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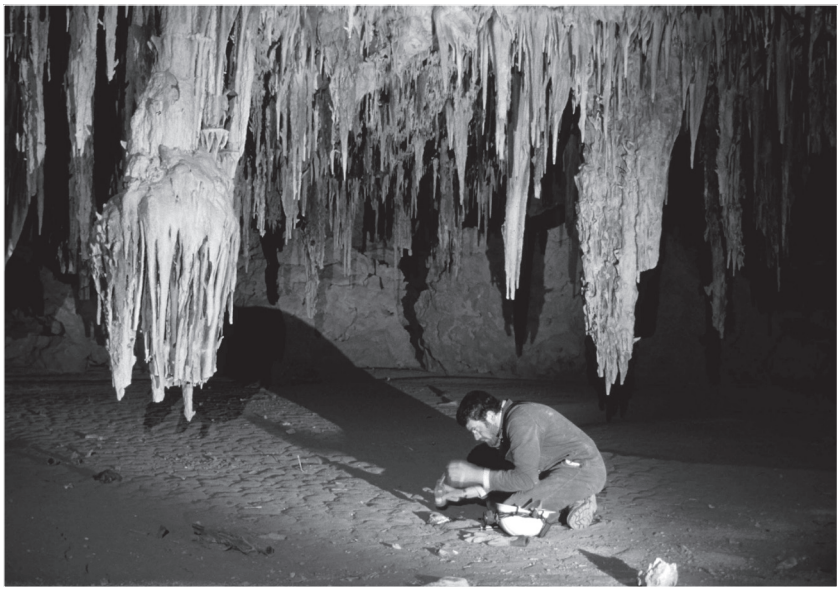
EXPLAINING AUSTRALIA'S PLEISTOCENE EXTINCTIONS

Gavin Prideaux

Australia's biota has fared poorly since European settlement. Countless species have been driven or are en route to extinction, and ecosystems have been irreversibly damaged. Deplorable as this is, it was not the first wave of extinctions to sweep across Australia in recent times (geologically speaking). The first people to set foot on the continent around 50 thousand years ago (ka) found a very different landscape occupied by very different animals, which bore little resemblance to those they had seen before. These unique creatures included the rhinoceros-sized *Diprotodon*, marsupial 'lions', giant wombats, short-faced kangaroos, horned tortoises, and giant flightless birds related to geese. These were not the ancestors of modern species, but cohabited the continent with them for at least the last half-million years. By 40 ka more than 90% of larger species (and numerous medium-sized species often overlooked in our fixation with 'megafauna') had become extinct. What could possibly account for the disappearance of such a diverse array of animals?



Gavin Prideaux and the skull of an extinct kangaroo. Thylacoleo Caves.

This question has become one of the longest-debated in historical science. Anatomist Sir Richard Owen fired the first salvo in 1877, arguing that "no adequate cause suggests itself to my mind save the hostile agency of man". A few years later, in 1885, geologist Charles Wilkinson, having seen the effects of severe drought on kangaroos and emus, as well as the diversity of fossil remains, including crocodiles, in the Pleistocene Cuddie Springs deposit (north-central New South Wales), emphasised the lack of "conclusive proof" for a human role. He suggested that "the general cause of the disappearance of these animals since Pleistocene times [was the] want of water". Move forward a century and a quarter, and the debate superficially seems to have shifted little. Surely we must have learned something given the past few decades of intensive research into faunas, people and environments of the late Pleistocene (125–10 ka). Will we ever know what caused these extinctions? And what effects have these had on vegetation patterns and ecosystem complexity?

Until the late 1960s overhunting by people and increased aridity remained the two dominant extinction hypotheses. A third idea, landscape burning by people, was tabled by archaeologist Rhys Jones of the Australian National University and Duncan Merrilees of the Western

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Greetings!

EDITORIAL

After the last issue, many people commented how much they enjoyed the stories and snippets of information from members; you will find some more fascinating happenings in this issue.. I even got an email from my counterpart in south-east Queensland, asking what is the best way to persuade landholder members to provide such information. My response was "Ask them!", so here, again, I appeal for readers to share interesting natural history snippets of text and photos! Digital cameras make the recording of images so much easier now. And talking of images, look at the article on motion-sensitive cameras - so much information and not stressful for the animals, either.

Academics are such busy people, doing research, writing articles for scientific journals and teaching students, that it is often difficult for them to find the time to write a summary of their work for the interested public. But when they do, it makes fascinating reading. There are several such articles in this issue, on soil seed banks, dispersal of weed seeds, the amphibian chytrid fungus and the demise of the megafauna. I am now very intrigued to find out, eventually, what 'cats' are in the Tight Entrance Cave results bag!

There has been such a spectacular display of wattles this year, that it should be an excellent opportunity for seed collection. If dry, clean and free of insects, wattle seed can be stored for years until required.

Best wishes, everyone, for an excellent ending to this year's cropping season.

Penny Hussey

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Sign presentaion day, Nell's Block (see p. 19)

Estelle Whitford (ALCOA), Thelma Crook (Greening Australia). Heather Adamson (LFWO), Tony Hiscock (ALCOA), Jane Townend (Rivercare Officer) and Katrina Hall (ALCOA Fairbridge Trainee) at the special day organised to celebrate the upgrading of Nell's Block from 'interim' to 'full'. (Photo: Alan Wright)

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FAUNA

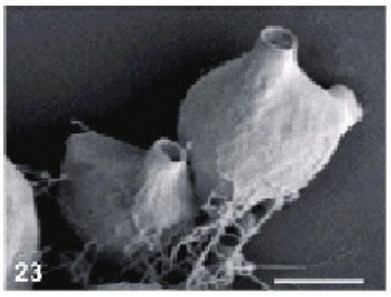
CHYTRID FUNGUS IN SOUTH-WEST FROGS

Karen Riley and Dale Roberts

A recent UWA study has revealed a high infection rate of the amphibian disease chytridiomycosis in a south-west frog species. The quacking frog (*Crinia georgiana*), a common species in forested areas across the south-west of WA, was found to have an overall infection rate of more than 75%. The study also expanded the known eastern range limit of the disease by some 400km, from Elleker near Albany to Esperance.

Chytridiomycosis is caused by an infection by the microscopic fungus *Batrachochytrium dendrobatidis*, which eats away at keratin in the frog's skin. The fungus was first discovered by Australian scientists in 1994 following frog population crashes in Queensland and Central America. It is believed to be responsible for the decline and extinction of several frog species worldwide. This included four Queensland species which have not been seen since suffering heavy population declines during a chytrid epidemic which began in the late 1980s. The fungus has been present in WA since at least 1985, however it does not seem to have had such devastating effects on our frog populations.

The UWA study attempted to determine any relationship between climate and chytrid infection rates in the quacking frog. The fungus has a waterborne stage in its life cycle and studies on east coast frog communities reveal an increase in disease prevalence in cool, wet conditions. The quacking frog was selected as it has a widespread distribution, from Gingin to Albany, and across the south west coast to Esperance. As a result it covers a range of temperature and rainfall, which can be compared to disease prevalence to reveal any influence



Two Chytrid zoosporangia, the larger with two spore discharge tubes. The scale bar is 10 microns (1/100h mm).
Ph: Lee Berger and Alex Hyatt, JCU.

of climate on chytrid growth. The quacking frog is also known to carry the fungus, although there is no evidence of chytrid related mortality in this species.

More than 570 quacking frogs were tested for chytrid from 15 sites across the south-west, with every site having at least one frog testing positive for the fungus. Six sites had infection rates above 90%, and the overall prevalence of the disease was 75.4%. Long-term climatic conditions were not found to influence the absolute distribution of chytrid fungus in the south-west. However, disease prevalence was found to be significantly greater in areas receiving high rainfall in the 30 days prior to sampling. This information is useful as it allows a prediction of when chytrid levels are highest. In the weeks following rains, extra vigilance can be exercised when working in the field in order to minimise the spread of the disease between sites.

Such a high rate of infection in the quacking frog was unexpected. Frog chytrid has a waterborne stage in its life cycle and cannot tolerate complete drying. As a result, species suffering the most from chytrid infection have been from high rainfall areas, and tend to spend a large proportion of their time in or around streams. The quacking frog on the other hand, spends most of the year burrowed under leaf litter in the forest, where conditions are too dry for chytrid to survive. The frog emerges only in winter to breed in temporary puddles formed after rains. So how does the disease persist at such high levels, on a host whose environment is dry for most of the year?

One possibility is that the fungus can produce a resistant spore that can tolerate drying. Scientists have long suspected that chytrid, like many related fungi, can produce a life stage with a tough outer coating to persist in harsh conditions. The existence of such a form in frog chytrid would explain how it has been able to spread and how it can remain in the environment for long periods. So far, however, no such life stage has been discovered. The quacking frog may be a good species in which to investigate the existence of this so far elusive resistant spore.

While the quacking frog does not seem to be adversely affected by chytrid fungal infection, the resistance of many other WA frog species remains unknown. This includes three threatened species which co-habit in parts of their range with the quacking frog. The quacking frog, by helping the fungus to persist at such high prevalence in frog communities, may be acting as a reservoir for chytrid, which could potentially contribute to the decline of less resistant frog species. It is important that more knowledge is gathered on the effects of the fungus on our local frogs, particularly in the face of an uncertain future threatened by climate change.

Karen Riley undertook this study as part of her Honours Degree in Zoology at UWA in 2008.

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Megafauna

FAUNA

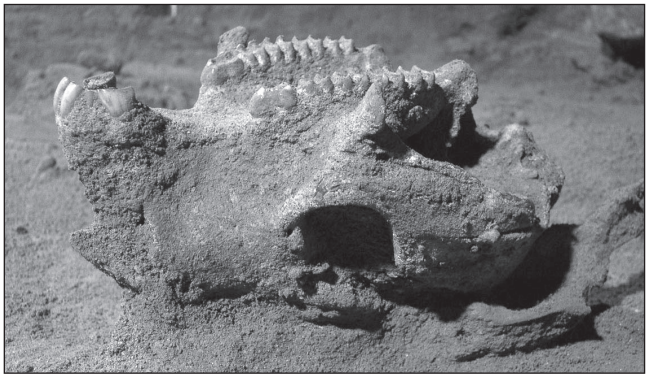
Excavating in Naracoorte Caves

Australian Museum, entirely independently of each other in 1968. Observations by Jones of modern burning practices by Aboriginal people led to his coining the term 'firestick farming', a technique involving repeated burning of vegetation to promote grassy understorey development, facilitating easier hunting, particularly of kangaroos. Jones and Merrilees argued that, when first implemented, this burning regime greatly altered the composition of plant communities, selecting against fire-sensitive food plants, and severely impacting browsing herbivores (consumers of shrubs and leaves of trees). Grasslands spread favouring grazers, including red and grey kangaroos, which have benefited further since European settlement due to the provision of permanent watering points for stock. A number of studies over the past decade have independently supported landscape burning as a likely extinction cause.

What about disease? Could a particularly virulent pathogen, brought here by humans, have played a role? This general idea has been proposed as a possible explanation for Pleistocene extinctions on other land masses, which saw mammoths, sabre-tooth cats, giant lemurs, moas and so forth disappear, at different times in different places. In Australia, however, it is difficult to imagine how a disease could account for the disappearance of such an array of unrelated species – more than 60 species including a giant goanna, crocodiles, snakes, turtles, several kinds of birds, echidnas and many marsupials – and then primarily the larger species. Humans would have to have been capable of spreading the disease continent-wide, but be unaffected by it themselves. In his excellent book on Australian mammal extinctions in 2006, Chris Johnson also pointed out that large species in south-east Asia (e.g. tapirs, rhinoceroses, primates) would have been exposed to this disease, but were evidently not susceptible. This leaves us with the relative importance of climatic changes preceding and/or concurrent with human arrival in Australia, and the activities of humans themselves through unsustainable hunting or habitat disturbance, as the most likely culprits (in isolation or combination).

Much of my research over the past decade has tried to address the problem by tracking pre- and post-human changes in the makeup of vertebrate communities through time, and by gaining a better understanding of the ecologies of extinct species. This work mainly involves retrieving large fossil samples from caves. Animals fall into caves through roof openings and are unable to escape. Bones become encased in sediments that enter the cave the same way. Some deposits also incorporate bones derived from regurgitated owl pellets or remains dragged in by mammal predators. Presence/absence data for species along with abundance data within one layer can then be treated as a 'snapshot' of a fauna from one interval in time, and compared with those above or below in the same section, or with other deposits elsewhere. Recent advances have allowed cave deposits to be dated using multiple techniques.

The World Heritage listed Naracoorte Caves in south-eastern South Australia represent the only known locality on Earth with a record of vertebrate life covering the past half-million years. Its value is enhanced by the fact that it is directly comparable with a rainfall record preserved in stalagmites and stalactites. Our work at Naracoorte was the first (2007) to show how an Australian mammal community responded to glacial-interglacial climatic cycling (warm/wet versus



Skull of extinct kangaroo

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Megafauna

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cool/dry times) prior to human arrival. We showed that populations waxed and waned in response to climatic cycling, with forest-adapted species retreating in drier times, while others became more abundant in drier times. Despite these fluctuations, all larger species there before 500 ka were still there at 300, 200 and 80 ka. The fauna was resilient to climatic variations. Extinction of all larger species bar the grey kangaroo by 40 ka cannot be ascribed primarily to increased aridity, especially given that all small- to medium-sized mammals persisted until Europeans arrived. Local climate was relatively cool and moist, and judging from the earlier record, should have been favourable for most larger mammals until 30 ka. The arrival of humans in the region just prior to the extinctions arouses suspicion.

Excavation in Tight Entrance Cave

Ossuary, Thylacoleo Caves

Some of our other work has been concentrated in the Nullarbor Thylacoleo Caves, where pristine Pleistocene marsupial skeletons were discovered by cavers in 2002. Penny Hussey reviewed our findings in the April 2007 issue of *Western Wildlife*. To recap, we discovered that a diverse fauna consisting of 69 vertebrate species, including around 30 different herbivores, inhabited the centre of the now 'Treeless Plain' at around 500 ka. Unfortunately, we have no pollen to indicate vegetation directly, but to support so many species it must have been very different to the modern shrub steppe, and was probably a woodland / shrubland mosaic. Was it wetter than today? Not according to the evidence. Isotope ratios preserved in herbivore tooth enamel and the modern distribution of smaller mammal, bird and reptile species found alongside the larger mammals suggest the climate was similar. Clearly, the large species were well adapted to a dry climate for half-a-million years before succumbing, which rules out aridity alone as the extinction cause. Interestingly, the more palatable plants scattered around the periphery of the Nullarbor Plain today (e.g. myoporums, sandalwoods, quandongs, native apricots) are united by their sensitivity to fire. Perhaps an increase in bushfire frequency and/or intensity changed the vegetation and precipitated the extinction of animal species reliant on fire-sensitive plants. The mystery that needs solving is the cause of this changed burning regime; one possibility is that it was human induced.

We are currently in the process of compiling and analysing data collected from 1996 to 2008 in the aptly named Tight Entrance Cave in the Leeuwin-Naturaliste Region, where we have a record of vertebrates, climate and bushfires (courtesy of charcoal preserved alongside fossils) extending back to 150 ka. The results are exciting in the light of our other research, but until they are published in a scientific journal we won't be letting any thylacoleos out of the bag! However, one thing our Western Australian research does emphasise is just how little we know about the environmental history of the State. In the long-term we hope to generate similar datasets from other regions (e.g., Kimberley, Pilbara, Gascoyne, Goldfields), but ou finding out about potential sites is entirely reliant on landowners, miners, cavers, travellers, explorers, kids, anyone and everyone keeping their eyes and minds open and reporting discoveries to the WA Museum.

Gavin Prideaux is Australian Research Fellow at the School of Biological Sciences, Flinders University, South Australia.

REVEGETATION

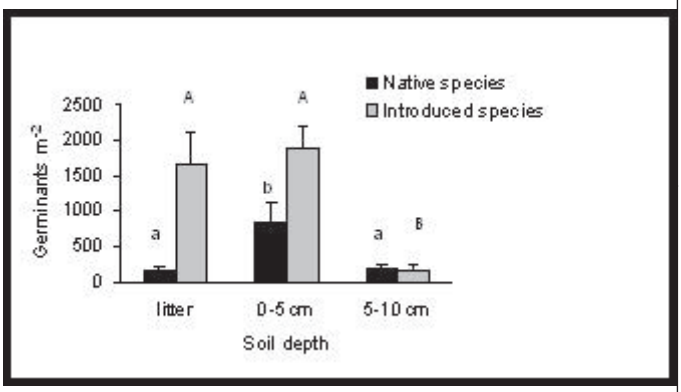
SOIL SEED BANKS - A TOOL TO CONSERVE AND MANAGE ECOSYSTEMS AGAINST WEED INVASION

Judy Fisher

Seeds in the soil provide us with knowledge of the past vegetation and the potential future vegetation, while enabling us to predict the restoration potential of invaded areas. Seeds arrive in the soil through seed dispersal and leave the seed bank through germination, consumption or death. If the remnant vegetation has a mixed seed bank of all native species in sufficient numbers, we would feel confident that the plant community will be resilient and able to resist weed invasion following disturbance. However if the soil seed bank contains a 'healthy' mixture and representation of weed seeds along with, or instead of, a native seed bank we would have less confidence in the plant community's future resilience. Results of a soil seed bank study in a banksia woodland in Bold Park, Perth, a 437-hectare reserve, demonstrate the potential to formulate management protocols for remnant vegetation to control weed species and conserve biodiversity utilising knowledge of the soil seed bank. The two dominant weed species studied were perennial veld grass (*Ehrharta calycina*) and rose pelargonium (*Pelargonium capitatum*).

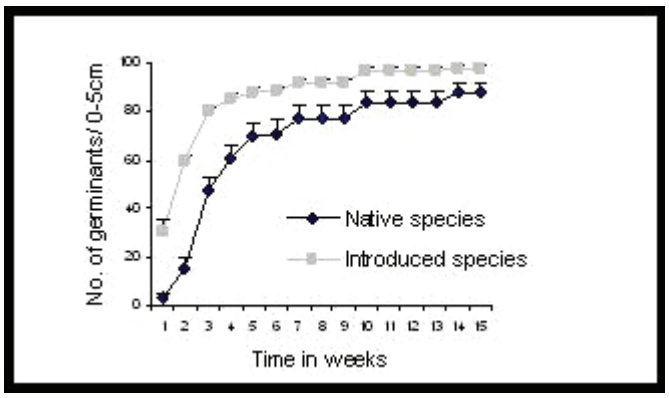
The study found that native and weed seeds, and by association plants, behave quite differently to each other*. Differences of relevance to managing remnants are the depth of seed in the soil (Fig. 1), germination timing (Fig. 2) and the large quantity of weed seed produced compared to the native seed (Fig. 1).

Fig. 1. Density of native weed seed at three depthe in a banksia woodland.



Weed seed dominates the litter and 0-5cm depth, while the majority of native seed is located at the 0-5 cm depth. Rapid germination of introduced species (30% in week one) compared to native species (4% in week onr) provides the potential for their early dominance at the start of winter rains. Consequently, if we have a large weed seed bank, those located in the litter have first access to water when the summer drought breaks, rapidly establishing their below-ground root structure and above ground biomass, before the native species have had the opportunity to germinate. If the germination season follows fire, weed species are able to rapidly exploit open spaces and increased nutrients, out competing the native species.

Fig. 2. Cumulative germination of native and weed seed over 15 weeks.



As found in this study, a high proportion of the weed seed bank may be persistent; meaning the seed has the ability to arrest development and persist long into the future, potentially existing as sleeper species awaiting ecological change to confirm their presence in the vegetation. Frequent fire can assist the establishment of a large weed seed bank, due to weed species' large and rapid seed production, compared to native species which require lengthy periods to attain seed production rates that ensure their replacement following fire. So how can this knowledge of similarities and differences between native and introduced soil seed bank contribute to the formulation of conservation protocols to control dominant invasive species in remnant vegetation?

An example is the perennial *Ehrharta calycina* which was found to have smoke-responsive seed, the ability to germinate in the dark (i.e. from depth), rapid germination following water addition, and an extremely large annual seed production, with the parent plants able to regenerate following fire. Based on these competitive

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Soil seed banks

REVEGETATION

survival strategies we can make the following restoration assumptions as to what will occur for *Ehrharta calycina* seed following an inadvertent fire:

1 The large seed load in the litter will be incinerated.
2 Seed at depth will be stimulated by the fire to germinate.
3 This seed will germinate rapidly following the onset of rains.
4. Parent plants will resprout in the period between fire and the start of the rain season.

Based on this knowledge, the Botanic Gardens and Parks Authority decided to trial a different management response in Bold Park following a fire started by an arsonist. An *Ehrharta calycina* control programme was started once the germinating seedlings had established, targeting the resprouting adults and the germinating seedlings. Essentially this should have virtually depleted the *Ehrharta calycina* soil seed load, eliminated the resprouting individuals prior to sufficient growth to return seed to the soil seed bank. This management method virtually eliminated *Ehrharta calycina* from both the above ground vegetation and the soil seed bank, that is, elimination of a species known to transform an ecosystem. This example indicates how knowledge of soil seed banks in remnant vegetation can assist in determining the best way to manage the weed seed bank and so the future weed population.

Determining the soil seed bank both in areas in good condition, as a reference, and where you may have difficult weed species is an excellent management tool and easy to conduct. Collecting soil samples before the start of winter rains from the litter, and a depth of 0-5cm, enables you to gain knowledge of the underground environment and the potential future vegetation within your remnant bushland. Spread the soil thinly in trays and begin to water, keeping the soil moist - if you have access to smoke water this can be applied initially. Over the next eight weeks, monitor the germinating seedlings - if you are unable to identify the seedlings transplant them to a pot to allow them to grow to maturity. Not only will this provide you with knowledge of your soil seed bank but it will assist your seedling identification skills, valuable knowledge when caring for your remnant. Gaining an understanding of the soil seed bank will help determine the best way to tackle invasive species which may be impacting the biodiversity of your remnant vegetation.

It is clear from the banksia woodland study that poor vegetation condition may well be associated with significant changes in the soil seed bank, namely, a depletion of native seed, and a predominance of seeds of introduced species. These shifts in the soil seed bank are likely to be signs of shifts in remnant vegetation species and life form composition, and highlight the importance of considering the soil seed bank in conservation management.

[* For ref contact Ed]

Judy Fisher is an ecological consultant. This PhD research was conducted through the School of Plant Biology, UWA and the Botanic Gardens and Parks Authority

Congratulations from the LFW team!

to **Suzanne Dennings** who was awarded the 2009 Great Southern Development Commission Medal for Excellence in Natural Resource Management. Suzanne was nominated by *LFW* for her leadership in the Malleefowl Preservation Group (MPG) and her success in promoting the malleefowl as an icon species to promote wider NRM issues. The MPG is now recognised internationally, while maintaining its grass-roots base.

to **Mike and Mary McCall**, winner of the Landholder Award in the Cape to Cape Catchments Annual Awards.

The McCalls have put a great deal of time, energy and money into not only their own property but also surrounding neighbouring properties and Shire reserves. They have contributed all of this initially separate from any outside funding, paying for all the works themselves. This included weed control, feral animal control, feral proof fencing, rehabilitation works, creekline re-establishment, fauna habitat creation and finally translocations of local native animals. They funded initial blackberry control within their property, adjoining properties and along the Shire reserve so that a strategic approach was taken. At a later date, the Cape to Cape Catchments provided funding for this initiative to continue for a further few years.

Mike and Mary, like other *LFW* property owners, well deserve this award.

FAUNA

BUTTERFLIES IN URBAN BUSHLANDS AROUND PERTH

Matthew Williams

In a previous article I discussed the effect of fire on butterflies and some results of the initial surveys I had completed at four sites (*Western Wildlife*, October 2003). This article summarises the results of surveys of 46 suburban bushlands (mostly *Bush Forever* sites) between the suburbs of Casuarina in the south and Kingsley in the north. Full results of these surveys were recently published in a scientific journal*.

To briefly recap, there are 63 species of butterflies in the south-west, and another dozen or so brightly coloured day-flying moths with similar habits that are often mistaken for butterflies. Many butterflies and day-flying moths (collectively referred to as 'butterflies' in this article) are becoming increasingly rare because they are susceptible to local extinction in urban bushland remnants, often as a result of fire and/or the displacement of their food-plants by weeds. Almost all butterfly caterpillars live and feed on the above-ground parts of plants, and so are killed by fire. And despite being able to fly, most butterflies will not disperse across unsuitable habitat to recolonise sites where they have become extinct. For butterflies, remnant bushlands are now 'islands in suburbia'.

*The Australian painted lady (*Vanessa kershawi*) is common in both bushlands and suburban gardens. Its caterpillars eat Capeweed - so not all caterpillars in the garden are bad! (Colour, black, white and bright orange.) Photo: Geoff Walker.*

Overall, surveys between 2001 and 2007 recorded 41 species: 36 butterflies and five day-flying moths. More than 1,000 km of tracks and transects were surveyed, often with the help of volunteers and Friends groups – many of whom contacted me after the earlier *Western Wildlife* article. Over 17,000 butterflies were seen. Among the most common and widespread species were the Australian painted lady (over 5,000 seen!), western xenica (2,000), marbled xenica (1,800), fringed heath-blue (1,300), and, of course, the introduced cabbage white (700). The most rare or restricted species were the large bronze azure, yellow sand-skipper and golden-haired sedge skipper (each was found at only one site each, although all have much wider distributions in the south-west), as well as the declared endangered graceful sun-moth, which was found at only five sites.

This sun-moth, from inland WA, is very similar to the endangered graceful sun-moth. Most species have brightly-coloured red or orange hind wings and dark forewings. Photo: Matt Williams.

The sightings of the graceful sun-moth were particularly important, because this endangered species only occurs on the Swan Coastal Plain between Mandurah and Quinns Rock, where it is threatened by clearing for urban development. Several sites where it had been recorded in the past (such as at Mandurah, Crawley and Fremantle) have since been cleared. It was recently declared Endangered under the Federal EPBC Act, based on earlier listing by DEC. On one exciting day in March 2004, Phyllis Robertson and I saw a female sun-moth laying eggs at the base of *Lomandra hermaphrodita*, confirming this as a food-plant (most butterflies and day-flying moths have caterpillars that are very specific in what plants they will eat). Subsequently, *Lomandra maritima* has also been found to be a likely food-plant, and other species of *Lomandra* mat-rushes may yet prove to be food-plants. This helps with conservation of the species because it enables us to determine from flora surveys if sites proposed for clearing are likely to contain populations of the sun-moth. This is very useful information because the graceful sun-moth is only active in March each

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Butterflies

*The western xenica (*Geitoneura minyas*) is one of few native butterlies that have benefitted from disturbance, and is now very common. Photo: Andy Williams.*

year, and is more difficult to find than its food-plant, so sites where the food-plants are present or common can be targetted for surveys.

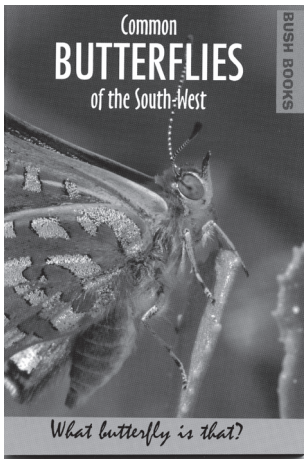
The number of species found at each site was highly variable – between one and 28. The most important factor in determining how many butterfly species were in each bushland was the proportion of the vegetation in 'very good' or better condition, based on the *Bush Forever* rating system. Perhaps surprisingly, the size of the bushland remnant was of lesser importance. Many 'smaller' bushlands, those around 10 ha or less, still contain several butterfly species including some now quite rare in the Perth metropolitan area. For example, Cottonwood Crescent and Errina Road bushlands still contain populations of the western brown skipper, blue iris-skipper and the spring sun-moth. These species were notably absent from some of the largest reserves surveyed, such as Kings Park and Bold Park.

*The fringed heath-blue (*Neolucia agricola occidens*) is common in most bushlands. It can be recognised by its brown wings with white chequered edges. Photo: Geoff Walker.*

In contrast, a few native butterflies are now more common in disturbed sites. These are a small minority of species that have adapted to introduced weeds, such as veld grasses. For example, the western xenica was probably quite rare on the coastal plain before these weeds were introduced, but is now one of the most common species of Perth bushlands and elsewhere in the south-west. It is extremely abundant in some places, such as near Camel Lake in Bold Park, where hundreds (if not thousands) can be seen flying each October.

Of all the study sites, Koondoola bushland had the most species. Many butterflies that are very sensitive to disturbance, such as the western jewel, blue iris-skipper, large bronze azure, mallee ochre, and the western and large brown skippers, still occur at Koondoola. And no western xenicas were seen in the northern part of the bushland, testimony to the good condition of this area.

If you plan to seek out our native butterflies this spring, the results of the surveys can offer some tips for finding them. First of all, butterflies are most common between mid September and mid December. Sunny days with maximum temperatures between 23 and 30 °C are ideal, especially if not windy. They are most active between 9.30 am and 3 pm, depending on temperature (late morning is typically the best time, especially on warmer days). Don't be surprised if you don't see many butterflies in September or early October – many species don't really get going until it warms up in mid October and early November. A few species, such as the graceful sun-moth and wedge grass-skipper, can only be seen between late February and April. Autumn is also the best time to see females of the western brown, although males are only around in November and December – but that's another story!



DEC has published a new Bush Book, *Common Butterflies of the South-West*, which describes and illustrates 31 of the most common species in the region. Almost all of the butterflies to be found in suburban bushlands around Perth and the major regional centres are covered by the book. A follow-up book on the other 32 species found in the south-west is almost completed and together they will provide a complete guide to the butterflies of the south-west.

[For ref, contact Ed.]*

Matthew Williams is a Research Scientist in DEC Science Division. He can be contacted on 9334 0399, or email Matthew.Williams@dec.wa.gov.au.

RESEARCH - WEEDS and FERALS

SPREADING WEEDS - THE HIDDEN COSTS OF RABBITS AND FOXES

Laurie Twigg

Readers will no doubt be aware of the direct detrimental impacts of introduced vertebrates (e.g. rabbits, foxes, feral pigs) on biodiversity and agricultural production in Australia. Such impacts include soil erosion, crop and pasture losses, degradation of on-farm bush remnants, competition with native species, preventing native plant regeneration, damage to tree plantations, predation of domestic and native animals (e.g. rock wallabies, woylies, bandicoots, numbats, and quolls), and the maiming of livestock (e.g. calves and lambs). However, readers may be less aware that many pest animals can also have indirect environmental and agricultural impacts, such as the spread and maintenance of weeds. Again, you may be aware that some animals can spread seeds contained in fleshy fruits (e.g. foxes and blackberries, silvereyes and bridal creeper), but I suspect you may just be a bit surprised to learn that some pest animals can also spread viable seeds not contained in fleshy fruits (hereafter, non-fruited seed). Such occurrences have implications for the successful management of exotic and other undesirable plants. Thus, to enable us to better understand just how important vertebrate-spread of non-fruited seed is in weed management, we undertook a collaborative study with Mike Calver's (Murdoch University), and Ric How's (Western Australian Museum) groups investigating the ability of a range of vertebrates to disperse *viable,* non-fruited seed.

Our methodology

Three main techniques were used to assess the importance of rabbit and foxes in dispersing non-fruited seeds; 1) faecal material was collected from several locations in the agricultural region of WA, and the number and viability of any seeds present was determined; 2) the seed preferences of captive-held, wild-caught rabbits were assessed to determine if rabbits consumed weed seed (e.g. gorse); and 3) seed passage time through the gut, which influences seed dispersal distances, was determined in captive-held rabbits. All recovered seeds were placed in 'incubators' for at least four weeks to assess their viability (i.e. produced seedlings). Test-seed included soft-seeded crimson clover, gorse, and canola. Their consumption was compared to that of a commercial rabbit-seed mix.

Rabbits

In summer, viable seeds were recovered from 3-4% of the rabbit faecal pellets compared to 21-40% of pellets in autumn (Fig. 1). Of the 1,136 seeds recovered from these pellets, 16% germinated. Overall, 13-30% of rabbits passed viable seeds in summer, and this increased to 44-73% of rabbits in autumn. We also know that seeds make up a around 50% of rabbit's diet during their summer/autumn dispersal period. Ten (77%) of the 13 species of seed identified in the faecal pellets were known weeds (e.g. flat weed, capeweed, Guildford grass, goosefoot, crowfoot/storksbill, dock). Seedlings identified during the passed-seed germination trials included goosefoot, *Crassula* sp. (Pygmyweed), clover (two species), Guildford grass, and a range of grass species. Seedlings of crimson clover and gorse were also grown successfully during the passage time trials. However, overall, the viability of recovered seeds of these species was reduced compared to that of undigested seeds (crimson clover 57% vs. 100%; gorse 14% vs. 84%).

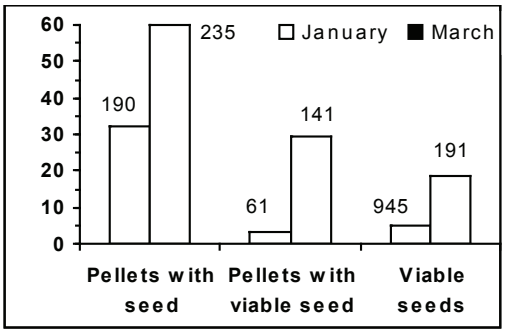


Fig. 1 The percentage of rabbit faecal pellets containing seed, viable seed only, and the viability of passed-seed. Internal values are the numbers assessed.

Our findings fit nicely with earlier work where over 65 species of plants, including 18 alien species, were identified in the diet (stomach contents) of rabbits from south-western WA. European rabbits are also important seed-dispersers in coastal sand dunes and woodlands in Spain, and in some British forests. Many of the viable seeds passed by the British rabbits were domesticated or weed species.

In our captive wild rabbits, passage time of biomarked seed (dyed with Carmine Red) through the intestinal tract was 4-7 hours. These relatively quick passage times, and the fairly small home ranges of rabbits, suggest that seed dispersal by rabbits may generally occur over short distances (<1 km). However, seasonal rabbit-dispersal distances for adult males can be up to 15 km, and even the

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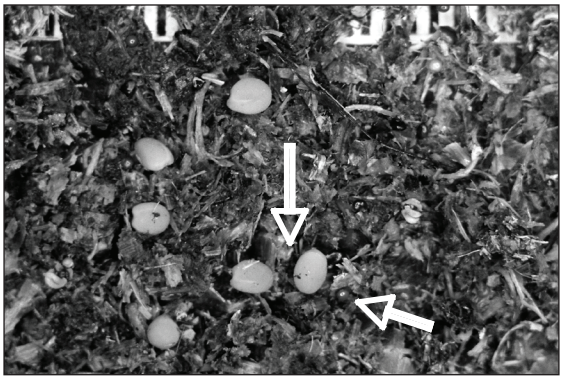
Weed seed dispersal

WEEDS and FERALS



Some small and large seeds in a rabbit faecal pettet.

more routine dispersal distances of 1-2 km would often take viable seed beyond the usual dispersal boundary of plants. With unassisted dispersal, the vast majority of seeds are usually only dispersed 100 to 200 m from the parent plant.

The recovery of viable Goosefoot seeds from rabbit pellets is particularly interesting as species from this genus are known to be allelopathic, and can cause considerable crop losses unless control measures are implemented prior to seeding. Finding viable gorse seed in some faecal pellets also has possible implications for the management of this declared weed species in Australia and New Zealand.

Foxes

Although 48% of scats (n = 62) contained whole seeds, fortunately, only 12.9% of all scats contained viable seed (Fig. 2). Our study is the first we know of which clearly indicates that foxes are potential dispersers of viable non-fruited seed via their scats. Where examined, approximately 21% of foxes had whole seeds in their hides, usually in the belly region. Most were grass seeds and 50% were viable (4/8 seeds). Thus, considering all recovered seeds, 63% (12/19) of seed species identified in the scats and hides of foxes were weeds (e.g. nightshade, dock, Guildford grass, grasses). Seedlings grown from the recovered seeds included nightshades, grasses, clover, and figs.

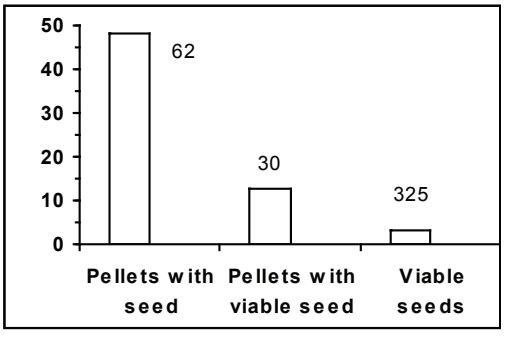


Fig. 2 The percentage of fox scats containing seed, viable seed only, and the viability of passed-seed during autumn. Internal values are the numbers assessed.

It is difficult to speculate about the origin of the seeds found in our fox scats, but some seeds were probably deliberately ingested (e.g. nightshades, mulberries, figs). Yet other seeds (e.g. clover, Guildford grass, grasses, flatweed, crowfoot/storksbill) were probably ingested secondarily through the rabbit-prey. It is difficult to predict the effect of seed-passage through the gut of foxes on seed viability, as this depends upon whether the seed is fruited or non-fruited. Such passage often increases or maintains germination of fruited seed, and decreases the viability of non-fruited seed. In some cases, foxes seem to prefer alien seed and fruits over native species. Our, and the findings of others, indicate that foxes have the potential to disrupt ecological communities by favouring the short and long-distance dispersal of alien plants.

Nightshade (Solanum nigrum) grown from a fox scat.

Long distance seed dispersal

Dispersal is generally defined as the unidirectional movement of an individual away from its source location. With plants, dispersal is often passive, and the dispersal of seeds usually only occurs over short distances. Long-distance dispersal events (distances greater than 100-200 m), although often rare, can be disproportionately important to the long-term survival of plant populations as they enable new individuals to establish away from other plants with potentially less competition for space and nutrients. Such dispersal can be critical to a species' survival as many plant populations are spatially isolated due to the patchy nature of many landscapes. This is particularly so in the spread of invasive plants following climate change in fragmented landscapes.

Some caveats

Remember that dispersal, germination, establishment, survival, and successful reproduction are important determinants in the establishment of new plant populations, and that the passage of seed through mammals and other seed consumers can also have indirect effects on seed germination rates. For example, whether seed deposition occurs in an environment which is suitable for plant establishment is at least partially governed by

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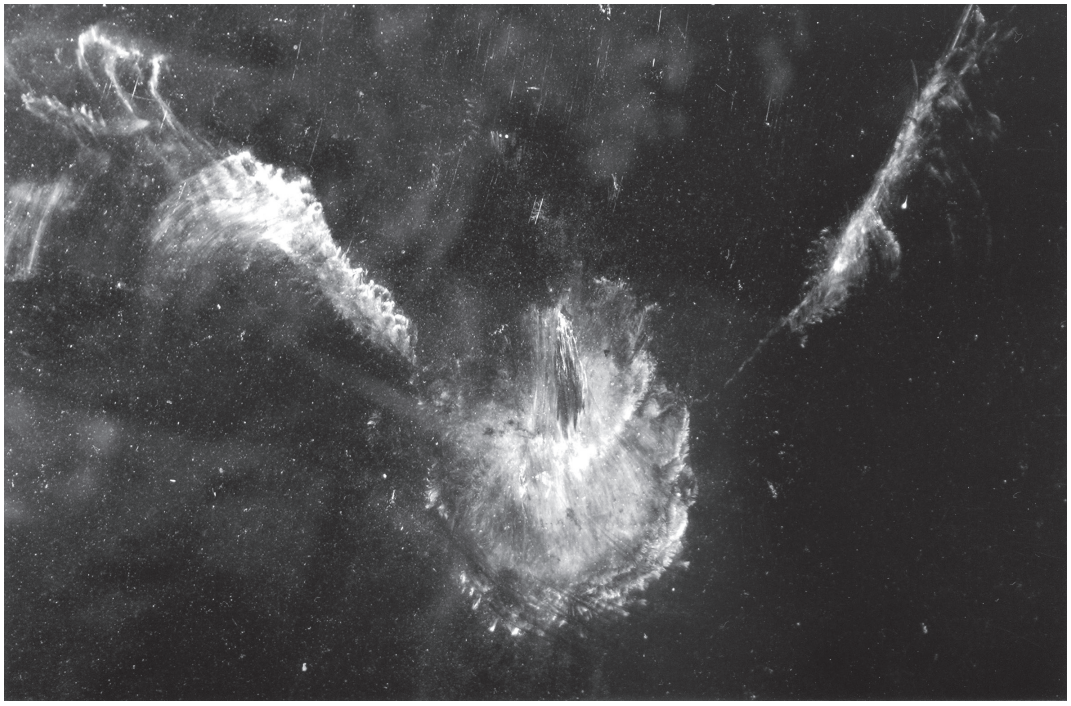
A GHOSTLY IMAGE



During the summer months, our sliding glass doors had received scant attention. The film of dust that had covered the surface of the glass had gone unnoticed. On a rain-soaked evening in early June at around 7pm, the verandah light was on. About half a dozen or so ghost moths were flying up and down and around our glass doors, probably attracted to the light, or maybe just trying to keep dry. One of these finger-thick sized moths stretched the tape at 11 cm body length. Ginny and I had not been watching the evening news for more than a few minutes when suddenly a southern boobook owl flew from its wet perch three metres away in a marri sapling and collided into the glass door. Thankfully the owl appeared unhurt as it gathered itself and flew away into the night, minus the moth! Wet feathers and a very dusty glass door made this ghostly image. I heard a boobook the following night – hopefully the same one!

John Barnett, Julimar, Toodyay.

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continued from page 11

Weed seed dispersal

where and how often defecation occurs. Also, the simple presence of seed in the gut or scats does not necessarily imply that viable seeds are dispersed, as the viability of such seeds must be determined. Unfortunately, such assessment is often overlooked in many studies.

Also remember that our assessments of passed-seed viability will represent minimum estimates as we were generally only able to monitor germination for a 4-week period. That is, we have probably underestimated the ability of both mammal species to spread viable seed.

Conclusions

When both dispersal of seeds via the digestive tract (endozoochorous), and by adhesion to animals (exozoochorous), are considered, we believe that rabbits and foxes can be legitimate dispersers of viable seeds. Thus, suppression of weeds can be added to the benefits of reducing the abundance of rabbits and foxes in Australia. Moreover, as rabbits and foxes can travel relatively large distances, and as seed retention times are sufficient to enable viable seed to be dispersed, we suggest that both species could also act as long-distance dispersal agents. However, the importance of such dispersal remains unknown as the dispersal efficacy of rabbits and foxes is yet to be determined in Australian environments. But, it is becoming increasingly evident that the role of mammals in the dispersal of some Australian plants may be greater than previously thought, and that the influence of such dispersal needs to be considered in the management of weeds and ecological communities.

Acknowledgments

I thank the many people who helped with this project, particularly Tim Lowe and Gary Martin from DAFWA. The Feral Animal Control Program of the Australian Government's Natural Heritage Trust also supported this project. [*For refs, contact Ed.*]

Laurie Twigg is a Senior Research Scientist at DAFWA's Forrestfield Vertebrate Pest Research Section.

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PRACTICALITIES

REMOTE CAMERAS SPOT CHUDITCH AT DRYANDRA

Mick Davis

DEC's Wheatbelt Region has successfully trialled the use of remote sensing day/night cameras to monitor fauna. The cameras use an infra-red flash to replace the traditional white flash, making night photos and also short videos possible. Motion sensors fitted to the camera take photos whenever there is movement.

A recent deployment of remote cameras at Dryandra Woodland uncovered some very interesting results. Western grey kangaroos, tammar wallabies, brush-tailed possumsechidnas, a grey kurrawong, several woylies and even chuditch were detected and successfully photographed over a one month 'trapping' session.

"The cameras were instrumental in confirming that Chuditch continue to use the main block at Dryandra" said Peter Lacey, Nature Conservation Leader for the Great Southern District. "In the past we have used traditional cage trapping to detect animals in Dryandra. Although these remote cameras are not a replacement for traditional trapping techniques they have a number of advantages.

"The cameras use fewer resources, provide additional information about fauna behaviour and provide photographic proof of animals, which is less disruptive to animals. There is less potential to miss animals because of poor weather conditions or situations where the trap is already full, and they can potentially pick up animals that are in poor health and consequently may not enter a cage trap."

Below is a composite image of some of the animals observed over the period. Which ones can you identify?

Remote cameras are increasingly being used by DEC and the community in the role of 'bush detective', and the more the cameras are deployed, the more we begin to understand about native and feral species in the bush.

If you are keen to know more or get one of your own cameras, contact your local *LFW* Officer.

Mick Davis is DEC Ecologist, Wheatbelt Region . Contact: mick.davis@dec.wa.gov.au or 9219 8730

Members' Page

THINGS THAT GO BUMP IN THE DAY …

Wayne Gill

Isn't it supposed to be things that go bump in the night? Please read on.....

Intrigue... Recently a *Land for Wildlife* member approached me at the local Wildflower Society meeting to relate a story about 'something' in the roof of her town house. Several snippets of the story excited my herpetological bones with talk of hearing a slow sliding from within the roof cavity, the mystery creature spending hours or days even above the same spot in one room and lastly the fact that they used to have to bait for mice and haven't had to do so for the last few years. All this information, coupled with the fact that the house in question is at the base of Wireless Hill, a granite headland bound to be home to a few scaly creatures, had me thinking there was a snake of some kind practicing biological control of rodents within suburban ceilings.

Clues... Excited by the prospect of wrangling a snake, maybe even a carpet snake, in a ceiling found me handing all my contact numbers to Bev (the homeowner), on the proviso that if she heard the distinctive slow sliding noises to give me a ring. Anytime! Any day! SO, .a week later I am hanging out at home with my two young boys when I get the call saying that the 'thing' is within a few metres of the man-hole and I may have a reasonable prospect of finding it. I was around there in a flash and up into the dusty, but large and open ceiling space. I didn't hear anything that day but my suspicions were confirmed by the number of reptilian scats with distinctive white spots of urea similar to that of birds. Also, the ceiling insulation seemed to have cozy nests and tunnels in and under it, similar to what a snake would make. Most pleasing was the complete lack of rodent smell and any sign of them for that matter. But, still no clear indication as to what our quarry was, but this *LFW* Officer was now on the scent. However, there was now one very nervous *LFW* member wondering who she was sharing her house with!

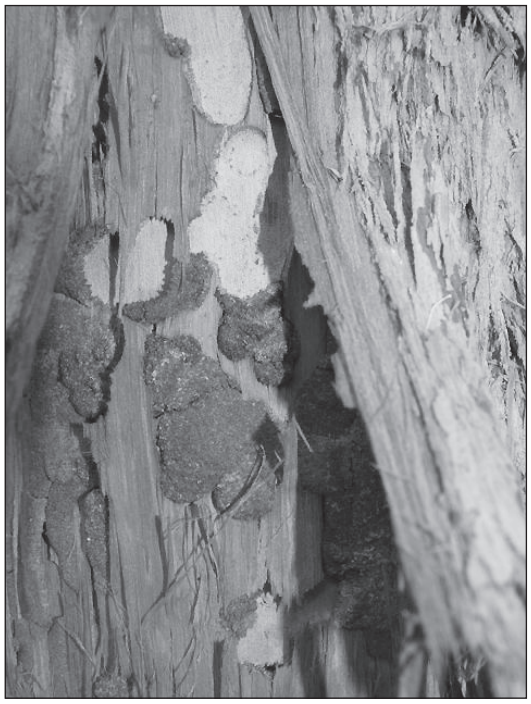
Resolution... Fast forward a couple of weeks to late in the day, I have just arrived home after work when I get another call from Bev saying that the 'thing' was now within a few feet of the man-hole and I should come if I could. A quick hello goodbye to the family and I was off again and back into the roof. This time she had a good idea where it was and after lifting several pieces of insulation I saw a yellow spotted tail disappear from view. I called to Bev to relieve her anxiety "Well, it's not a snake". A minute later I was climbing down with the fattest, healthiest, if not a little upset, king skink (*Egernia kingii*). The slow sounding movements were caused by the lizard having to crawl under the insulation, pressing it hard against the ceiling and restricting its speed. I reassured Bev by telling her that I would be ecstatic to have such a large skink running security in my roof, reducing any need for poisonous baits. Still not convinced she let me leave with the lizard in a bag.

Reconciliation... I had only been home for half and hour or so when Bev called saying that she was feeling guilty about evicting her housemate and would it be okay for it to be retuned to her roof. The following day I headed back around to her house where we had a few photos before releasing our grateful reptile into its grand manor. Although Bev was happy that our captive was a skink rather than a snake, she remains convinced that the noises she heard in the past belonged to something substantially bigger.....

Photos Wayne Gill

Bush Detective

What's attacked this tree?



Justin Hardy, Development Officer at DAFWA, Albany, sent in this pic, asking if LFW *could identify what had torn into this sapling on a river bank near Denmark. Most of the bark had been torn off and it looked as if it had been attacked by a demented maniac with a serious grudge against trees!*

The close-up pic gives the clue - somebody's after the borer grubs. You can see active borer galleries, plus some filled with frass (excreta and debris). The usual culprit here is black cockies. They have very strong beaks and can easily tear off bark to reach the protein-packed grubs beneath. These are a very nutritious meal, and well worth the effort. The birds cling to the trunk, tilting their head from side to side, ?hearing the animals beneath. Then, in they go. A full thickness (2.5cm) of marri bark can be stripped right back.

Justin asked, will the tree survive? Well - this tree looks as if it was heavily infested with borers. They, of course are feeding on the cambium and living cells, seriously interfering with water and nutrient movement. If their galleries meet around the stem they can ringbark the tree, or just kill it slowly, as it probably happening here because of the very high numbers of borers present. Dying, or severely stressed, trees give off pheromones, which insects can sense, so even more adult beetles arrive to lay their eggs which develop into larvae that feast on the struggling tree. Healthy trees can wall off the borers' depredations, but the sicker they are, the easier the borers can feast.

Ironically, the dearth of the borers' predators (cockies) mean that more can survive to adulthood, and so the borer population has presumably built up, and continues to do so. Thus the cocky ripping up the bark to eat the grub can be seen as a beneficial action for the tree (or at least for the woodland as a whole) as it is controlling a pest.

This tree? It doesn't look as though the trunk will recover, but it may reshoot from the base You would need to look at some other recently-dead trees in the vicinity, and see if you find the distinctive shape of borer tunnels on the surface of the wood (as shown very clearly in the second pic).

There may be some other explanation for the damage, but this looks the most likely. If anyone has any other ideas, we'd like to hear them, please!

Did you know that ...?

… when grasstrees (*Xanthorrhoea* sp.) sprout after a bushfire, the length of frond affected by the heat provides an indication of the fire intensity at that location? Measurements and comparison across a burn site may be helpful in interpreting the pattern of post-fire regeneration,

Steve Easton, Botanic Gardens and Parks Authority

In Brief

EMERGENCY CONSERVATION ACTION TO HELP SAVE THE WOYLIE

The State Government recently pledged $600,000 to fund an Emergency Conservation Action Plan for the woylie (*Bettongia penicillata ogilbyi*) to establish insurance populations at risk of extinction in the wild. DEC will use $500,000 to establish a 400 ha predator-free enclosure in Perup Nature Reserve (300 km south of Perth) that should be capable of naturally supporting up to 500 woylies. At least 40 founders will be sourced from the surrounding area, which previously constituted the largest of three indigenous populations that persisted after pan-continental declines of the species in the 19th and 20th centuries.

In 1996, the woylie was the first Australian vertebrate to be removed from state and national threatened species lists in response to a spectacular recovery facilitated by extensive fox-control and woylie translocations since the 1970s (see *Western Shield* Project at www.dec.wa.gov.au/programs/western-shield/index.html).

However, the species is now relisted as endangered or critically endangered (depending on jurisdiction) as a result of even more spectacular population collapses that have so far led to an 80% decline of the species since 2001. As yet, there have been no clear signs of a recovery. Since 2002 the Perup population has declined by more than 95% to less than 300-500 individuals.

The remaining $100,000 will be directed towards a collaborative captive breeding program at the Perth Zoo with a focus on conserving the genetics of the Batalling woylie population (150 km south of Perth), which also has unique genetic attributes and has been reduced by more than 97% to almost undetectable levels.

The cause of the recent declines remains to be verified but both predators and disease have been implicated (see Woylie Conservation Research Project at www.dec.wa.gov.au/programs/saving-our-species/woylie-conservation-research-project.html). However, these initiatives will present particularly valuable research opportunities to improve the understanding of the species and the declines in a manner that is necessary to deliver a sustained long-term conservation outcome for an otherwise robust species with a proven ability to bounce back from the brink of extinction.

Adrian Wayne is a Research Scientist at DEC Manjimup. Ph: 9771 7992; Email: adrian.wayne@dec.wa.gov.au

BE CAREFUL WITH FUSILADE®

The grass-selective herbicide Fusilade®, which contains the active ingredient fluazifop-p-butyl, has long been used as a blanket spray to control weed grasses within bushland. In WA, scientists at Kings Park and Botanic Gardens (KPBG) led the way with this use, conducting numerous trials to determine the effectiveness of the herbicide on the target weeds, combined with off-target effect on native species. Commercial sources claim that this herbicide is grass-selective, post-emergent, non-residual, has rapid breakdown and is active though foliar application only. But over the years, especially after the release of the stronger preparation Fusilade Forte™, KPBG staff began to wonder whether it wasn't having some residual effects, particularly on native seed germination. So they set up a study to try to find out*. The results are disturbing.

It appears that both herbicides are residual, can be taken up through the soil and can have a negative effect on native seed germination. The stronger Fusilade Forte™ has greater effects. Given that in practical use, operators do not always follow the label recommendations as there is a common perception that 'if a little is good, then a bit more must be better', this could lead to disasters – and perhaps already has.

The authors conclude that use of Fusilade® may have left a 'negative legacy'. For example they state "Native seedling recruitment within our study ecosystem (previously exposed to Fusilade®) is limited following natural fire events. There may be several other causes, including seedbank decline through weed invasion and frequent fire events, but a potential contributory cause following herbicide application is now recognised." The authors recommend great care and more exact targeting when these herbicides are being used in bushland. *[*For ref, contact Ed.]*

BIRDS OF ROTTNEST ISLAND

Birdos who visit Rottnest will no doubt be aware of Denis Saunders and Perry de Rebeira's informative book *Birds of Rottnest Island**. The same authors have recently published a case study that collates and reviews a large number of Rottnest avifauna records from 1905 to 2007*. It details changes to the avifauna, postulates causes and suggests monitoring and management actions for conservation. This paper will be of interest to anyone who is trying to manage for bird conservation in a small, confined area in which there are also a large number of human beings.

[For refs, contact Ed.]*

Members' Page

AN APPREHENSIVE-LOOKING YOUNGSTER

This photo was taken during a *Land for Wildlife* visit to Alec and Kath Trendall's nine ha property 'Springhaven' in January. The property borders the Lowland Coastal Reserve half way between Albany and Denmark. They love the peaceful environment and spectacular coastline.

The southern part of the property sits on top of the old aeolian dune system and contains bushland typical of the coastal heathland of the area. However the northern part of their property is very different in landform and contains woodlands of bullich, yate and peppermint trees. The swale areas at the base of the dunes have a natural permanent supply of water. In the late 1920s this area was targeted for potato production. An old irrigation drain runs through the property providing the 'tell tale sign' that the Trendall property was also cleared at this time and used for potato production. When the Trendalls purchased the property in 1995 they received a letter from the

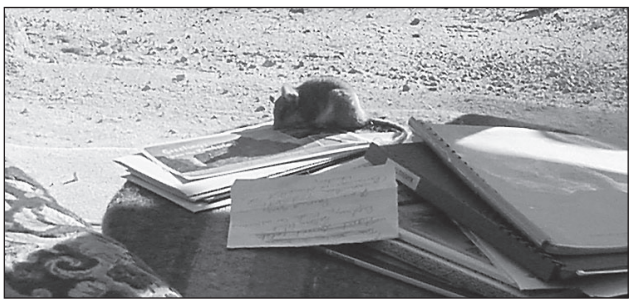
Agriculture Department informing them that there were possibly organochlorides still residing in the soils. This does not appear to have affected the local native wildlife. There are large populations of kangaroos, southern brown bandicoots, western bushrats, water rats etc. They have also recorded at least thirty species of bird.

During our *LFW* property visit, Kath and I came across a young raptor sitting on one of the firebreaks. It was obviously a juvenile because it still had some soft down feathers poking out. We asked the Threatened Species Conservation Oficer at DEC Albany, Cameron Tiller, which species he thought it might be.

He replied: "The bird is a very scruffy looking juvenile brown falcon. This picture would have possibly been taken on the fledgling's first attempt to leave the nest (it is not often that raptors able to fly would have the remains of down on them) or else the fledgling may have even fallen from nest (would have to check around the site to find out). Also, given the apparent proximity the photographer was able to approach, I would assume that the bird was not at all an experienced flier. The first defense of birds of this age would be to flip on its back and strike out with its legs rather than flee".

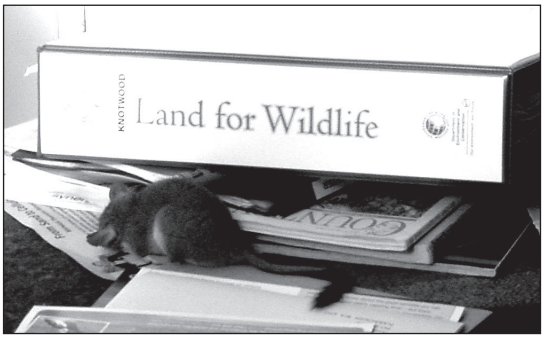
Sylvia Leighton

ITS TIRING WORK BEING A PHASCOGALE!



On a cold frosty morning in early July, *LFWO* Avril Baxter found a redtail phascogale absorbing the warmth of the early morning sun in the north-facing sun window. She assumed it was a recuperating male, judging by the noise in the roof cavity the previous nights. The animal allowed her nephew Torin Baxter to photograph it, but eventually ran off, only to return to the same area in the afternoon.

Redtail phascogales moved into the roof cavity in the house that Avril and Ned are building as soon as the roof went on. They have been seen on a regular basis ever since, but never for such an extended period during the day. This is the most westerly report of the redtail phascogale on DEC's Threatened Fauna database.



(Avril swears that the adjoining shot, in front of the *LFW* folder, was not posed - honest!)

NEWS

COFFEE MORNINGS IN TOODYAY

LFW members in the Shire of Toodyay were blessed with fine weather at the two coffee mornings held in July, allowing pleasant rambling through two totally different properties.

The first was held at Desrae and Wayne Clark's property, and of interest were the variety of bushland types, and the marked differences in their boundaries. Lack of ground cover and understorey was attributed to over grazing by kangaroos and changes in hydrology secondary to the road being bituminised. In addition, some vegetation types, like powderbark woodland, have naturally sparse understorey.

Desrae pointed out branches laying across the slope to stop erosion.

Later in the month, Don and Eva Smith hosted the second event. *LFW* members were treated to slide shows, orchids, fungi and declared rare flora. Don demonstrated the measures he takes to protect the balgas from attack by twenty-eight parrots.

Harmony, the educational Carnaby's cockatoo, attended both events, and managed to entertain participants by upstaging the speakers!

Discussing regeneration on the Clarkes' place.

Zara Kivell

Practicalities

Having problems with pesky twenty-eights tearing the heart out of your balgas? Don Smith demonstrates a method which is working well for him. As soon as there is a sign that parrots are attacking an individual balga, he loosely fixes a 'mob cap' of chicken wire across and around the top of the plant, so the birds cannot get at the fragile central growing point. They will bounce up and down on the wire, but eventually abandon the plant as it is not the dark green leaves that will grow up through the wire that they want to eat, but the soft white bases at the growing point. So don't throw away that old chicken wire, put it to good use!

What is this?

Eric Boon, manager of Doorawarra Station east of Carnarvon, sent us this pic asking "What is this strange-looking creature that appears in claypans when they fill after rain?"

Despite its unusual appearance, this animal is really quite common and widespread in suitable habitats. It is a shield shrimp, one of the many crustaceans whose eggs lie dormant during the dry season in the mud of claypans or saltlakes until stimulated into germination by the rains. Along with other crustaceans such as brine shrimps, and the very small ostracods, copepods and waterfleas, they feed on algae and themselves form part of the food chain for animals such as tadpoles and birds. Sometimes these crustaceans are in such huge numbers when our inland lakes fill after exceptional rains that they can support vast breeding populations of birds.

For further information read 'Is there life in our inland salt lakes?', *WW* 4/4 Oct 2000, on the *LFW* website.

NEWS

BUSHWALK IN BOYA

On a cool Sunday morning in late August, 26 visitors from the Darling Range Branch of the WA Naturalists' Club and the Eastern Hills Branch of the Wildflower Society of WA gathered for a bushwalk at *LFW* member Joan Seaborn's property in Boya.

The two ha site is located on the Darling Scarp on the outskirts of Perth. It slopes down to a seasonal creek at the eastern end and the vegetation consists of a woodland of marri and wandoo with fringing flooded gums along the creekline. The reason for the bushwalk was to show the benefits of weed control and how the bush can recover.

After the visitors had a warming cuppa, Joan explained how she came to purchase the property. Longing for peace and quiet and plenty of space around her, she purchased the bush block 12 years ago. This was the start of Joan's dedication to weed control and regeneration of the bushland on the block.

Joan said that when she first arrived the property was 90% infested with weeds. However, Joan was not daunted and immediately set to work controlling weeds, often starting work in the dark on the road verge at 6 am.

Firstly, the local bushfire brigade came in and burned a section of dry watsonia to reduce the extreme fire hazard. Later, the regrowth was sprayed with glyphosate. Other patches of watsonia were either blanket sprayed, wiped with herbicide if growing among native plants, or slashed near the creek. The combination of chemical and manual control methods has now virtually eradicated watsonia from the property.

The beneficial effects of weed control can be seen in the increase in native flora, especially spider orchids, blue sun orchids and the bicolour kangaroo paw. In addition, weed control has contributed to a reduction in fox and rabbit numbers by removing the dense weed infestations which covered fox dens and rabbit warrens.

About one month earlier. a motion sensor camera provided on loan by WWF Threatened Species Network had been set up next to a bridge over the creek by WA Naturalists' Club member, Mike Griffiths, who was hoping to record what animals were moving through the property. A number of bronzewing pigeons and silvereyes were recorded and non-natives included a black rat, three foxes and three cats. Mike said that it was a useful exercise, but having the camera there for a longer period of time may have recorded a wider range of species.

With ongoing weed control, natural regeneration, and a National Trust conservation covenant on the bushland, the future of this property is looking very bright. Joan is going to name her property 'Bush Treasure'. She says that she feels blessed to live on her property and has a great passion for the natural world, even when pulling out weeds!

Claire Hall

Joan Seaborn (Photo: Claire Hall)

NELL'S BLOCK RESTORATION

It was a pleasure to upgrade 'Nell's Block' at Yarloop from interim to full and to present a sign to the organising committee. This 16 ha was originally owned by Kathleen Ellen Piggot (Nellie) who was a very independent woman and developed her own poll Hereford stud and a passion for the land. In 2005, the block was bought by ALCOA and a partnership was formed with a number of community groups.

When the site was first registered in 2006, the virtually treeless paddock was being cut for hay. "Wildlife – what wildlife?" I often heard people say. But even then there was wildlife, people just hadn't noticed. Scores of little dragon lizards lived in the dry cracked soil. Hundreds of Christmas spiders dangled from the boundary fence line, numerous common grass-blue butterflies and native wasps visited the pennyroyals. More than 20 bird species were recorded and the latest count by the Mandurah Bird Observers group listed 32 bird species, including the southern boobook owl.

Baseline data was recorded and photopoint monitoring conducted for visual impacts. Weed management was instigated and on-going. During the past two years, 26,000 rushes, sedges and seedlings, have been planted. The vision is to extend this wide wildlife corridor, from the Darling Scarp all the way to the Harvey Estuary

Witnessing the dedicated determination of a whole range of people, transforming this landscape back to life is truly inspiring and infectious. Congratulations on your 'full' membership with *LFW,* it's been great to work with you!

Heather Adamson

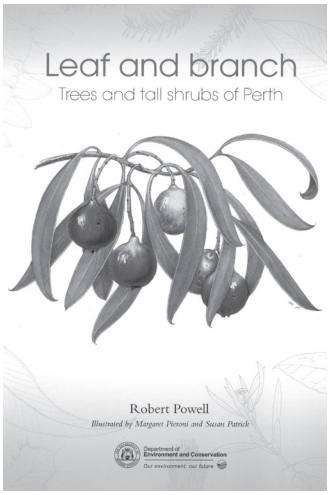
NEW BOOKS

Leaf and branch: Trees and tall shrubs of Perth (second edition)

Robert Powell

DEC, 2009

$29.95



Robert Powell is known for his love of gardening with local native plants, and for his encyclopaedic knowledge of bushland ecology, especially the smaller creatures. In 1990 he wrote the first edition of this book, with the aim of getting people to look at Perth's plants in a different way. Restrained and elegant, illustrated by line drawings rather than photographs, it encouraged the reader to look at pattern, shape and design and to see beauty and fascination in detail – have you noticed, for example, that marri has wiggly branches? Why do they grow like that?

The book has long been out of print, and Robert has spent much of the last two (or three?) years revising and updating it. Essentially, it is the same text, but in a larger format (A4) giving a more attractive layout. There are some extra illustrations and more information, especially in the introductory chapters and in new snippets about fauna.

Attractively priced, this book would make a wonderful present for someone – even yourself, if you are not already familiar with it. It is a gentle celebration of the wonderful world in which we live, and an appeal to understand and conserve that world for future generations.

How to know WA wildflowers; Part II.

BJ Grieve. UWA Press

Now remaindered, this most recent volume of the essential identification series 'Blackall and Grieve', is available from the Wildflower Society for the astonishing price of $10.00!!!!!! It has ID keys for wattles and peas, boronias and several other families. Although some of the names are now out of date, they are easily updated from FloraBase, and the small drawings that accompany the keys are still extremely valuable – just look at the jacksonias, for a case in point. Any plant person who hasn't got their own copy of this book, contact the Wildflower Society of Western Australia on ph 9383 7979, fax 9383 9929 or email wildflowers@ozemail.com.au. You will never get a better offer!

Common Butterflies of the South-West

Andrew Williams, Robert Powell, Mathew Williams and Geoff Walker

DEC, 2009. $6.50

(See note on p 11.) The descriptions are compact but clear, and include interesting life history and behaviour information. The accompanying photographs are excellent. Although there are other field guides available, this book will be very useful for WA residents as you can search for the animal you saw without the distraction of similar species from other States.

After the article 'Antics' in the last issue, a number of readers contacted me regarding ants. They, and others, may be interested in the following very informative and easy to read book that I obtained from my local library.

The Lives of Ants

Laurent Keller and Élisabeth Gordon (translated by James Grieve)

Oxford University Press. 2009.

Ants are everywhere! They exist in teeming millions in complex and very successful societies. How can such tiny individuals have evolved such complex behaviour? This book takes you through the whole world of ants, from evolutionary beginnings to complex societies, collaboration to war, parasites and predators; finishing up with chapters on using ants to design medical robots. Below are a few fascinating facts, there are literally thousands that could be quoted!

- *Ants form about one tenth of the weight of all the animals on Earth.*
- *Ants are mostly tiny. The world's biggest ant is the giant forest ant from Borneo, which is 3 cm long. Its head is large enough to house an entire colony of a minute ant from South Africa!*
- *some ants use their own larvae as the sole source of food for their queens.*
- *in the Jura region of Switzerland, worker ants collect spruce resin which has anti-microbial properties, and spread it through the nest to decrease the number of pathogens.*
- *some ants in Malaysia produce workers who are 'suicide bombers'. They can detonate themselves and spray attacking enemies with deadly venom.*
- *Ants have about 40 secretory glands, producing different pheromones that enable them to communicate by smell.*
- *Some worker ants may live for only a few days, while queens of some species may live up to 15 years.*
- *etc!*

Book notes by Penny Hussey

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 Environment and Conservation.
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