Woodland Wanderings
Newsletter of the Grassy Box Woodlands Conservation Management Network
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Wildlife on Farms of the South West Slopes.

by Rebecca Montague-Drake. - ANU Fenner School of Environment and Society

Woodlands: A Disappearing Landscape

Since European settlement, more than 85% of the native vegetation of the South West Slopes, the majority of which would have been woodland, has been removed. Over-clearing has caused major problems such as soil salinity, erosion (and consequent sedimentation of our waterways), dieback of remaining trees and loss of farm productivity. Unfortunately, it has also had significant negative effects on native wildlife, with many species either now extinct or endangered.

She'll be right: we'll just plant more trees…?

In the past decade, millions of dollars have been spent on revegetation. While the resulting plantings are undeniably important in helping to curb landscape degradation, the loss of our unique wildlife, with their myriad of diverse needs, is a much more complex problem.

In 2000, Ecologist Professor David Lindenmayer and his team from the Fenner School of Environment and Society began the 'Restoration Study' to explore the relative contribution of plantings and remnant vegetation to wildlife conservation.

The Restoration Study

This extensive study is being conducted on 46 production farms across the South West Slopes of NSW, located from Albury in the south to Gundagai in the north, thereby spanning many different landscapes. Because of its unique design, the Restoration Study is delivering information about what makes some sites, farms or landscapes better than others for wildlife.

A range of factors was considered to ensure the study's scientific validity. For instance, farms and landscapes with varying levels of remnant woodland and plantings were chosen. Sites were selected to include old growth woodland, multi-stemmed (coppice) regrowth woodland, natural regrowth woodland and native vegetation plantings. Planting sites were chosen to include different shapes and sizes. The amount of paddock trees, native grass, logs and other farm variables were also measured. Such careful stratification enables clear determination of the features most attractive to wildlife.

Studying Wildlife

The Restoration Study focuses on possums and gliders (arboreal marsupials); birds; snakes and lizards (reptiles); and small mamals. Studying such a diverse range of animals requires many kinds of survey techniques, including spotlighting, hair sampling, active searches for reptiles and audio-based bird surveys. To date, the team has found:

- 169 species of birds, including many threatened and declining woodland species;
- 25 species of 'herpetofauna', including skinks, geckoes, dragons, legless lizards, frogs and snakes;
- 4 species of arboreal marsupials, including the endangered Squirrel Glider; and
- 2 species of native small mammals, such as the Yellow-footed Antechinus.

Key Findings of the Restoration Study

Statistical examination of the large volume of data collected for the Restoration Study has recently commenced and is yielding many exciting and novel findings, including:

What Makes Some Farms Better Than Others for Wildlife?

This is an important question, particularly because a "farm" is a real unit of management that landholders can work with to improve wildlife conservation outcomes. Historically, this scale has rarely been investigated with most scientific studies instead focusing on the landscape or site level. In this study, the team found strong relationships between amounts of natural 'features' on a farm and the presence and/or abundance of wildlife. These natural 'features' include: native grassland, paddock trees; and remnant woodland area (particularly large, block-shaped patches).

Indeed, the study found that most variation in bird species effects at the farm level could be explained by a composite measure of the above attributes. Thirty-seven species responded positively to this composite measure, including many threatened and declining birds, such as the Brown Treecreeper,Crested Shrike-tit, Jacky Winter and Hooded Robin. Nonetheless, some species did not like high levels of this index. These species included birds commonly associated with human infrastructure, such as House Sparrows, and also birds assocated with open habitats, such as Brown Songlarks.

Reptiles also responded to elements of this composite measure at the site level. For instance, Rainbow Skinks responded to the presence of native tussock grass while Marbled Geckoes liked the presence of large, old trees (these trees shed more bark: a key habitat requirement of this species).

Strong relationships were also found between high levels of fallen timber and the presence of mammals, such as the Yellow-footed Antechinus and Common Ringtail Possum. While it may seem strange that an arboreal marsupial should respond to the presence of fallen timber, field observations showed that they often use fallen logs as 'runways' while out and about foraging at night.

In summary, the farms that wildlife prefer are those that have a range of natural features, including:

- **Native grasses;**
- **Paddock trees;**
- **Big, block-shaped remnants.**
- **Fallen timber;**

We believe that farmers who maintain these features as part of farm management, i.e. have a 'feature farm', are the ones who should be celebrated, but we also believe that it is these farmers whose properties will be more productive and in a better position to receive future stewardship payments.

What is the Relative Value of Replantings?

The study found some interesting relationships between the presence and abundance of certain taxa and native tree plantings. For instance, while 17 bird species responded positively to the presence of plantings on a farm, they were generally a different 'set' of birds than those that responded to the composite measure outlined above. Examples of birds that responded positively to tree plantings included many smaller birds often associated with 'finer textured habitat' (such as Superb Fairy-wrens, Red-browed Finches and Yellow Thornbills), common native birds (such as Red Wattlebirds), introduced species (such as the Common Blackbird and European Goldfinch) but also some declining woodland birds such as the Rufous Whistler and Scarlet Robin. Anecdotal evidence also showed that a variety of other threatened and declining species, such as the Speckled Warbler and Flame Robin were also present in plantings, and indeed, one of Professor Lindenmayer's current Phd students, Susie Bond, has also noted a number of rare birds successfully nesting and rearing young in these plantings. It was also interesting to note that some species, such as the Yellow-rumped Thornbill, would have been absent from entire landscapes (10,000 ha areas) had it not been for the presence of plantings, highlighting the role of these resources as refuges in areas where clearing has been extensive.

Similar to the birds, reptiles represented a 'mixed bag' when it came to plantings, with 7 species found more often in plantings, 3 species equally detected in plantings and remnants and 11 species never found inplantings (i.e. only found in remnant vegetation). In contrast to the reptiles, all native mammal species (including four arboreal marsupials and the Yellow-footed Antechinus) were more commonly found in remnants. Interestingly though, House Mice and Black Rats had more detections in plantings. While introduced, it is important to remember that these animals can be a valuable food source for species such as Barn Owls and Carpet Snakes that have lost their traditional prey items.

In summary, plantings are not a substitute for remnant vegetation, rather they should be considered complementary, offering, in the short-term, a different type of habitat and therefore attracting a different set of species. In the longer-term, it is hoped that these areas, if planned correctly from the start, will have a wider array of esources and therefore support more animals. For instance, fallen timber for Brown Treecreepers, tall trees to provide suitable foraging environments for species such as the White-naped Honey-eater, and hollows for arboreal marsupials such as the iconic Squirrel Glider.

Cumulative Effects of Remnant and Replanted Vegetation

Because plantings generally support a different set of species than remnant vegetation, it is not surprising to learn that farms with plantings and simultaneously high levels of the 'feature farm' measure (i.e. remnant vegetation, paddock trees, native grasses and fallen timber) supported the largest numbers of wildlife species. Having a variety of habitat present is known as 'landscape heterogeneity'.

Other Findings

• Planting size and shape matters. Big plantings provide better wildlife habitat than small plantings and blocks provide better habitat than strips. For instance, Red-capped Robins and Buff-rumped Thornbills were only found in large, block-shaped remnants.

• Not all remnant woodland is equal habitat for wildlife. Old growth woodland, coppice regrowth woodland and natural regrowth woodland vary in attractiveness to a range of different animals.

• Farm management makes a difference. Other activities on your farm, such as bush rock removal or ploughing, can have negative impacts for wildlife, while activities such as fox-baiting, particularly when done in conjunction with neighbours, can have positive impacts.

• Small Bits Matter. While big, block-shaped remnants are best, small remnants (and even individual trees) are all important. As an example, the smallest old-growth remnant in the Restoration Study (which is no more than a few scattered trees up an incised drainage line) has a bird list which includes declining species such as the Crested Shrike-tit, Brown Treecreeper, Grey-crowned Babbler, Jacky Winter, Rufous Whistler, White-browed Babbler, and Dusky Woodswallow!

• The effects of clearing remnant vegetation cannot be offset effectively by replanting, at least in the short-term. For instance, statistical modelling has shown that clearing remnants on a farm could lead to a loss of, on average, 7 species, but that conducting plantings would lead to gains of, on average, only 1.6 species (with the species lost and gained being from very different 'sets').

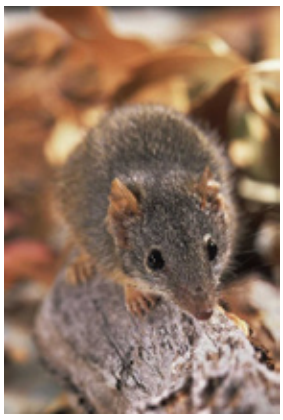

Photo by E.Beatson

Antechinus

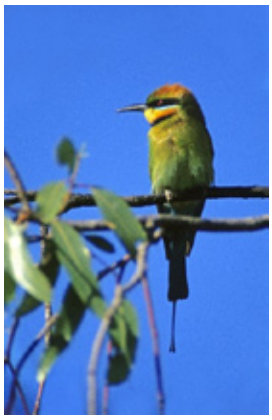

Photo by E.Beatson

Rainbow Bee-eater

Editor's Note

Editorial

by Toni McLeish

Over the past 12 months our network has been funded by the National Landcare Programme in partnership with the Department of Environment and Climate Change and the Lachlan Catchment Management Authority. The focus has been on "Management of Grassy Woodlands – maximising production and conservation".

We have produced a series of 3 Box Gum Woodland (BGW) interpretive signs for each CMA to aid the promotion of BGW's, their value, threats and actions. These are supported by glossy educational fliers for distribution at field days etc by CMA's and other partner groups.

The network held a successful 2 day training in "Holistic Decision Making in Grazing Management" for Rural Land Protection Board rangers in Dunedoo.

We distributed and workshopped 30 Grassy Ecosystem Management Kits with CMA's and managers, focusing on monitoring in Box Gum woodlands.

Our filming of "The Better Bush Conference" in Albury on September 19th has proven a huge success with over 150 land managers attending the outreach conferences in their local area. I have enjoyed many great discussions prompted by these presentations and look forward to providing the presenters with land holder feedback. I thank the groups that organised local events and invited me along to convene the viewing.

I will continue to offer the Better Bush Conference Outreach until the end of 2008 for groups with a minimum of 15 people, so claim your date ASAP. *(See insert for presentation summaries).*

The Australian Government Stewardship programme is about to role out with the Lachlan and Murrumbidgee CMA's taking on the role of delivery agent. Good luck to CMN members in those catchments who will be tendering for the programme. I will be keen to receive any feedback regarding the processes, positive or negative to pass on to the Australian Government.

We have been preparing a Caring for Country funding proposal that if successful will see the network get more on ground support into the future, along the lines of the CMN EEC Catchment officer in the Lachlan CMA. In the mean time don't forget your spring monitoring just before what I hope will be a good harvest for those of you with crops!

NETWORK CONFERENCE NOV.14TH-15TH see pg19

Insular Granite Outcrops – Botanical Refuges in Agricultural Landscapes.

by Damian Michael – Senior research officer, Australian National University.

Granite outcrops, or inselbergs as they are commonly called, have long been recognised around the world as being rich in floristic diversity, often supporting unique ecological communities and large numbers of endemic species. Despite interest in Western Australian inselbergs, much less has been published on the flora of south-eastern Australian outcrops, especially those which occur in agricultural landscapes. As part of a study investigating the role of granite outcrops in conserving reptile diversity within the southwestern slopes of NSW, we collected data on plant species composition from 44 insular outcrops (Photo 1). Outcrops situated within grazing or cropping paddocks varying in size from 25 m² to 25 ha are often threatened by processes including; over grazing by stock, vegetation removal, soil nutrification, soil erosion and weed infestation. However, due to the hostile nature of most large outcrops, many plants are inaccessible to stock, thus providing rare insights into past vegetation communities.

Photo by Damian Michael

Photo 1. Insular granite outcrops are a prominent part of production landscapes in south-eastern Australia and can support a diverse array of flora and fauna.

The study was conducted within the south-western slopes of NSW (south of the Murrumbidgee River & north of the Murray River) during the summer months of 2006 and 2007 at a time when persistent drought conditions had already taken a significant toll on ground cover vegetation. Plant species were recorded within a 200 m x 200 m (4 ha) sampling quadrat. Despite unfavourable conditions for native plants, a number of locally rare species were found, including the Granite Bushpea (*Pultenea platyphylla*); discovered growing from small cracks on large granite domes between Burrumbuttock and Gerogery (Photo 2). Five new plants of the threatened Woolly Ragwort (*Senecio garlandii*) were found growing between boulders on the now Greening Australia managed property near Wagga Wagga (Photo 3), along with a small population of *Acacia penninervis* (approximately 50 plants). This locally rare wattle also occurs on Mullemblah hill, a large inselberg north of Walbundrie, whereas *Senecio garlandii* is known from several other locations within the region. Several outcrops, near Walla and Henty, contained mature Quandongs (*Santalum acuminatum*) and one outcrop near Tabletop contained approximately six Rock Correa (*Correa glabra*).

Distinct vegetation communities occur on granite outcrops depending on geology, mineral composition of the parent rock and derived soil conditions, including soil type, structure, depth and water holding capability. These communities include; Box-Gum woodland, White Box (*Eucalyptus albens*), Blakely's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) as well as other associations such as: 1) Long-leaf Box (*E. goniocalyx*) Red Stringybark (*E. macrorhyncha*); 2) Tumbledown Gum (*E. dealbata*) - Currawang (*Acacia doratoxylon);* 3) White Cypress Pine (*Callitris glaucophylla*) and, 4) Drooping Sheoak (*Allocasuarina verticillata*). In addition, the variety of microhabitats on granite outcrops provides refuge for a diverse array of plant species evolved to cope with either dry or wet conditions. These conditions change within a relatively short distance depending on variables such as the amount of solar radiation, soil depth, drainage and aspect. With the exception of cryptogams, lichens and mosses, few vascular plants are able to survive on rock surfaces, but some species such as Rock Ferns (*Cheilanthe sp.*) and Rock Isotome (*Isotoma axillaris*) can colonise small cracks on the exposed rock face. Many outcrop

species can cope with drought conditions, including the small ferns which are often referred to as resurrection species as they can withstand desiccation to less than 5% of their normal leaf moisture content, rehydrating within a day of rain.

Photo by Damian Michael

Photo 2. Species such as the locally rare Granite Bushpea (*Pultenea platyphylla*) can survived in heavily grazed landscapes by colonising inaccessible locations such as granite domes.

A total of 197 plant species were recorded, of which 2.5% were parasitic canopy species such as mistletoe, 3% were midstorey species, 4% were cryptogams and ferns, 7.1% were native overstorey species, 7.6% were native shrubs and 34.5% were native ground cover species. Exotic species accounted for 45.3% of the total flora and dominated most of the small, low lying scattered outcrops. Plant species richness varied considerably between outcrops, ranging from 5 to 48 species with the average number of species being 25. Native forbs and grasses were dominant on outcrops that covered a large area and contained massive boulders and domes which create small refuge pockets from which plants can be protected from stock. Larger outcrops contain substantially less broad leaf exotics and pasture grasses, presumably due to low soil nutrient levels.

Insular granite outcrops are wonderful yet delicate environments which can support a diverse array of species no longer found in surrounding cleared landscapes or heavily grazed lowland remnants. Future management of these sensitive habitats will vary from site to site depending on geomorphology and landscape position, but immediate conservation measures such as protection from stock, controlling invasive weeds and implementing appropriate fire regimes may be adequate to rehabilitate some sites.

Photo by Damian Michael

Photo 3. Spaces between granite boulders provide protection for threatened species such as Woolly Ragwort (*Senecio garlandii*) pictured regenerating in response to a wildfire.

An interesting phenomenon on granite outcrops, which is being investigated in more detail, is the negative effect of dense eucalypt regrowth on reptile and plant diversity. Regrowth can occur from coppiced woodland stands (a result of past logging activity), seedling germination (a result of grazing suppression) or wildfire. Preliminary results suggest that dense thickets of regenerating trees, especially *Callitris* sp., have the potential to compete with and shade out native ground cover species, increase leaf litter depth and alter moisture levels. In addition, excessive amounts of canopy cover shade (reduced solar penetration) as a result of dense regrowth produced a strong negative response in the abundance of the saxicolous (rock dwelling) reptile, the Tree Crevice Skink (*Egernia striolata*, Photo 4).

This may have enormous implications on the design of future tree planting programs in areas which contain granite outcrops, as high density plantings may compromise theecological values of such sites. It might therefore be preferable to enhance native ground cover species, increase shrub diversity and establish overstorey species at a density of 10 - 30 trees per hectare, emulating natural spatial patterns found in old growth granitic woodland.

Damian Michael is a Senior Research Officer with the Fenner School of Environment and Society, Australian National University. He is undertaking a PhD investigating the ecological role of insular granite outcrops in agricultural landscapes of southern NSW.

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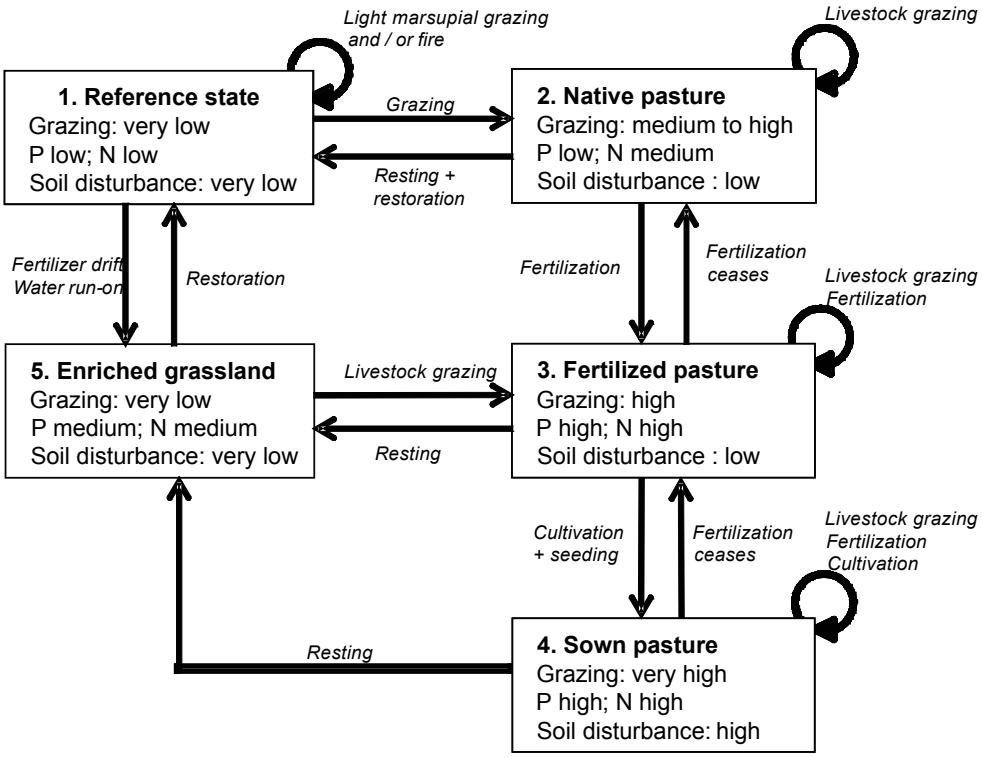
Contact Toni for copies of the species lists from Damians article.

Photo by Damian Michael

Photo 4. The abundance of specialised rock-dwelling species such as the Tree Crevice Skink (*Egernia striolata*) can be negatively affected by canopy shade produced by dense overstorey regeneration or coppice regrowth.

State and Transition Model

by Sue McIntyre *Why Limit the use of fertilizers in rural landscapes? pg.15*



What Makes a Good Squirrel Gilder Petaurus Norfocensis Den Tree?

by Mason Crane - ANU Fenner School

The squirrel glider is a medium size gliding possum which was once found commonly throughout the woodlands of the sheep/wheat belt. Today it is endangered in Victoria and threatened in NSW. This is because its preferred habitat coincides with the most productive parts of the landscape, which today is mostly converted to grazing and cropping lands.

The squirrel glider is rarely found in conservation reserves and if so they are often in low numbers. That is because most Nature Reserves or National Parks in the western slopes are setup on the unproductive lands that no one wanted and cleared, much of it not suitable for gliders.

Today the squirrel glider is primarily found on road reserves (including paper roads), privately owned agricultural land and travelling stock reserves and routes. So to conserve this species it is up to private landowners, Councils and Rural Lands Boards. A major threat to this species is the loss of den trees. Den trees are trees in which gliders use for shelter and raising young, they are mostly hollow bearing eucalypt trees (including dead trees). One squirrel glider on average will use 7 den trees in a 4 month period with the number of den trees used increasing over time. So to have a healthy population of gliders you need to have plenty of denning sites.

To conserve the squirrel glider we need to know what makes a good den tree for two main reasons, 1. so they can be protected and 2. so we can understand how to make trees more suitable.

To answer these questions we setup a study to examine the characteristics of such trees, but first we had to identify which trees were indeed den trees. To do this we radio tracked 36 squirrel gliders over 4 months, tracking them to their day time dens, resulting in the identification of 152 den trees. Detail measurements were taken of these trees and compared to randomly selected trees in the immediate area. From this we could identify which tree characteristics were preferred by gliders for denning, some obvious and some very interesting.

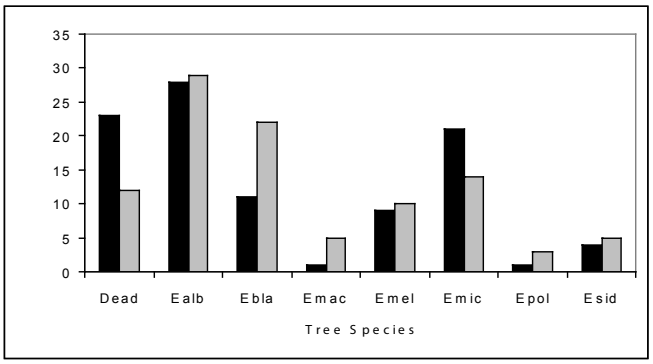


Fig 1. Percentage of den trees used by P. norfolcensis (black columns) and available trees (grey columns) across various eucalypt species. The tree species are Dead = dead trees of all Eucalyptus species; Ealb = *E. albens*; Ebla = *E. blakelyi*; Emac = *E. macrorhyncha*; Emel = *E. melliodora*; Emic = *E. microcarpa*; Epol = *E. polyanthemos*; and Esid = *E. sideroxylon*

We found squirrel gliders were more likely to den in a tree as the number of visible hollows increased, especially branch hollows and also as the health of the tree declined eg. an increase in dieback. We also found that some tree species were more favoured than others. Dead trees and Grey Box being favored and Blakely's Red Gum and Stringybark not liked (see figure 1).

All the above characteristics help indicate whether a tree has a suitable hollow. Many hollows are not obvious and often what seems to be a visible hollow is sometimes shallow and insignificant. Visible hollows help identify den trees as they indicate the presence of hollow developing processes. So the more visible hollows the more likely the tree will contain an actual suitable hollow. This is also the case with tree health, as the tree show increase signs of dieback the more advanced hollow forming processes will be and the greater the chance of a suitable hollow being presence. This explains why dead trees are important as den trees. Different species also have differing propensities to develop suitable hollows eg. with Grey Box more likely to develop branch hollows and Blakely's Red Gum less likely.

What Makes a Good Den Tree

While containing a suitable hollow is single most important feature of a den tree, there is range of other tree characteristic preferred by squirrel gliders once a hollow is presence. Gliders prefer their den tree to be large and surrounded by other tree particularly other large trees with interconnecting canopies. In contrary to what was said early gliders prefer healthy trees with big, thick canopies, but only when there is more then four visible tree hollows (so only when there is a good chance of the tree containing a suitable hollow).

Den trees are still under threat from firewood collecting, clearing, road widening and by people "tidying up" 9% of the dead den trees I identified were burnt or cut for firewood as farmers "tidied up". Future identification of den trees we can help to protect them.

Protecting existing hollow bearing trees is essential if we are to conserve hollow dependent animals such as the Squirrel Glider, as suitable hollows take 150 years to form. While many trees may contain suitable hollows they can often only provide a marginal den sites or simple be to isolated for gliders to get too, such trees however can have there denning values improved.

Photo by Mason Crane

Squirrel Glider is a medium size gliding possum.

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• You can make existing hollow trees more suitable glider den sites by planting other trees around them and trying to improve their health.

• Isolated trees and groups of trees can be link to each other or to other large remnants with tree planting allowing gliders access to these potential den sites.

While nest boxes are not a substitute for hollow trees they may be helpful in conserving gliders in area with few old trees. To optimise the effectiveness of nestboxes they should be place in large, healthy trees closely surrounded by other trees particularly large ones.

Ensuring squirrel gliders populations have suitable denning sites is the most important aspect in conserving this species, as gliders cannot survive with out them.

Photo by Mason Crane

Setting up a study to examine the characteristics of den trees, and squirrel glider behavioral patterns.

Better Bush on Farms

Better Bush on Farms

A one-day conference highlighting current research to improve native vegetation management on farms. Held on 19th September, 2007. CD Blake Theatre, Thurgoona Campus, Charles Sturt University, Albury. The GBW CMN filmed this event and has since shared the DVD with over 100 land managers and CMA staff. The extracts below were from the most requested and frequently viewed presentation.

The following extracts are from the proceedings .

featured articles by

Veronica A.J. Doerr, Erik D. Doerr, Micah J. Davies
Dr Phil Gibbons
Peter Spooner
Ian Lunt
Sue McIntyre

Corridors and Connectivity: the what, where and why?

Veronica A.J. Doerr, Erik D. Doerr, Micah J. Davies
CSIRO Sustainable Ecosystems

Fragmentation of Australia's woodlands has led to reduced dispersal of native animals between remnants, making populations in small remnants more susceptible to extinction. Corridors (continuous strips of native vegetation between remnants) have been widely embraced as the solution to restoring dispersal. However, we don't know what characteristics corridors might need to have, or whether other elements in the landscape might be more effective. By using radiotelemetry to follow dispersing brown treecreepers in fragmented landscapes, we found that scattered paddock trees were just as effective at facilitating dispersal as traditional corridors. However, the distance between paddock trees may be critical, as treecreepers only moved through areas where the majority of trees were separated by less than 100m. A handful of other studies have similarly concluded that woodland birds may have difficulty crossing gaps of 65-85m.

Traditional corridors may still be critically required for some species, but there is a risk that if corridors are occupied, they may serve as population sinks and be detrimental in the long term. Thus, current best practice would be to protect and restore a variety of types of connectivity in any given area, including traditional corridors and paddock trees separated by no more than 80-100m.

Finally, recent research has shown that animals often search for dispersal opportunities by making exploratory forays rather than by wandering through the landscape. In treecreepers and in eastern yellow robins, these forays are rarely longer than 1km. Thus, efforts should be focused on restoring corridors and paddock trees in areas where remnants are within 1-1.5km of each other.

MANAGEMENT MESSAGE .1
We need to provide a variety of types of connectivity in any given landscape
Corridors, vegetated drainages, paddock trees
Paddock trees should be separated by no more than 80-100m
Corridors may need to be very wide—risky to rely on them alone

Photo Veronica Doerr

MANAGEMENT MESSAGE .2
Corridors should not be relied on to serve as habitat
Separate CMA targets for restoring habitat and restoring connectivity
Separate guidelines and actions for landowners

Photo Veronica Doerr

MANAGEMENT MESSAGE .3
Prioritise efforts at habitat vs. connectivity restoration
Focus on connectivity where patches support only small populations & no more than ~1.5km apart
Otherwise focus on making patches bigger or restoring patches within 1.5km of remnants

(GBW CMN Comment: Remnant bush can provide a home (a place to feed and breed) for a range of species. Scattered paddock trees and corridors cannot replace them; they can however provide crucial connections across the landscape. They each provide different types of services therefore all must be valued.)

Perpetuating paddock trees

Dr Phil Gibbons
The Fenner School of Environmen and Society
The Australian National University

Mature paddock trees are keystone structures because their influence on the health of landscapes is disproportional with the area they occupy. They provide habitat for native biota, are stepping stones for some species, improve elements of soil quality, help lower water tables in saline landscapes, provide shade and shelter for stock and contribute to higher property values. Paddock trees and small remnants (<0.5ha) represent around 40% of remaining box gum woodland, mortality is relatively high (0.6-2.4% per annum) and only around 20% of this vegetation is regenerating.

Under prevailing management I predicted that paddock trees may be gone from our landscapes within 120 years. Because eucalypts take so long to mature, a strategy based on regeneration alone will not reverse the rate of decline of mature paddock trees for over a century. The best way of perpetuating the existing cover of mature paddock trees is to institute regeneration as quickly as possible AND reduce the rate of mortality among existing trees to below 0.5% per annum through strategies such as protecting them from clearing, avoiding herbicide drift and avoiding stock congregating under individual trees for extended periods. Because eucalypts are long-lived (300-600 years), regeneration could occur as seldom as once every century to perpetuate paddock trees which means that the cost of recruitment will be small if considered over the long-term. In areas that are cropped, recruitment should be focused around defined clumps of trees in which cultivation and threats like herbicide drift are excluded. Under all feasible management scenarios I predicted that numbers of mature paddock trees will decline before they increase, suggesting that strategies such as nest boxes, other forms of deep rooted perennial vegetation and alternative shade and shelter should form part of a strategy to perpetuate the functions provided by paddock trees.

Paddock trees will continue to decline as long as native vegetation in relatively poor condition, but under high threat, is considered a lower priority for conservation than vegetation in good condition, but under low threat.

Photo Veronica Doerr

Summary

1.What % of box gum woodlands occur as paddock trees? 40%

2.What % of paddock trees are regenerating? 10 - 20%

3.How long before we lose paddock trees? 120 years

4.What are the best strategies for mitigating the loss of paddock trees? Recruit, reduce mortality and plan for fewer trees.

5.How do we manage paddock trees in intensively managed landscapes? Protect existing trees where possible and recruit new trees elsewhere (in islands).

6.Which should be a priority for management (good quality veg. or threatened veg.)? Native vegetation in poor condition and under high threat (e.g. paddock trees - provided restoration is feasible)

(GBW CMN Comment: Box Gum Grassy Woodlands are listed as an endangered ecological community both in NSW and nationally, therefore by definition are deemed to be under high threat)

Fencing remnant woodlands – what does it achieve?

Peter Spooner
School of Environmental Sciences,
Charles Sturt University

Fencing incentive programs have been widely used throughout Australia to assist landholders fence remnant woodland vegetation, to control grazing and improve native vegetation condition. In 2005, a study was carried out to investigate vegetation and soil condition in remnant woodlands fenced for 7-9 years in the Murray catchment area in southern NSW. Surveys were undertaken at 42 sites, where vegetation condition was assessed in paired fenced and unfenced sites. Semi-structured interviews were also conducted with landholders to gather management information. Woodlands surveyed were yellow box / Blakely's red gum (*Eucalyptus melliodora* / *E. blakelyi*) (15 sites), grey box (*E. microcarpa*) (13 sites) and white cypress pine (*Callitris glaucophylla*) (14 sites).

Fencing resulted in a range of responses which were highly variable between sites and vegetation types. In general, fenced sites had greater tree regeneration, a greater cover of native perennial grasses, less cover of exotic annual grasses and weeds, and less soil compaction than unfenced sites. There was greater tree recruitment in remnants to the west of the study area, and tree recruitment was positively correlated with time since fenced. Within sites, tree recruitment tended to occur in more open areas with a good cover of native perennial grasses, as compared to sites with a dense tree canopy, or dominated by exotic annuals grasses or weeds. A range of grazing strategies were implemented in fenced sites which require further research as a conservation management tool. Continued long-term monitoring is essential to detect key threats to endangered woodland remnants.

Full details of this paper have been submitted for publication in the journal Ecological Management & Restoration (in review)

Photo by Peter Spooner

Photo by Peter Spooner

Reflections on fencing program

Results highly variable, due to previous land-use history, initial site conditions etc
Farmers require clear and simple biodiversity indicators to assist in adaptive management practices
On-going property visits by experienced NRM officers required
Change in property ownership a problem – binding covenants are essential
Support for conservation programs on private properties needs to be continued

When can stock grazing help biodiversity conservation?

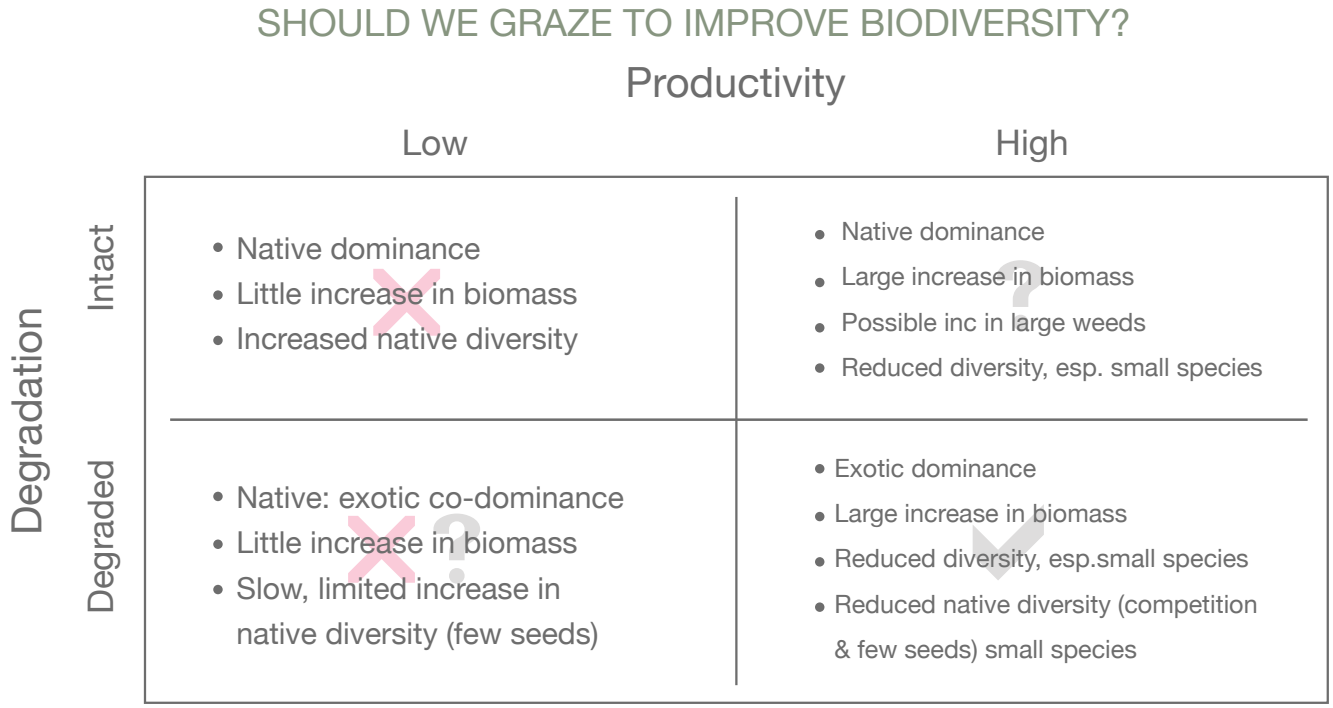
Ian Lunt
Institute for Land, Water & Society
Charles Sturt University

In recent decades, there has been increasing interest in conserving biodiversity in production grazing landscapes. This has spurred lots of attention to the important question – 'how can grazing be managed to maintain (or improve) biodiversity values whilst maintaining (or improving) production outputs?' This question acknowledges potential trade-offs between production and conservation outcomes. Many superb extension guides have been published on conserving biodiversity in grazed native pastures, grasslands and woodlands.

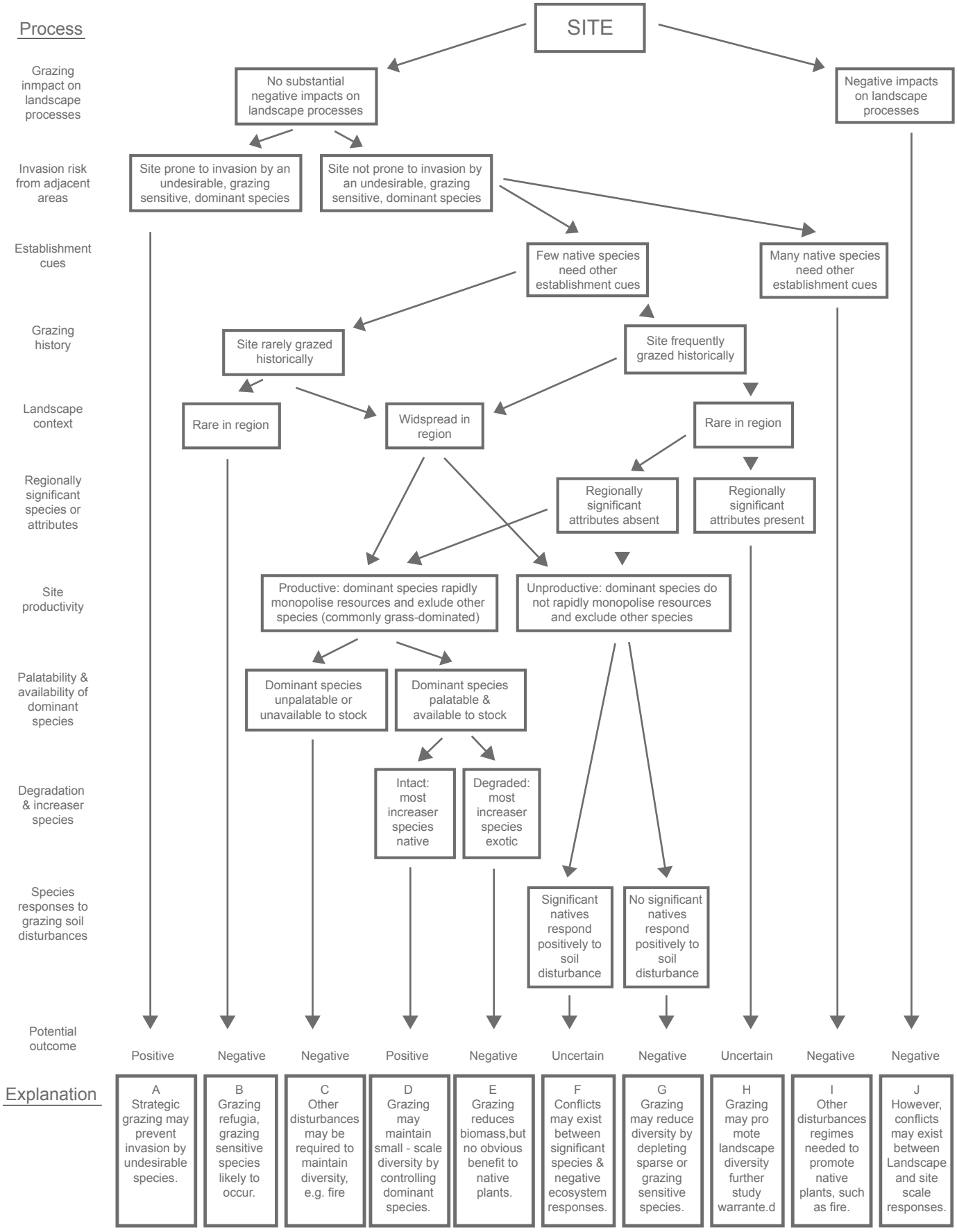
However, a parallel land management trend has occurred during this period – more and more areas in agricultural regions are being devoted solely (or primarily) to biodiversity conservation. These include new national parks and reserves, and areas on private land protected by covenant, property agreement or voluntary goodwill. The areas, which have typically been grazed in the past, are not subject to broader requirements to produce economic outputs. Thus, the key question in these areas is not, 'how can grazing be managed to maintain biodiversity vales whilst maintaining production outputs?', but instead becomes, 'How can these sites best be managed to maintain biodiversity values? Would continued grazing or stock removal give better outcomes?' Little information is readily available to address this basic question.

This talk is based on a recent review paper (Lunt et al. 2007), in which we described the ecological factors which influenced vegetation responses to grazing and grazing removal, to help managers to decide whether to maintain or remove grazing stock from areas devoted to conservation. A number of factors affect whether grazing will be useful, including potential damage to landscape processes (such as water flows), grazing history, vegetation quality and degradation, site productivity (or fertility), and the vigour and palatability of dominant species.

In general, livestock grazing has the most potential to assist conservation outcomes in previously grazed, fertile, productive sites, where stock may promote native plant diversity by reducing potentially dominant species (native and exotic). This role is particularly important in degraded areas. By contrast, livestock grazing is likely to have neutral or negative effects on conservation values on unproductive soils, especially which vegetation condition is relatively high. The important question, 'where should we retain and remove livestock' requires further attention, given that more areas are likely to be devoted to biodiversity conservation (both formally and informally) in agricultural regions in the future.



"A framework to predict the effects of livestock grazing and grazing exclusion on conserv-ation values in natural ecosystems in Australia"



Reference

Lunt, I.D., Eldridge, D.J., Morgan, J.W. & Witt, G.B. (2007). Turner Review No.13. A framework to predict the effects of livestock grazing and grazing exclusion on conservation values in natural ecosystems in Australia. Australian Journal of Botany 55(4), 401-415.

Why limit the use of fertilizers in rural landscapes?

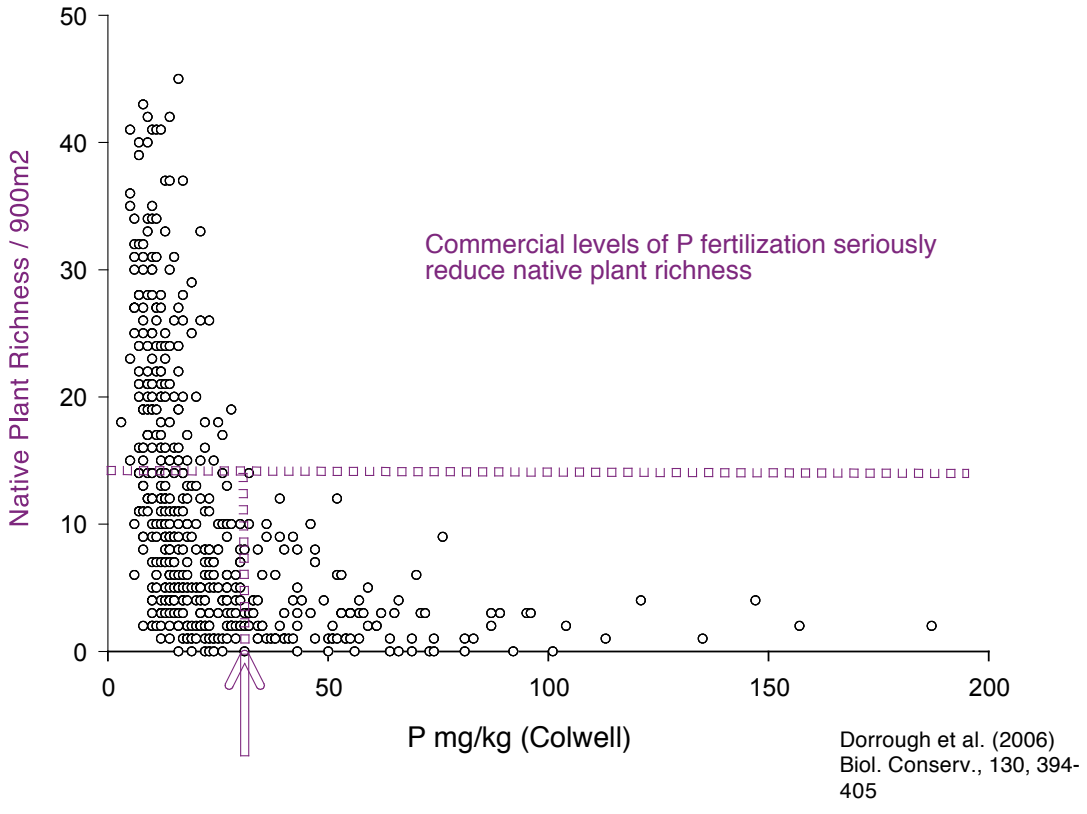
Sue McIntyre
CSIRO Sustainable Ecosystems

The value of maximizing the use of fertilizers on pastures is increasingly being questioned, particularly when the broader issues of natural resource sustainability are taken into account. Recent research on grassland diversity has highlighted the issue of fertilizer use even more, and demonstrates that for any particular location, high productivity and high native plant diversity are not compatible.

It can be shown that grazing on unfertilized grassland can affect diversity, but the effects may be small as native plants have the full range of grazing tolerances. However, grazing can have an adverse effect in combination with disturbance and soil enrichment. Raising phosphorus levels through the use of fertilizer profoundly affects native plant diversity and the resulting vegetation is poorly equipped to protect soil from erosion or to maintain clean water runoff. Grassland on fertile sites has soft thin leaves and tends to be annual rather than perennial; this makes it less persistent and prone to soil erosion.

Grazing pressure is the most important grazing factor affecting pasture condition. Fertilized pastures are prone to higher grazing pressure as additional animals are needed to consume the increased plant biomass and recoup the cost of the inputs. This means that fertilized pastures both more vulnerable grazing yet are subject to greater trampling and grazing pressure and more bare ground is exposed.

Nonetheless, diversity and resource sustainability can be achieved in rural lands though recognizing the limits to intensive land uses.In a landscape mosaic, it is possible to combine different land uses to achieve a compromise between conservation and production. Achieving the balance is about identifying appropriate types, locations and amounts of intensive and extensive land uses. However, recommended limits to intensive land use are rarely applied when economic circumstances make intensification profitable.



(GBW CMN coordinator comment: Sue also presented a "State in Transition Model" (see bottom of page 6) which represents the evolution of our management influence.)

Leaf Litter Invertebrates and Leaf Litter Decay within Woodland Remnants

by Elizabeth Lindsay Woodland wanderings article April 2008
CSIRO Entomology, Black Mountain, Canberra.

Many woodland remnants today are found on private property surrounded by productive agricultural land. Most have been disturbed by landscape fragmentation, livestock grazing, weed invasion, nutrient enrichment or soil compaction. In order to better manage our woodlands we need to understand how these ecosystems function and how they respond to different disturbances. We have been doing research on small patches of woodland within agricultural landscapes for three years. Our study sites are on private properties in N.S.W near the townships of Boorowa, Murrumbateman, Bungendore and Braidwood. All the woodland remnants we have looked at have had a long history of livestock grazing. We have categorised each site into one of three general grazing regimes; set stocked with sheep or cattle, rotational or strategic grazing or no livestock grazing for 7 years or more.

Part of our research involves examining the invertebrates that live in these woodlands. Terrestrial invertebrates are one of the most diverse and abundant group of animals, which includes the insects (e.g.ants, cockroaches), arthropods with more than six jointed legs (e.g. spiders, millipedes) and crustaceans (e.g. slaters and landhoppers). We focused on invertebrates that spend part of their life cycle on the ground, and trapped them using small pitfall traps dug into the ground. Invertebrates form an essential part of a woodland ecosystem, and though they can't always be seen they are just as important as more visible animals such as birds and mammals.

Invertebrates are involved in a range of functions or 'jobs' that need to be done in an ecosystem, these include flower pollination, pest control, nutrient cycling and soil structure and health. The decomposition, or break down, of organic matter is a process that affects both the cycling of nutrients and properties of the top-soil. Decomposition of leaf litter and fallen timber is performed by a group of invertebrates, microbes and fungi known as detritivores. Invertebrates break the litter down into small pieces and along with the microbes convert the organic matter down to simpler inorganic compounds (e.g. nitrate) which can then be used by plants again.

We were interested in knowing if small patches of woodland have a diverse and abundant invertebrate community and at what rate the leaf litter is decomposing. We also wanted to know if the invertebrate community and the litter decomposition rate responded to a reduction in grazing pressure.

In order to rapidly quantify the leaf litter decomposition rate we choose two materials that would decay within one year; lettuce and high quality filter paper. Once air dried, and weighed within mesh bags these were placed in contact with

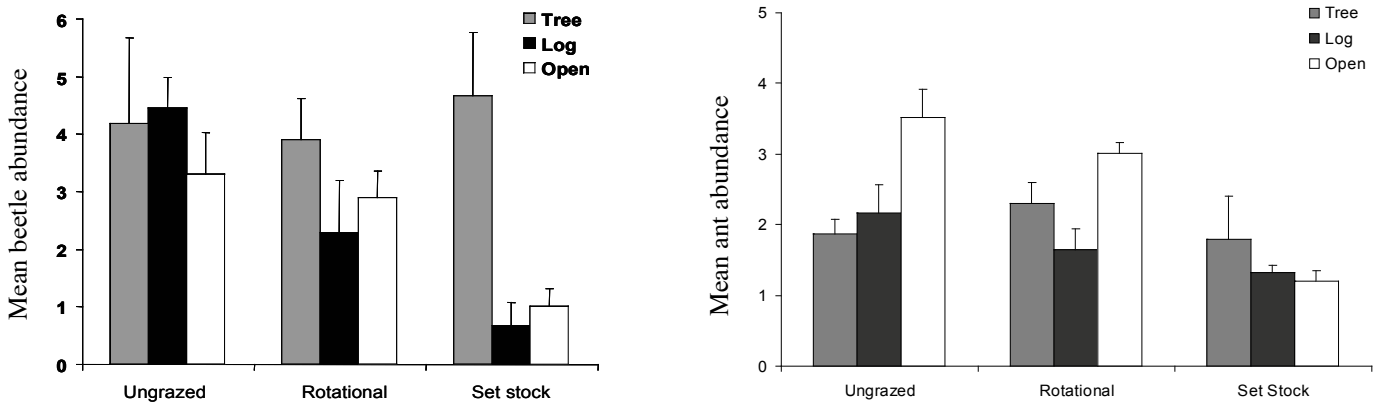


Figure 1. The mean abundance of (a) beetles and (b) the Dominant Dolichoderinae group of ants near logs, trees and open spaces in woodlands. Sites have been classified as ungrazed (livestock grazing excluded), rotationally grazed or set stock grazed.

the soil surface. The invertebrate traps and decomposition bags were placed next to logs, trees and in open spaces at each site. Trees are essential to a woodland, and open spaces are required to distinguish woodland from forest. Logs are an important obstacle within landscapes, and studies in other vegetation types have found them to be important habitat for many invertebrates.

What we found

We found a diverse group of invertebrates was still present within most of the woodland patches. We collected over 21000 individuals from 25 invertebrate groups. Ants (*Hymenoptera-Formicidae*) and beetles (*Coleoptera*) were the two most abundant groups collected, and so we looked at them in more detail. Some of the predators collected included scorpions, harvestmen, spiders and wasps. Figure 2 shows one of the spiders people are likely to encounter in woodlands in autumn, the Golden Orb Weaver. One of the groups collected people would rarely see are the *Embiopterans* (webspinners). These live in galleries built in crevices under bark or rock and feed on plant material. To get more food they extend their gallery.

Photo by Elizabeth Lindsay

Figure 1. Logs, sticks and leaf litter within woodland remnants provide valuable habitat for invertenrates, reptiles and small mammals.

Generally across all the different invertebrate groups the highest abundance was collected either near trees or logs, not in open spaces. When taking into consideration the grazing intensity at each site, the highest abundance and diversity of invertebrates was found when livestock grazing was completely excluded or at a low intensity under some type of rotational grazing.

Beetles

Beetle diversity and abundance was similar near trees and logs and slightly less in open areas. The average beetle abundance is shown in Figure 1a, beetle diversity had a similar response to grazing and trap location. The greatest diversity and abundance of beetles was found at sites where livestock grazing had been excluded. The value of open areas and logs as beetle habitat was slightly less at rotationally grazed sites and decreased dramatically at woodlands under set stocking. One thing that was clear is that the ground beneath trees is important beetle habitat under all grazing regimes. Established trees could be harder for stock to disturb, as they still contribute leaves and sticks to the leaf litter layer on the ground regardless of stock presence. Figure 3 shows a Golden Stag beetle which lives on the ground as a larva and in eucalypt trees as an adult.

Photo by Elizabeth Lindsay

Figure 3. Beetles of varying shape and size live in woodland remnants, including the colourful Golden Stag beetle (*Lamprima aurata*). Adult beetles can be found in eucalypt saplings while the larve prefer to live under old tree stumps.

The diversity of beetle families contributing to the collection decreased as the grazing intensity increased. On average nine different families made up the beetle community in ungrazed sites, seven under rotational (strategic) grazing and only three at sites under set stock grazing. Two beetle families, *Byrrhidae* and *Anobiidae*, were unique to woodlands where grazing had been excluded. After a disturbance it is common for a small group of insects to prosper in the new conditions and dominate, while others stay at the same level or decline.

Ants

Ants were the dominant invertebrate group collected (11000 individuals). The two most common orders were the *Monomorium* and *Iridomyrmex* (e.g. meat ants), which are common all over Australia. Unlike the other invertebrates the greatest diversity of ants was found in open areas, rather than trees or logs. Many ants like to build their nests and forage in

warm open areas. Similar to the beetles, ants were generally found in greater abundance in woodlands with no or low intensity livestock grazing.

A common and useful way to look at ants is to place them in functional groups. These group ants together based on their behaviour, habitat and feeding. The Dominant *Dolichoderinae* were the second most common functional group of ants, behind the Generalists. The Dolichoderinae were in higher abundance in sites with no grazing or low grazing intensity. Like the beetles fewer were collected in woodlands with set stock grazing (figure 1b). These ants were more active in open areas. This is as they are thermophilic, liking hot spaces which you will rarely find directly under a tree.

Photo by Elizabeth Lindsay

Figure 2. Spiders are an important predator in woodlands, they are just as likely to be found on the ground as they are in webs. The female Golden Orb weaving spider can commonly be seen on her web in autumn. The male is a lot smaller and can sometimes be found on the edge of the weh.

A higher abundance of Dominant *Dolichoderinae* was found in sites with an understorey dominated by native perennial grasses, compared to sites where exotic annual grasses made up ≥50% of the grass cover. We think this is due to a change in the spatial makeup of the understorey. Sites with low weed cover are a mosaic of large tussocks, small fine grasses, forbs and gaps. In comparison annual grass dominated woodlands have a more homogeneous structure, almost like a lawn. This is an area we will be doing more work on this spring.

Litter Decomposition

Leaf litter decomposition is a crucial part of nutrient recycling within woodlands, and it was very promising to see that there was some decay of at least one of the substrates at all sites. The dried lettuce was a great eucalypt leaf substitute to compare leaf litter decomposition rates between our field sites. After three months there had been significant lettuce decay (mass loss) at some of the sites. Lettuce leaves are a very palatable material, and the breakdown was mainly done by invertebrates, with fungi also present on the surface of some leaves (Figure 4). In woodland the leaves decayed fastest when placed near logs rather than under trees or open spaces. Logs can create a stable microclimate; the surrounding soil can be moister and many detritivores find logs or the area around them great habitat. Leaf decay was also fastest at sites where livestock grazing had been excluded, and generally increased as the woodland condition improved.

Photo by Elizabeth Lindsay

Figure 4. Dried lettuce three months after being on the soil surface near a log. It was eaten by invertebrates, bacteria and fungi, some which are still visible on the leaf surface.

The paper was a lot slower to decay than the lettuce, with the breakdown mainly due to microbes and fungi. Filter paper has a very different chemical make up to lettuce leaves. It is about 80% cellulose, a main component of wood, and is unpalatable to most insects. The paper also decayed fastest when placed near logs. Using lettuce and paper as substrates has allowed us to capture the contribution of different parts of the detritivore invertebrate community to litter decay.

Conclusions

The invertebrate and decomposition work both show that logs are an important part of woodlands. They serve as invertebrate habitat and enhance the breakdown of organic material which is a crucial step in nutrient cycling. The value of logs within woodlands is greater when grazing pressure is reduced. Excluding livestock from woodlands appears to have benefits to biodiversity, however reducing grazing pressure and having rest periods could also improve the invertebrate community and ecosystem processes.

To have a functioning woodland ecosystem we need more than plants. When managing vegetation we need to start thinking about invertebrates and the roles they perform as well. Small woodlands in modified landscape support invertebrate biodiversity which could persist into the future with the right management.

Our woodland research is ongoing, and we still have more exploration of our invertebrate data to do. Other work we are currently doing is exploring the links between nutrient enrichment and weed invasion across a gradient of land use intensity.

We would like to thank the landholders who have let us conduct our research of their properties and Kim Pullen for identification of many of the specimens. This work has been funded by the NSW Environmental Trust and the Land and Water Australia Defeating the Weed Menace program.

Further reading about invertebrates

Harvey M.S and Yen A.L (1997). Worms to wasps, an illustrated guide to Australia's terrestrial invertebrates. Oxford University Press, Melbourne

Up And Coming Events

Conservation Management Network/Landcare
NSW NRM Networking Partnerships Conference

"COLLABORATION THE KEY TO SUSTAINABLE RESOURCE OUTCOMES"

14th and 15th of November 2008 in Queanbeyan
In conjunction with the State Landcare Muster

Joint Landcare and Conservation Management Network Conference in Queanbeyan that will bring together existing stakeholders and networks working in regions to facilitate better information flow and, coordinated approaches as well as, explore potential new partnerships, resulting in the more efficient use of resources, skills, programs and outcomes.

PUT THESE DATES IN YOUR DIARY

This conference provides an **opportunity for you to:**

- **Share your interest in conservation.**
- **Meet other like minded Conservation Management Network members.**
- **Influence future support of natural resource management in NSW.**
- **Highlight to the community the number of rural Australians including primary producers who genuinely have an interest in conserving biodiversity.**

You will be posted a detailed invitation in a few weeks so put these dates in your diary and contact Toni if you would like to have input into the conference agenda. Costs will be kept to a minimum thanks to sponsorship from the National Landcare program.

Resources

Watch this space

Payments for Biodiversity outcomes.

Australian Government Environmental Stewardship programme: Stage one to begin shortly in the Lachlan and Murrumbidgee catchments.
For more information phone 1800 552 008

Or visit: http://www.nrm.gov.au/stewardship/index.html

Conservation Management Network State Conference
Collaboration the Key to Sustainable Resource Outcomes
Queanbeyan 14th - 15th November

Woodland Wanderings (Grassy Box Woodland CMN) newsletter was edited by Toni McLeish and was produced with funding from the Australian Government National Landcare program. The views expressed in this publication do not necessarily represent those of either the Department of Environment and Climate Change or Department of Agriculture Fisheries and Forestry. While every effort has been made to ensure that the information in this newsletter is accurate at the time of printing, neither the DECC nor DEWHA can accept responsibility for any errors or omissions.

Useful resources

CRES Wildlife on farms DVD
Contact Toni McLeish

Useful websites

Catchment Management authorities
http://www.cma.nsw.gov.au/

Better Knowledge Better Bush
http://www.betterbush.org.au/research.htm

Bird routes of NSW
http://basna.birdsaustralia.com.au/regional.html

Landcare CarbonSmart
http://www.carbonsmart.com.au/

Plantnet
http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm

Faunanet
http://www.faunanet.gov.au

Australian Organic Journal
www.bfa.com.au

Birds Australia
www.birdsaustralia.com.au

Australian Farm Journal
http://www.farmonline.com.au

HotSpots
www.hotspotsfireproject.org.au

Weed identification
http://www.weeds.gov.au/identification/index.html

Veg futures Conference
http://www.greeningaustralia.org.au/resources/veg-futures-08

Members support

Woodland Stationery supporting Friends Klori
Phone: Joan Overeem 02 6767 1518
Email:jovereem@aapt.net.au

CMN website www.gbwcmn.net.au

Ongoing challenge! Do we have any member volunteer who may like to assist in the management of the site

Article deadlines for *Woodland Wanderings*

No funding for a spring 08 edition
Autumn Edition deadline: 1st March 2009

Making contact

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