bigger.
- As with a picture, framing can enhance the effect.
- In future, plantings with a greater variety and mix of species - different heights, colours and textures - will have more appeal to the buyer.
- Properties with more hardwoods will be sought-after. Think how long the future is when you plant a tree. Farms that are held securely by families should be planting some hardwood species for their future generations' use on the farm.
- Trees create a feeling of privacy, value, well-being and security.

So, plant the shelter belts, fill up the non-productive areas on your farms and you will definately increase the value of your property. This applies to all sizes, shapes, locations and soil types on ANY property. NO DOUBTS!!!!!

Brian Moulton is Director of Hooker Realty in Busselton.

FAUNA

DUNG BEETLES

by Ian Dadour

As you wave 'the Australian salute' this summer, think about how many more bush flies there would be without dung beetles!

THE ancient Egyptians thought that beetles rolling dung represented what was happening in the heavens. The Earth was the ball of dung and the beetle was the sun, turning the Earth over and over. The legs of the beetle represented the rays of the sun.

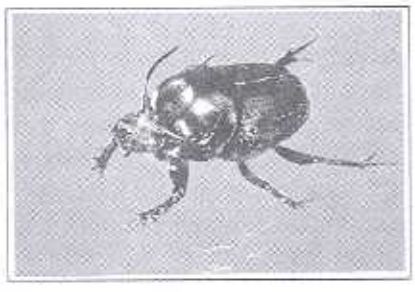
Ancient Egyptians thought highly of the dung beetle, and so do many Australians, but for a number of different and more practical reasons such as the removal of pasture fouling and the reduction of the bush fly.

In 1964 the dung beetle program was initiated in Australia by CSIRO and the first beetles (mostly summer species) were released in 1968. The major aims of the program were to remove pasture fouling (by dung burial) and to control (by competition) the buffalo fly, *Haemotobia irritans*, and the bush fly, *Musca velutissima*. Both species of fly spend their larval stage in dung. Bush flies utilise all types of dung, and large amounts became available following European settlement and the introduction of stock.

Although native dung beetles are present in natural vegetation in the south-west, they normally feed on the faecal pellets of marsupials, and dung from cattle, sheep and horses does not suit them. This imbalance, caused by an accummulation of dung, led to an increase in the breeding sites of the bush fly. Introduced dung beetles, on the other hand, do not utilise marsupial dung, it is too hard.

The dung pads of cattle dry hard and remain in the pasture for months or even years. Cattle will not graze in the immediate vicinity of a pad unless desperate, so farmers lose a significant amount of grazing land. This means reduced stock numbers and lost income. To increase the breakdown of cattle dung in pastures, between 1972 and 1986 CSIRO released 14 species of dung beetle from Europe and Africa into south-west WA. Nine species are known to have established and seven species are common. They are now the dominant members of the dung beetle fauna in pastures.

Dung Beetle *Onthophagus alexis* - native south-west



Dung beetle *Onthophagus taurus* - summer active introduced early 1980's

Dung beetle *Copris hispanus* autumn/ spring active. Introduced late 80's early 90's

Dung beetle activity improves pastures in several ways. Firstly, increasing the breakdown of cattle dung decreases the amount - and therefore the cost - of harrowing needed. Secondly, nutrient recycling by dung burial increases pasture productivity. Thirdly, it reduces the numbers of gastroenterinal worms, which normally spread from dung pads to surrounding grass and thus reinfect grazing cattle. Finally, the numbers of both buffalo flies and bush flies are reduced.

The larvae of both buffalo flies and bush flies breed in dung. They are pests of both livestock and humans, spreading diseases such as 'pink eye' in cattle. When beetles are abundant in a dung pad they compete with the flies, which are then killed because there is insufficient dung for them to complete their life cycle. The buffalo fly requires a blood meal before laying its eggs, and this biting causes a reduction in meat and milk production. The bush fly also pesters livestock (and humans!), obtaining protein for egg production from tears, nasal mucus or blood from a wound. This feeding activity may also cause a reduction in meat and milk production in cattle, though this is, as yet, unproven.

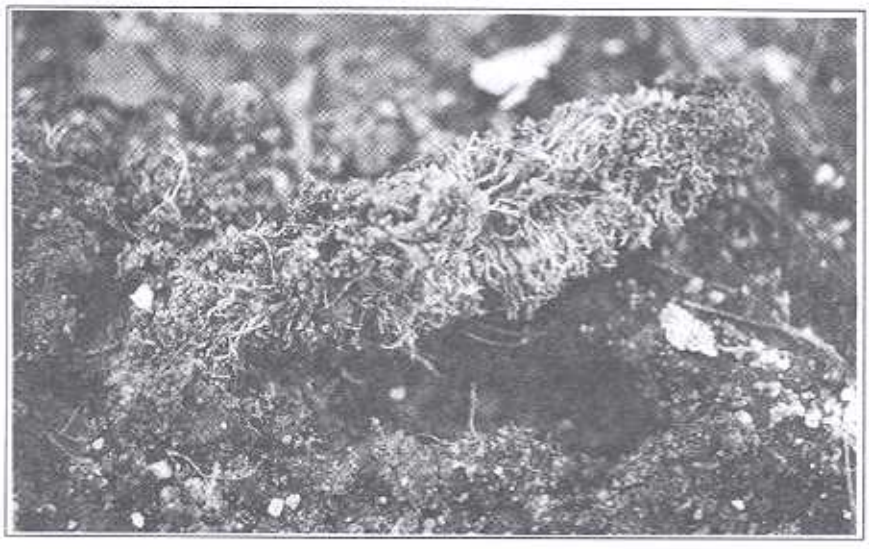
From 1989 to 1996, AgWA and CSIRO introduced two species of dung beetles from Spain, specifically to try to control bush flies. The project was also supported by the Dairy Research Development Corporation. These beetles are active from September to early January, and fill a different seasonal niche from the previously-released summer-active species. They were released at 500 sites, and have become established at 28. As far as bush-fly numbers go, it will be a long time before we feel the effect of these new dung beetles.

During the last three years, a project supported by Healthway has determined that bush flies are vectors of both trachoma and salmonella in the Kimberley and Goldfields. Dung beetles have been introduced to these remoter areas to try to reduce bush fly numbers.

continued on page 8

BUSH DETECTIVE

Buried bottlewashers!



What's this? Looks like Granny lost her old-fashioned wire and bristle bottlebrush! Same size, pale colour, but a bit limp ... buried just below the surface of the ground ...

In fact it is the specialised root, called a 'proteoid root', of a member of the Banksia Family. These strange roots extract nutrients from the humus-rich upper soil layers. They grow rapidly as soon as the soil becomes moist (April-May), work throughout winter and early spring, and die off as the soil dries in late October. Next year the plants will grow new root clusters.

Plants from this family are one of the very few groups in Australia which do not have mycorrhizas - relying on their proteoid roots for most nutrient uptake. Because they are so close to the surface, these roots are easily damaged by hooves if stock graze in the bushland - causing decline and eventual death of the plant.

Proteoid roots can be located early in winter by looking for a raised line in loose soil near a parent plant. Dig carefully (it could be an insect burrow!) and replace the root *in situ* after you have looked at it.

continued from page 7

Good news!

Calibrated fly traps used by AgWA and CSIRO between 1977 and 1995 have shown a dramatic decrease in bush fly numbers, caused by the activity of introduced dung beetles:

- ▷ 90% reduction in January in Busselton / Margaret River area
- ▷ 65% reduction in the Bunbury area
- ▷ 60% reduction in the Perth and Albany areas.

The future of introduced dung beetle populations remains assured, as long as there are cattle and horses in the south-west of WA. It would be of particular importance and good government foresight if, ten years from now, some research on the post-evaluation of dung beetles' dispersal and bush fly abundance should take place.

Ian Dadour is a Research Fellow at the University of Western Australia.

IN BRIEF

Rehabilitation benefits from research into mycorrhizal fungi

Much of the information about the essential role of mycorrhizal fungi in the rehabilitation of disturbed sites comes from a long-term reserach project supported by the Australian Minerals Industries Research Association, and carried out at the University of Western Australia. The importance of using topsoil (which contains spores) spread onto recently-mined sites has been shown very clearly - regeneration is much better. The team is also investigating the possibility of developing an innoculum that could be applied to a site in a cost-effective manner. This research has important implications for the long-term stability, sustainability and diversity of revegetated ecosystems - not only on minesites but in Landcare as well. Failure or poor growth at some sites may well be related, not to salt or waterlogging etc., but to lack of the appropriate mycorrhizal fungus in the degraded soil.

For further information, contact
Dr David Jasper, UWA,
on 08 9380 2635
or email:
djasper@uniwa.uwa.edu.au

PRACTICALITIES

RABBIT CONTROL - OR BLAST THE BUNNIES!

by Eliza Dowling

RABBIT numbers are on the way to plague proportions again. The Rabbit Calicivirus Disease, as with any biological control, had its limitations; lack of follow-up by farmers and development of immunity has meant that RCD did not meet the high community expectations. Obviously we can't sit back and wait for the next wave of RCD, myxomatosis or whatever to do the work for us - rabbits are a major agricultural and environmental pest and it is everyone's business to keep them under control. Almost every property has rabbits to different degrees - and the degree is often how hard you look for them!

Autumn is a good time to effect control, as feed is scarce and the rabbits are already under stress.

What are your options for rabbit control?

1 BAITING AND POISONING

Agriculture Protection Officers will work with groups and individuals to eradicate rabbits. They supply Pindone and 1080 poisons which they mix with oats on site free of charge. Farmers are expected to supply their own oats. Pindone is used when domestic animals could be affected, as it is safe for them but fatal to native animals. 1080 is safe for native fauna.

At the start of 1998, charges are:-

- $84.00 / hour for bait laying operations
- $6.50 / mix for Pindone
- $4.00 / mix for 1080 one shot
- $12.00 / day hire of trail-laying equipment.

Obviously it is cheaper to get your neighbours together so that the officer can do several clients at a time and you can share the trail-laying equipment.

2 WARREN AND HARBOUR DESTRUCTION

Deep ripping is the usual method on open ground. Most local governments use their earth-moving equipment to destroy warrens, and some are prepared to do the same on private land for a fee. Dozed up piles of rubble and heaps of dead trees all provide excellent safe harbour for rabbits and should be removed or burnt.

Using heavy machinery in remnant vegetation is very destructive of the bushland. Cuballing farmer, Scott Young, has been experimenting with the use of explosives to destroy warrens (and their inhabitants) with much success. At each warren, small charges of an ammonium nitrate and diesel mix are placed in some of the burrows and all the others are filled in and compacted. The charges are joined together with a length of detonator and ignited using a slow-burning fuse. The resulting blast implodes the burrows, causing them to collapse but causes negligible damage to the surrounding bush.

Trials of this technique in 1988 at Pingelly and Brookton showed that remnant vegetation improved after the blasting due to the destruction of the rabbits and possibly also to an increase in soil nitrogen. The smell of gunpowder in the soil discourages the rabbits from reinvading the area.

The use of explosives is a relatively inexpensive tool for removing warrens. It promises to be most effective in rocky outcrops, river sand and areas of remnant vegetation. However, it is most important to keep in mind the following:

- small charges only are required
- the work must be done by an experienced person with a shot-firer's licence
- success of the blasting operation relies on soil types and the amount of moisture in the ground. Ideally the soil should be dry and/or sandy, so big plugs of clay are not blasted out of the ground.

3 FUMIGATION AND GASSING

This you can do yourself using Carbon monoxide from a pre-'76 vehicle exhaust or phostoxin tablets. Make sure that all the burrows are sealed properly.

4 FERRETING, SHOOTING AND TRAPPING

In the context of a major rabbit problem these have little impact but are highly suitable to mop up individual rabbits causing damage.

More information

Contact you local Agriculture Protection Officer for more detail, including up-to-date pricing. For more information on using explosives to blow up warrens, contact David Lund at AgWA on 08 9881 0222. (Also, read 'Managing Your Bushland' pp122-125. - Ed.)

Eliza Dowling is a Landcare Development Officer at AgWA, Narrogin.

MULTIPLE LAND USE

MULTIPLE VALUES OF REMNANT VEGETATION, AN EXAMPLE FROM THE AVON DISTRICT

by Sue Patrick

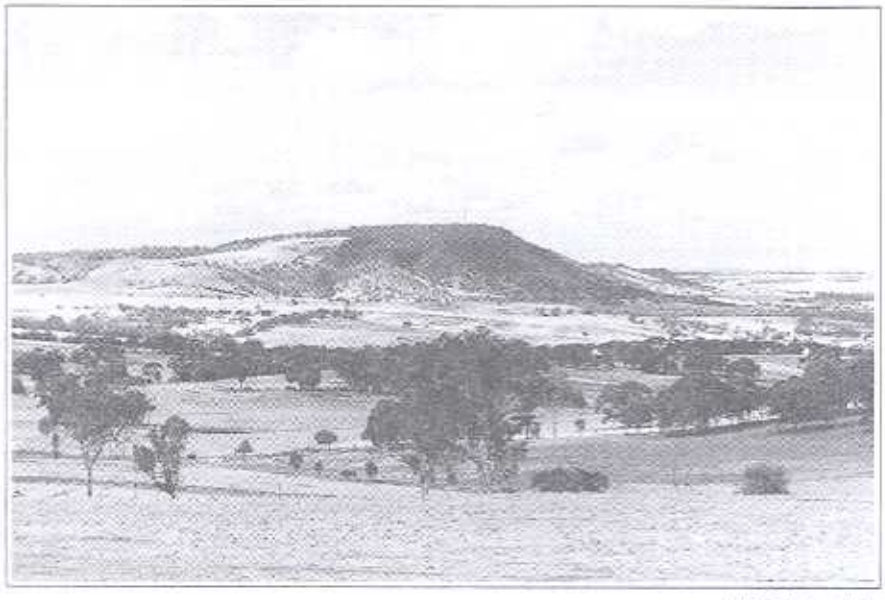
THE high biological value of remnant vegetation is without question, but some remnants have other values as well. These usually occur in the early settled districts, where heritage and historical values add to their importance.

Mount Bakewell is such a place. The mountain overlooks the town of York and was important to humans long before European settlement. For the Nyoongar people, the mountain top is of cultural significance and both Mount Bakewell and nearby Mount Brown are the background to a Dreamtime legend.

For Europeans too, Mount Bakewell has been significant since before settlement of the Avon region. In 1830, when Ensign Dale first explored the area, he climbed the Dyott Range and named the mountain at its highest point, which serves as a lookout over the surrounding countryside.

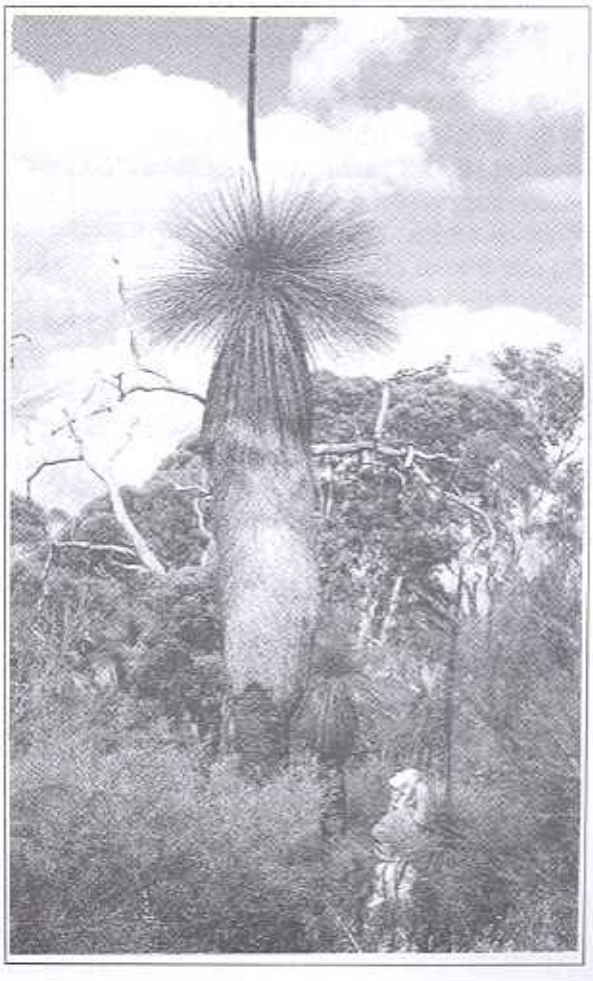
Subdivisions of the surrounding land were made in about 1842, but even before then, in 1839, the young German botanist, J.A.L. Preiss, visited the area and, over five September days, made plant collections on Mount Bakewell. As a result, like many other areas where he collected, such as Mount Eliza in Perth (now Kings Park) and the Suzannah Brook Valley in the hills above the Swan Valley, the locality is important because some of his collections were used by botanists to describe new species (at least six from Mount Bakewell).

Although a thorough botanical survey has not yet been made of the remnant vegetation on Mount Bakewell, we already know of its values, partly as a result of visits there by a number of well known botanists this century. The



Mt Bakewell ▲

Sue and a skyscraper! ▼



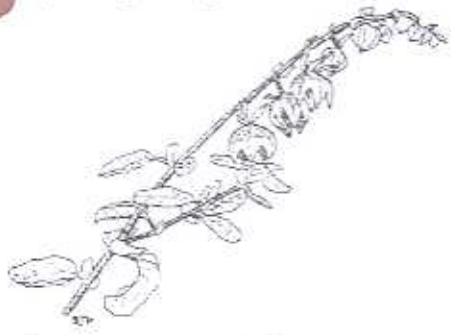
countryside around is heavily cleared but this remnant is generally in good condition. The lower slopes are all privately owned, making access restricted, and lessening likelihood of disturbance, fires and the introduction of weeds, diseases and rubbish.

The geology of the area is complex, giving rise to a variety of soils which support a number of diverse plant communities, representative of the natural vegetation now cleared from the surrounding area. Soils derived from the massive quartzite of the summit support wandoo and powderbark woodlands. York gum and jam woodlands grow on fertile red loams, with marri on sandier soils and

MULTIPLE LAND USE

rock sheoak around the summit and lower slopes. Shallower soils result in species-rich heath and shrublands.

Apart from the importance of the species which were described from Preiss's collections, including the rare Mountain Hibberta, Hill Thomasia and Broad-leaved Hemigenia, several others found more recently are also either known, or thought to be, rare. The mountain reaches a height of 457 metres above sea level and, perhaps as a result of this, some of the plants growing here differ from those of the same species growing elsewhere.



Thomasia montana, Hill Thomasia

Unusually tall grass trees, some over six metres tall, are found on the upper slopes. These are thought to be over 300 years old and therefore may provide an opportunity to study bushfire frequency before European settlement. The most recent bushfire to burn over the range was in 1985 and regeneration of the bush since then is continuing.

The area is also a valuable haven for fauna, including a population of Euros. Based on surveys made in nearby bushland it is possible that up to five species of mammals, 70 species of birds, and eleven species of reptiles could occur there.

The value of this important remnant was officially recognised in 1996, when a comprehensive Management Plan was prepared by the Shire of York and the York LCDC funded by the State Landcare Program and the Shire.

Until then, management of the area had rested largely with the surrounding landholders, although in the mid-1980s a draft plan had proposed formation of a 'Regional Park'. Ownership of the remnant vegetation is complex, involving private individuals, the Shire of York, a mixture of vested and unvested reserves, and freehold land owned by the State and Commonwealth governments. Future management aims to consolidate the crown land reserves and crown-owned freehold land into a single A Class reserve to be managed by the Shire of York.

Conservation issues include elimination or control of threatening processes, restoration of degraded areas and encouragement of research on the flora and fauna of the area. Heritage values are also to be identified and protected. The plan aims to ensure that all values of nature conservation, visual landscape and heritage will not be degraded by use for recreation and tourism. There is much to be done to implement the recommendations in the Management Plan, but already the first steps are being taken and its guidelines will enable this important area to continue to exist as it has done for over 150 years since so many changes have taken place around it.

The Mount Bakewell bushland exemplifies the value of a small remnant of natural vegetation. It contains plant communities now largely cleared from the surrounding area, and a unique assemblage of species of this particular locality, including both rare species and those of taxonomic importance. It is a haven for wildlife, and is of importance in the cultural heritage of both the Nyoongar people and European settlers. In addition the mountain is a dominant and attractive feature of the local landscape.

Sue Patrick is a Senior Research Scientist at the W.A. Herbarium, Como. She can be contacted on (08) 9334 0485.

Illustrations and photos by S. Patrick.

?

Here are the answers to the quiz questions in the last issue of *WesternWildlife*, so you can see how you scored. The final scores were tallied out of 19, one mark per correct answer.

Well done to everyone who participated, and thank you for the huge response we received!

(No-one got a score of less than 17, or 89.5%. That's better than when some of us were comparing marks at school – Ed.)

1 Corymbia (Vol1No1).

2 Mastiff Bat (Vol1No2).

3 Parliament (Vol1No2). We also accepted: convocation, gathering.

4 Fitzgerald Biosphere Reserve (Vol1No2). We also accepted: Fitzgerald River, Fitzgerald River National Park and Fitzgerald.

5 Any two of: create a recovery team, funding, reintroduction of a species to its natural habitat, research, fencing, selection of further suitable sites for reintroduction, assess biological criteria (Vol1No1). Some people gave answers specific to the recovery of the Corrigin Grevillea, but the question actually asked for the steps in the formation of a recovery plan, which are much broader.

6 a) Victoria (Vol1No1),
b) 1981 (Vol1No1). A few people missed this one!

7 Lower (Vol1No1).

8 Native Bee, *Euryglossa morrisoni* (Vol1No4).

9 Feral predator control (Vol1No3). We also accepted: feral animal control.

10 Red-capped Parrot (Vol1No1).

11 Lontrel (Vol1No3).

12 Echidna (Vol1No2).
a) Wandoo, *Eucalyptus wandoo* (Vol1No1),
b) Salmon Gum, *Eucalyptus salmonophloia* (Vol1No1).

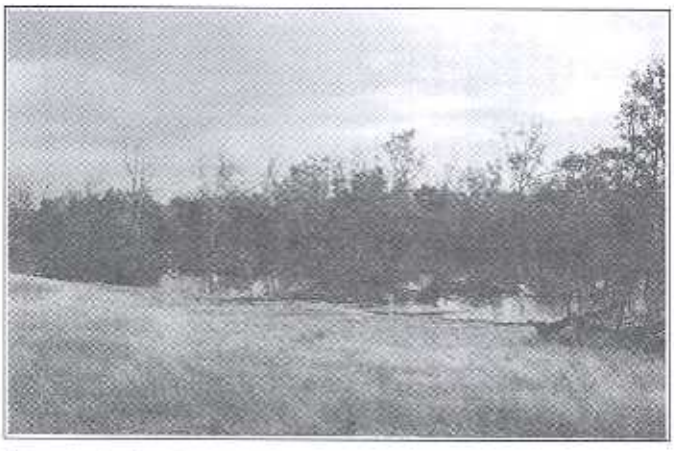
14 Carpet Python (Vol1No4). We also accepted python.

15 Any two of: contour banks, drainage line revegetation, no-tillage techniques, direct drill cropping (Vol1No1). We also accepted: selective herbicide use, banks, buffer zone creation.

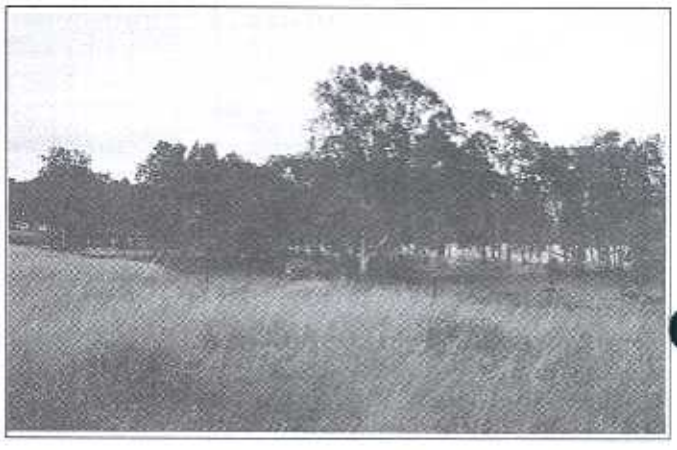
RESEARCH

WAS BARON VON MUELLER THE LAST PERSON TO SEE THE NATIVE VEGETATION AT GREENOUGH FLATS?

by Sheila Hamilton-Brown



The perched wetlands at Morilla Swamp showing extensive stands of living river gums across the lake floor. Photo: Val English



Diminution of river gums at Morilla Swamp due to waterlogging. Photo: Val English

You've heard of rare and threatened plants and animals, well, what about the ecocolgical communities that are also threatened?

BARON Ferdinand von Mueller travelled from Geraldton to Shark Bay in 1877, and was probably the last botanist to see the native plant community occurring on Greenough Flats - a flood plain between the coast south of Geraldton and the Greenough River.

In its heyday, the clayey loam soils of Greenough Flats probably supported an open woodland of river gum (*Eucalyptus camaldulensis*), with stands of summer-scented wattle (*Acacia rostellifera*), and numerous wetland herbs such as swamp sundews (*Drosera* spp.), Long-flowered Nancies (*Wurmbea tubulosa*) and clumps of wallaby grass, sedges and other native grass. Have you seen this community? You may have it on your property. You may even remember when the plain was last flooded. A patch of land near the Greenough River church is an example of what we believe Greenough Flats looked like.

Morilla Swamp (west of Morawa) is a unique wetland in that it contains populations of river gum on the lake floor where other wetlands in the area are dominated by York gum (*E. loxophleba*) and paperbarks (*Melaleuca* spp.). Now the wetland is practically always waterlogged, and the consequence is the diminution of these last stands of river gum. Morilla Swamp is being currently proposed as a possible **threatened community**, and if successful, plans to preserve it will get underway. Do you know of any other stands of river gum in your area such as Morilla swamp?

An ecological community is simply defined as a group of plants, animals or other organisms that live in a particular habitat. Threats to a community may be clearing, grazing, waterlogging, fire or anything that may reduce the size or change the make-up of the community. In the Wheatbelt, the clearing of the land for agriculture and related activities has reduced the biological diversity of the area. As the Wheatbelt continues to degrade, there is an urgent need to preserve what remains of our natural vegetation.

CALM's Threatened Species and Communities Unit (WATSCU) at Woodvale and the Division of Science at Murdoch University are undertaking a project to identify and promote the preservation of biological diversity in the Wheatbelt areas. This is to be done with the help of LCDCs, landowners, naturalists, other interested people and with funds from Environment Australia. If you live in the Wheatbelt and you think that there is a threatened ecological community in your area, like the two described here, then please let WATSCU know and we may be able to help you. Or you may be able to help *us* by identifying communities we believe no longer exist.

If you have any suggestions, inquiries or would like further information on the above or have any suggestions, then please ring me on
(08) 9405 5168 or e-mail me at sheilah@wood.calm.wa.gov.au

Sheila Hamilton-Brown is a Consultant with WATSCU.

IN BRIEF

Nest Watching

A lot can be learnt about bird behaviour if you have the opportunity to watch a nest. Small birds may nest in creepers around a verandah and in this sort of situation the birds can get quite tolerant of quiet observation. If you do get the opportunity to watch closely, keep a record of what you observe so that you can pass on to others all the fascinating information that you will acquire.

The sort of things you could record could include:

- the material used to build the nest
- the building rates (number of trips per hour) and the length of time taken to complete the nest
- the duration of the incubation period (time from laying to hatching)
- the duration of the nestling period (time from hatching to first flight)

- a description of parental behaviour and development of the young
- a description of the greeting and change-over displays
- the length of the incubation and brooding stints by each adult
- a description of the food being presented - what it is and how much of it
- the feeding rates (number of feeding visits per hour)
- the contribution of the male and female to different stages of the cycle (building, incubation, nestling and after first flight)
- whether the type of activity or its rate are influenced by the time of day, or the weather
- a description of the calls of both adults and young, and in what circumstances they were used.

Although this all looks rather complex, it is simply a matter of taking careful field notes each time you watch. Note down the start and finish time of each observation session, and also note the time of the start and finish of each significant behaviour or activity, and any other relevant details. Each day's entry in your note-book should commence with the date and weather. Then, when you have finished a session of watching, it is just simple arithmetic to calculate, for example, the building rate, or the percentage of the observation time spent by each adult in various activities.

Penny Hussey

Bushland Plant Survey Project

by Ann Gunness

THE Wildflower Society of WA, through its bushland plant survey programme, offers support to landholders and community groups to document the flora and vegetation of their bushland. By knowing what your bushland contains and recognising its values, it becomes easier to make successful management decisions.

The survey program has been conducted for the past 10 years, mostly on the Swan Coastal Plain. It has recently extended to rural areas, and surveys of farm remnants have been conducted at Popanyinning, Konnongorring and Woodanilling. Volunteers experienced in plant survey, along with botanists, assist the local community in carrying out the survey work. The project is currently funded by the NHT with some assistance from DEP and CALM.

Some of the benefits of the programme are:

- ▷ the bushland plants and the communities in which they grow are documented and a local field herbarium can be compiled
- ▷ the landholders gain a better understanding of the bushland and its management requirements
- ▷ rural and urban bushland managers are able to share expertise, information and ideas, and better understand management issues.

In addition to the survey weekends which will be held in spring, a selection of one-day workshops will be conducted. These will include plant survey techniques, seed collecting, and species selection for revegetation. Community participation is encouraged and people are welcome to join in the surveys or workshops which might be taking place in their area. This year's programme is in the process of being developed and details will be included in the next issue of *Western Wildlife.*

Ann Gunness is Coordinator of the Bushland Plant Survey Programme.
She can be contacted on:
ph 08 9524 2221 or
fax 08 9524 2239.

RESEARCH

THE FITZGERALD BIOSPHERE RESERVE,

a model for conservation and sustainable land use

Angela Sanders

A chance pit-stop at the roadside somewhere between Jerramungup and Ravensthorpe on the south coast led to my first sighting of the rare Western Whipbird. There were two exciting things about this, firstly it was my first experience of these shy birds and secondly I saw the bird in a narrow road verge, albeit in good condition. This was back in early 1993 and at the time I thought it was a sure sign that I was in for an interesting time carrying out biological surveys in the Fitzgerald Biosphere Reserve. Now almost five years later, and many, many trapping sessions later, I have been able to document the high biological diversity and hence high conservation value of the remnant vegetation surrounding the Fitzgerald River National Park (FRNP).

The FRNP has a special place in the hearts of the many people who have got to know this wild and wonderful area. Its name is synonymous with a high diversity of wildflowers, rugged coastal mountains and wilderness. What is less well known is that it is one of over 300 Biosphere Reserves that have been nominated worldwide.

So, what's special about a Biosphere Reserve, and what does the concept mean?

The Fitzgerald became part of UNESCO's 'Man and the Biosphere' Program in 1978 when it became one of the 12 Biosphere Reserves in Australia. It was originally nominated because of its high biodiversity and relatively pristine condition.

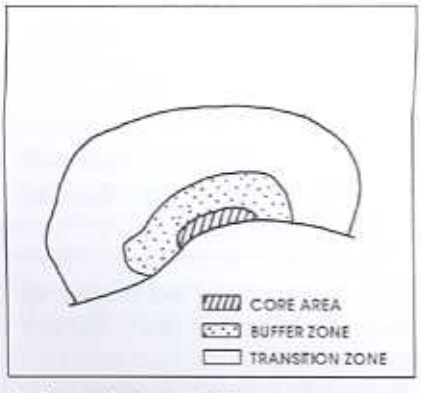
Ideally, Biosphere Reserves have three zones or areas; a natural core area where evolution can occur unhindered, a surrounding buffer zone where minimal human activity takes place and an adjoining zone of cooperation where most of the human activity takes place. In our case the FRNP makes up the core area and the buffer area comprises remnant vegetation surrounding the Park as well as the various corridors that link the Park along the coast and inland to other areas of native bushland. Farming is the main activity in the zone of cooperation and the involvement by farmers and others is purely voluntary.

The biosphere concept includes managing the core area or park to ensure biodiversity is protected and provision is made for research to be carried out. CALM manages to core area with input from the FRNP Advisory Committee, which is made up of local community members and CALM representatives. The concept also includes working towards managing the zone of cooperation and buffer zone in a manner that will protect the core area over the long term.

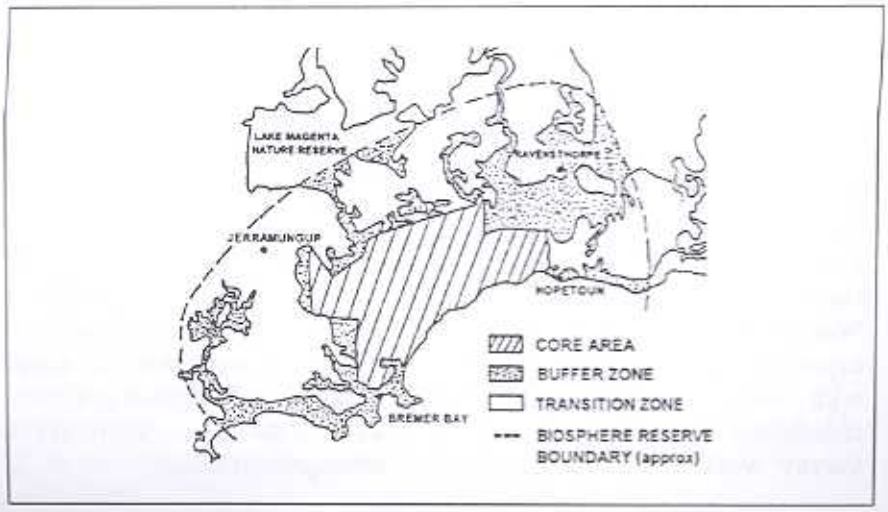
The FRNP, or core area, has five rivers flowing through it to estuaries on the coast and all of these rivers have their upper catchments in the cleared farmlands. Research on the estuaries and lagoons at the end of these rivers has shown that they are all suffering from increased salinity and siltation as a result of farm management practices. The challenge to landholders in the upper catchments is to work towards using their land in a sustainable way, which includes decreasing the amount of silt and salt laden runoff reaching the rivers. Many farmers are now working together with Landcare Coordinators and CALM to establish management practices that will help protect the values of the core area. A number of projects are now under way to address this with fencing and revegetation being carried out in the upper catchments of these rivers.

After working with a Biosphere Reserve on a large scale, I believe that the concept can also be applied at smaller scales and indeed, many people are already doing this in their catchment or on individual farms. Our challenge, I believe, is to take care of remnants that still support sustainable populations of flora and fauna, and to establish buffer zones around them. These

continued on page 15



▲ Truncated model biosphere reserve.



Fitzgerald River National park Biosphere Reserve in 1997. ▶

IN BRIEF

Moving House

by Joanna Seabrook

AMONGST the leaves of a trellis outside my kitchen window a pair of Brown Honeyeaters built a nest. I was able to watch proceedings, with great delight, as I often sit by this window for a cup of tea or kitchen work.

Brown Honeyeaters make great use of cobwebs and construct a beautiful delicate nest. Laying time arrived and when they had two eggs, along came a big, bad Singing Honeyeater. One day I heard a great to-do and the little Brownies were fighting off the Singing, who was darting at the nest. I went and chased Singing Honeyeater away and all was quiet until a few minutes later when it returned to attack the nest with renewed efforts. This time I thought I should refrain from interfering and let nature take its course. There was a great kafuffle and clapping of wings but the Brownies were not a match for the Singing Honeyeater who finally darted in and speared an egg, making off with the booty. It wasn't long before the Singing returned and repeated the procedure and, in spite of the best efforts of the Brownies, darted in and speared the other egg. It's hard to imagine birds look sad but it's a great temptation.

The next chapter - The Brownies began to dismantle the nest and they carried it piece by piece round to the front of the house where they rebuilt it in a Dryandra bush. Here they peacefully laid more eggs and reared a family. This is the second time I have observed a pair of Brown Honeyeaters totally shift a nest, making use of the same material a second time. Great recycling!

I will never trust a Singing Honeyeater again and sometimes wonder if this is the reason why they are often the only species of small bird in a country garden.

Joanna is a noted revegetation identity who is a member of the Board of Greening Western Australia and a Trustee of the Gordon Reid Foundation for Conservation. Her family farms at York. She can be contacted on 08 9299 6816.

Congratulations Joanna!

In the Australia Day Honours List, Joanna was made a Member of the Order of Australia, for 'services to the environment, especially revegetation'. Great recognition for a dedicated lady - who turned 80 this year! Congratulations from all *Land for Wildlifers!*

continued from page 14

could provide seed or other natural resources for the future and would also provide a source of plants and animals for the core area should anything untoward happen, such as a partial fire.

What you need to establish your own mini Biosphere Reserve is a patch of bush in relatively pristine condition (LFW 'excellent quality' assessment - Ed) or core area, that you want to protect in the long term. A buffer zone then needs to be established around the remnant, all the threats need to be identified and a management strategy put into place. This may include linking corridors to other patches, replanting native vegetation or fencing existing bush. My surveys of corridors in the Fitzgerald area showed that they were acting as fauna habitat in their own right and I am happy to say that my first encounter with a Western Whipbird was followed by many others in corridors and remnant patches of bushland throughout the area. In the zone of cooperation it is crucial that the farming is sustainable over the long term without compromising the values of the core area. Quite a challenge, but after working in the Fitzgerald I believe that the Biosphere Reserve concept is a sound umbrella under which to work, and is one that leads to truly integrated management.

Angela Sanders is a consultant biologist based in Ravensthorpe. She can be contacted on (08) 9838 1355.

For more detail, read:

'Networks and the Fitzgerald River National Park Biosphere Reserve, WA' Watson et al. IN: Nature Conservation 4: the Role of Networks Ed. Saunders, Craig & Mattiske. Surrey Beatty & Sons. 1995

'Fitzgerald River National Park Biosphere Reserve 1978-1997: the evolution of integrated protected area management'. Watson & Sanders. IN Parks. Vol 7 No 1. Feb 1997

The Fitz - Example to the World

Seventy of the world's leading national park and wildlife specialists went to Albany in Nov last year - members of the World Conservation Union's (IUCN) World Commission on Protected Areas. They were assessing the progress of protected areas from 'islands' to 'networks'. A focus during the week was on the jewel in WA's conservation crown, the Fitzgerald River National Park. The tremendous work done by the surrounding community and CALM in establishing and managing the Fitzgerald Biosphere Reserve was acknowledged by the delegates. It is an example for other developed nations to follow.

ABOUT GROUPS

Birds Australia

The Birds Australia Group was formerly called the Royal Australasian Ornithologists Union - a cumbersome title even for an Organisation which was formed in 1901. Since that date it has been the major force in the study of birds and their habitat. As well as being a strongly scientific group it has also many members who simply love to get out into the bush and watch birds. If their hobby can contribute towards the conservation of birds by the collection of data, so much the better. Birds Australia has its headquarters in Melbourne, but the WA Group has 820 members and is a strong and active Group. Although it takes part in nationwide studies such as the Atlas of Australian Birds, because of the tyranny of distance, the WA Group mainly runs its own affairs from its office at Perry House in Bold Park.

The WA Group organises many excursions; last year a total of 62, which range from 2 hour walks at places such as Herdsmans or Bibra Lake to weekend campouts and sometimes week long campouts to more remote places. These excursions often have a specific purpose such as searching for the Hooded Plover in the Esperance area. Several campouts have concentrated on searching for Mallee Fowl mounds in Ongerup and Perenjori and other areas. There are two Bird Observatories in WA, at Broome and at Eyre on the Great Australian Bight and these have done valuable scientific work as well as providing wonderful birdwatching experiences for members and friends. One of the projects of the WA Group has been to provide brochures for Country Shire Tourist Bureaux on the Birds which can be seen in the district and how to locate them. Over 45 such brochures have been produced by members.

Membership of Birds Australia includes the quarterly magazine 'Wingspan' which has interesting articles on birds and many excellent photographs. The cost of membership is $49 pa or $78 for a family but for people in WA it is well worthwhile to send an extra $8 and receive WA Bird Notes 4 times a year. As well as articles on Birding in WA it has details of excursions and meetings for the next 3 months. These meetings are held every month where there is always a speaker on some aspect of bird study. The WA Office address is 71 Oceanic Drive, Floreat, 6014. Phone (08) 9383 7749, or fax (08) 9387 8412. A Volunteer is on duty every weekday morning from 9.30 to 12.30 to answer your questions or send out membership forms and brochures telling about the Group and its activities.

Wendy Napier.

NEW BOOKS

FUNGI OF SOUTHERN AUSTRALIA
by Neale Bougher & Katrina Syme
Uni WA Press.

This is a beautiful book, both a work of art as well as an identification guide. It clearly explains the importance of fungi, where to find them and how to collect them, as well as describing and illustrating 125 individual species.

Beautifully illustrated by Katie Syme, the scientific accuracy is ensured by Neale Bougher of CSIRO. A book for every person interested in ecology - or botanical art.

Obtainable from: good bookstores. Cost $75.00

A FIELD GUIDE TO THE LARGER FUNGI OF THE DARLING SCARP AND SOUTH-WEST OF WESTERN AUSTRALIA
by Kevn Griffiths
pub: K. & M.A. Griffiths

A really excellent book to begin your study of fungi as it is very user-friendly! 110 species are illustrated and described on a family basis. There are keys and guides for both the amateur and practising mycologist. Illustrated with full colour painting throughout.

Obtainable from: good bookstores. Cost $20 (hardback) or $15 (softback)
OR ring Kevn on 08 9295 4212 and he will post you a copy for the same price!

LFW/CALM stand at Woolorama - see you at Dowerin! ▶
(photo: Avril Baxter)

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.
Published by the Department of Conservation and Land Management, Perth. All correspondence should be addressed to:
The Editor 'Western Wildlife', CALM Wildlife Branch, Locked Bag 104, Bentley Delivery Centre, WA 6983.
Design and Desktop publishing by Louise C. Burch Graphic Designer.