

Symposium Presentation No. 1

Box Gum Grassy Woodlands: restoration, grazing and woodland birds

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Note: A selection of slides was taken from the powerpoint presentation to make this transcript easier to follow. The full set of slides is available on the powerpoint presentation.

Summary

The diversity of grassy woodlands includes widely spaced trees, patches of shrubs and a very rich ground layer of tussock grasses, wildflowers and fallen timber. A wide diversity of wildlife use these ecosystems. But this is prime grazing country. The grassy woodlands and many of the woodland plants and wildlife are now critically endangered. Open paddocks can be effectively transformed back to a more diverse system for wildlife using a diverse mosaic of plantings linked across landscapes, but we need to think about the adaptive capacity of the plants we use. We need to protect the existing paddock trees. And we can use grazing and other management based on the state-and-transition model to promote transition of the grasslands to more resilient states.

Thank you so much for inviting me along to speak. I'm really looking forward to today because the really important thing is how we can bring the science that we're developing onto the ground? Everybody working together in a very cooperative way will make this happen. So, I share Traditional Owner Shane Monk's excitement to see everybody here together, working together on our very precious box gum woodlands.

I'm going to talk about restoration grazing and woodland birds. This is a real team effort. I work with fantastic scientists like Sue McIntyre who developed the state-and-transition model (see below), Suzanne Prober who did a lot of the early work in the box gum woodlands, and Josh Dorrough who was based down here for a long time. So, this is really a synthesis of all of that work done over the years.

The diversity of woodlands

In the original box gum grassy woodlands, we know that diversity is not in the trees. It's the ground layer that is such an important part of the woodlands. And it's an incredibly beautiful ground layer.

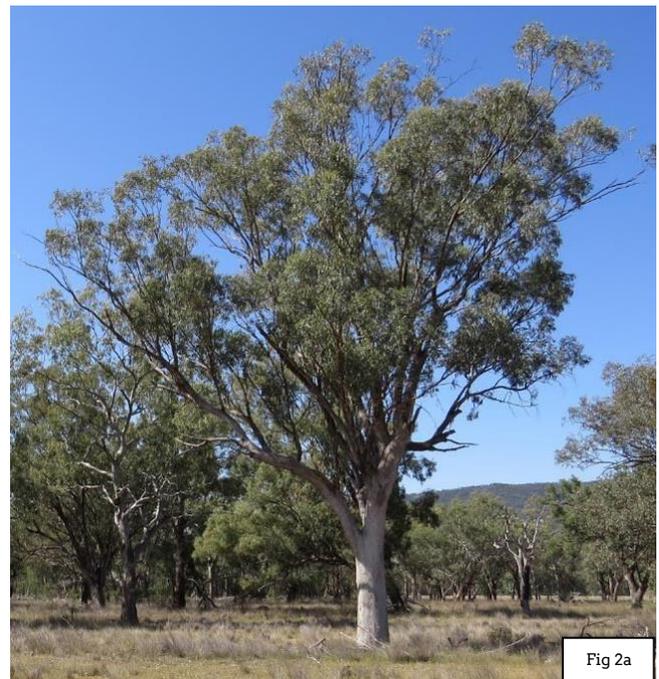
Very high conservation woodland remnants could have between 60 and 110 species of wildflowers and grasses – including Kangaroo Grass (Fig 1a) and Poa tussocks (Fig 1b with Creamy Candles) and carpets of wildflowers. Absolutely brilliant.



It is very hard to get a good photo of a really good intact box gum woodland. I'm always trying but they're just not that common. So I use a photo of my mum's garden in Melbourne (Fig 1c).

Mum moved into a retirement village, and she saw all the geraniums around, and she said, no, I don't want that. She said, what can you do? I said, what about we put some box gum woodland garden in your retirement village? We got all the plants from the nursery at La Trobe University. Now we've got a huge garden of box gum woodland plants. And she loves it, she sends me texts all the time and tells me how wonderfully the garden's growing.

One of the key trees in the box gum woodlands is the White Box (Fig 2a). Euroa is a bit on the edge of the range. Here, Yellow Box is one of the key species – a very magnificent and iconic species (Fig 2b). And of course, Blakley's Red Gum (Fig 2c). This species always shows a bit of dieback – it's very insect prone – and that is a very easy way to tell it a lot of the time, unfortunately. There is also a lot of Grey Box around here. Woodlands also have a whole range of other species such as Buloke, but eucalypts are the primary species.



Intact woodland and grassland remnants, if they're in good condition, have a fantastic diversity of wildlife, including many very uncommon, rare or declining species of woodland birds, reptiles, and mammals. I won't present much work on

mammals - they're pretty hard to track, but I was just reading last night about a great Phascogale study that was done near here and was very excited to hear that Phascogales are around. I'll focus more on woodland birds such as the Hooded Robin, Diamond Firetail and Rufous Whistler (Fig 3) and on the reptiles and the plants, as opposed to more common species - the Galahs, Cockatoos and Eastern Grey Kangaroos which are the more generalists and very common in farming country.



The structure of woodlands

Having bare spaces between the grassy tussocks is really important.

Often we talk about 100% ground cover, but we also do need bare spaces because that's often where the forbs are germinating in the autumn. The wildflowers are there but if you've got a really intact, fantastic bit of grassy ground layer, it can get very overgrown.



And grazing and fire traditionally kept these ground layer systems functioning. I won't talk much about that - Shane, and Cath Olive and other people will be talking about some of those innovative techniques later today. Sue McIntyre and her partner on her property up near Canberra do an autumn burn - they call it an autumn burn - across the property every year.



Fig 4b

Woodlands are woodlands because the trees are quite widely spaced. In the original condition there will be a space between the trees and a density of maybe around an average 30 -35 trees per hectare (=17-18m apart on average - Ed) over this diverse ground layer of grasses and wildflowers.

Normally within the box gum woodlands and between the trees and the ground layer, we had a patchy mosaic of shrubs. It wasn't a continuous layer of shrubs, so no more than 5% to 10% of the area in general. It's grazed out quite quickly as well, so is something that we've really lost. There isn't a picture of it here because again it's quite hard to get a photo of the shrubby mosaic. But they're one of the really key parts of a box gum woodland, and particularly for the birds. When you're doing revegetation, you need to remember that woodland trees aren't overlapping and a few more shrubs are needed – about 7 shrubs to one tree. Trees do thin out over time, of course.



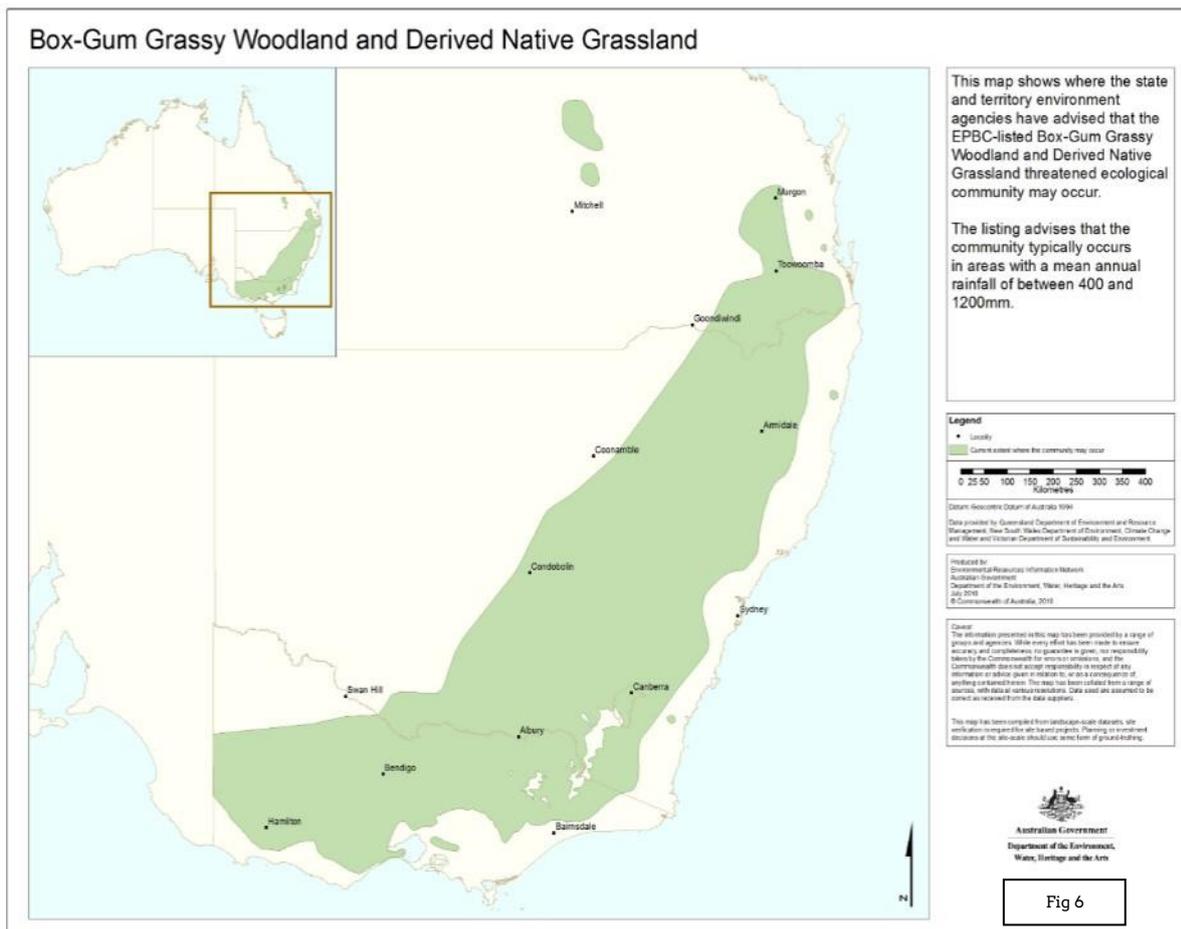
Fig 5

This low tree density emphasises for those who are grazing and using these woodlands productively that you can have the trees with a good grassy ground layer, and mix production and conservation out in the paddock. We'll explore that a little bit more as we go.

A lot of people, when they think about the box gum grassy woodlands, just think of it as the trees. We actually got some funding from fines imposed on a developer who cleared a huge area of the ground layer for urban development and thought "we'll just leave the trees". They had even had their consultants go in and do all their preliminary work, but still just really envisaged it as being only around the trees.

The decline of woodlands

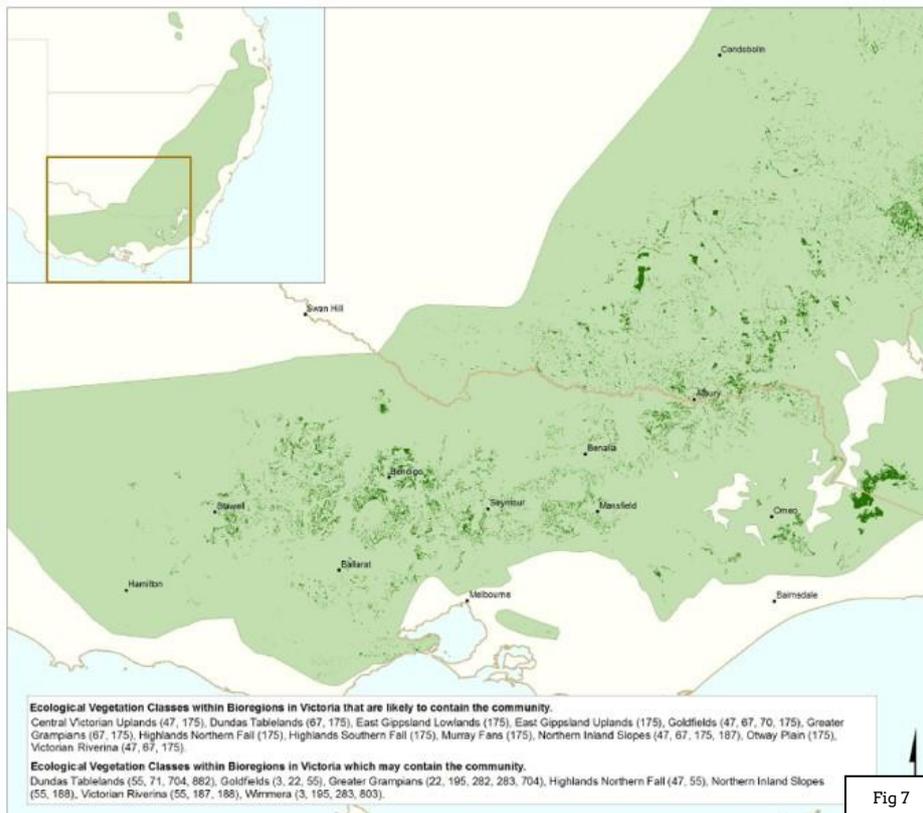
Sophie spoke about the historical context of our current woodlands. Of course, the box gum woodlands are in prime grazing country – the sheep-wheat belt in Australia. They have moderate to high fertility soils, annual rainfall between 400mm and 800mm, and altitudes up to 1,200m. So prime grazing country.



We have lots of iconic images of pastoral Australia, usually River Red Gums, but Yellow Box can also be magnificent as isolated paddock trees. But our long history of grazing has had an impact on these woodlands. Over 90% of the pre-European distribution of the grassy woodlands have been cleared. So the woodlands are now Federally and State listed as a critically endangered and threatened ecological community, with less than half of that remaining 10% actually considered likely to meet the minimum criteria of the listing for an ecological community. So, these woodland remnants and the grasslands are diverse, but they're very vulnerable. There are some native paddocks (and we'll see some on our property visits today) that are hugely important for biodiversity.

The minimum criteria for Box Gum Grassy Woodlands are: more than 50% of cover should be native understorey, plus 12 native non grass species in a 0.1 hectare patch or 20 mature trees in a two hectare patch. Less than 0.5% of woodlands fall into the high conservation value category. So, over the wide area previously occupied by Box-Gum Woodlands and Derived Grasslands (*Grasslands derived from Woodlands – Ed*), we don't have a lot left.

Box-Gum Grassy Woodland and Derived Native Grassland - Victoria



Often we'll see the woodlands with trees, but only a thin pasture underneath with maybe 1-10 native species. Some native pastures can have more than ten species, and a few can be very diverse, with up to 40 species or so. But as we said, as my mum's garden is demonstrating, typically we would have had a lot more in the ground layer.

And that's what we'll be focusing on today. Others will look at all the options for restoring the remnants. I'm going to focus more on grazing and other key drivers that impact on the diversity of that ground layer.

Impacts on birds and reptiles

Josh Dorrough, Sue McIntyre and I did some work on reptiles and birds on sites from down here around the Strathbogies all the way up into New South Wales.

The results demonstrated quite clearly that, in the more cleared open paddocks as opposed to the uncleared native pastures, there is quite significantly fewer reptiles and birds. And that's because the remnants have a lot more resources for the reptiles and birds to feed and breed - and survive. Uncleared native pastures have shade, shelter, food such as invertebrates and more. They have also had less impact from farming. Cultivation, sowing and fertilising of pastures mean that the biodiversity - the wildlife - have even fewer resources.

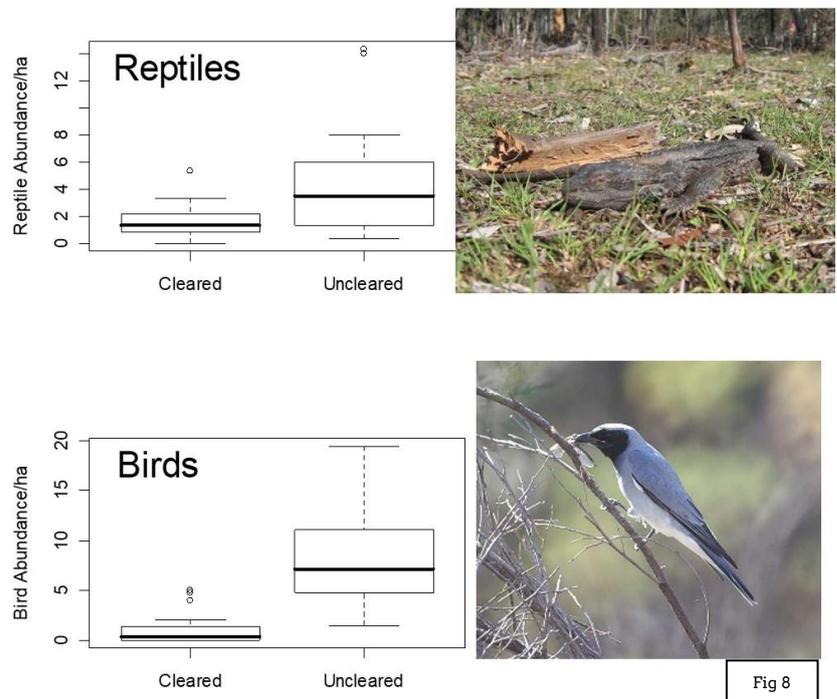
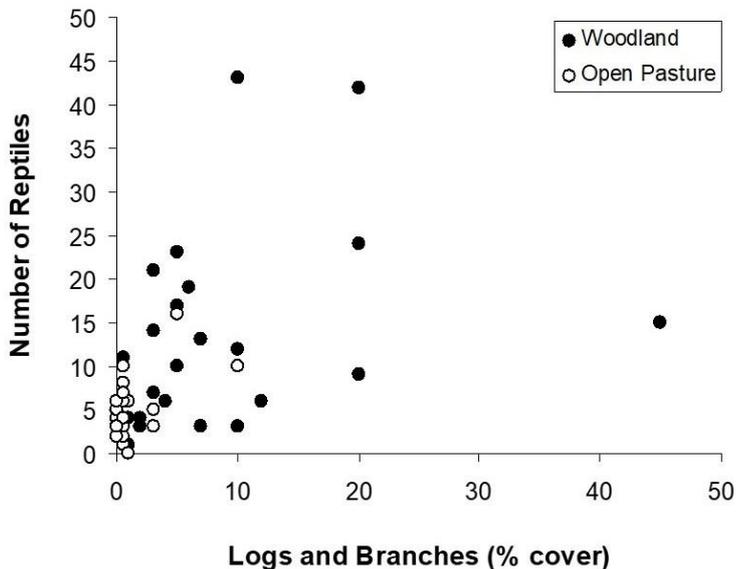


Fig 8

One of the factors that make a woodland and even a grassland really important as a resource is fallen timber. For example, there are more reptiles where the amounts of logs and branches are high. We've lost a lot of the fallen timber on the ground - it has been removed for firewood. On average, we have around one tonne of coarse,

woody fallen debris per hectare in many woodlands, whereas we would have had around potentially 50 or 60 tonnes.



Our property at home luckily hasn't been cleared yet, so we've got quite a lot wildlife. In the five or six years we've been there, I've noticed a whole range of small reptiles that are just becoming more obvious. I don't have any science around that, but it's just something that you notice. We also notice more Kookaburras as well. There's more invertebrates and more reptiles, so the Kookaburras are responding to that.

I'm going to talk briefly about some work we did up at Holbrook with a fantastic group that do so many good things (Barrett *et al.* 2008). We recorded 110 bird species across the Holbrook landscape, at sites in revegetation areas, in remnant woodlands, and in paddocks. Similar numbers of bird species occurred across the sites - 76, 73, and 68, respectively. But we've got different types and groups of birds in the different sites. Woodlands included the rarer woodland specialists compared with the more common open country species.

One species I'm particularly worried about is the Noisy Miner. Sophie talked about the value of smaller remnants. We've got a little six hectare remnant on our place with a beautiful set of woodland birds but virtually nothing else around us. Three years ago, Noisy Miners invaded the site and basically drove out the woodland birds. I used it as a pilot culling project. We got the woodland birds back, which is the good news story. But it's still a real concern.

I actually had a Diamond Firetail (a threatened species) turn up at home for the first time - so excited about that. I got to band a Hooded Robin, and we've got Scarlet Robins, Superb Parrots, Restless Flycatchers, Striated Thornbills. There's a whole group of these birds that we are very concerned about. They're vulnerable and we only generally find them in the remnant areas.



Diamond Firetail



Hooded robin



Scarlet Robin

Striated Thornbill

Restless Flycatcher

Superb Parrot



Fig 11

I don't know if any of you have heard the White-throated Warbler/Gerygone singing - absolutely beautiful. Go home and have a listen to the call whenever you can. I think it's my favourite call to listen to in the morning. I don't know why the Europeans rave about their Nightingales, because I have listened to a Nightingale, and it's nothing on a Gerygone. But even the Laughing Kookaburra is very sadly on the decline, particularly around urban areas. Maybe due to loss of hollows or invertebrates.



Rufous Whistler



White-throated Warbler
 (Gerygone)



even the Laughing Kookaburra ☹️

Fig 12

We've found a real difference in terms of the type and number of different species in the open areas, the open treed areas, and the treed areas, in terms of the type and number of species.

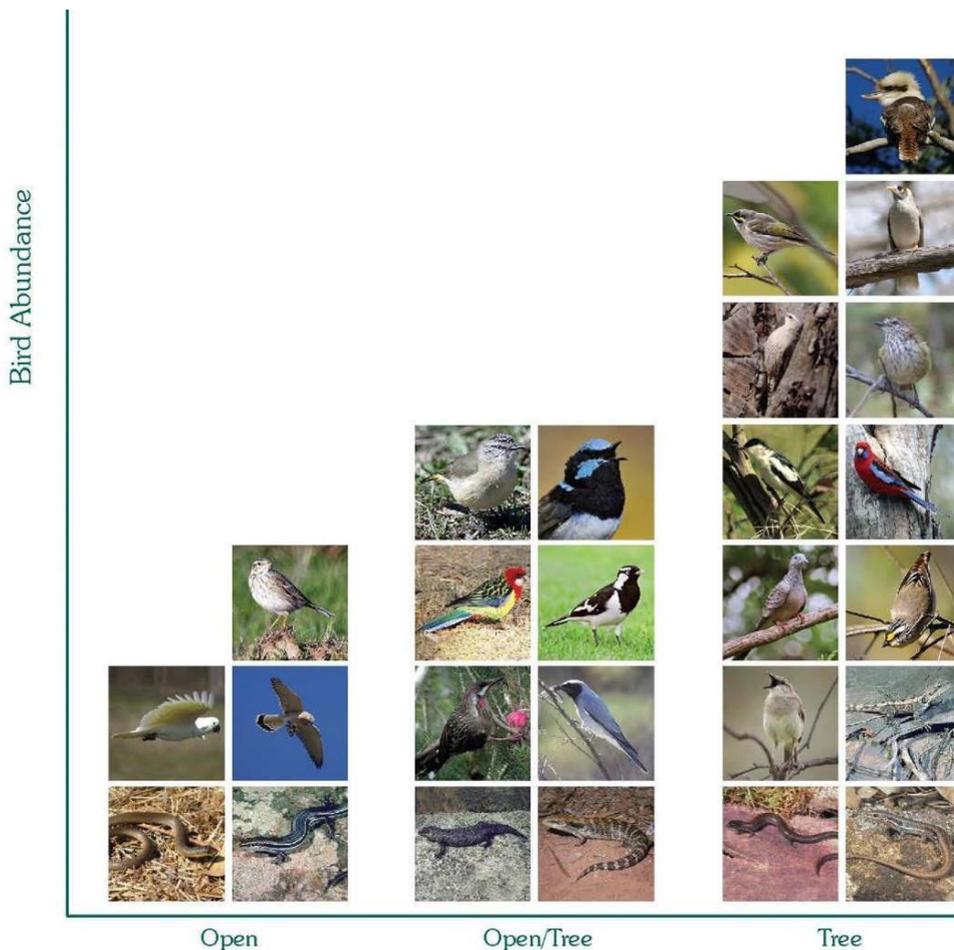


Fig 13

The *Biodiversity in the Paddock* book was put together back in 2010. It has some of the basic data from the Holbrook work, showing that the numbers of woodland species in the remnant woodland sites were higher. In the revegetation sites we do get a good suite of birds as well, but not quite so many. And then, out in the paddock, not so many of those woodland species – they need the trees.

One of the things we've been talking about is the ground layer, and that's really important for the birds. A lot of the woodland-dependent species (Fig 14) are taking their food from the ground.

Over 200 bird species occur regularly in grassy woodlands:

- 5% are true grassland (matrix) species
- 95% are woodland dependent
- 60% of woodland-dependent species take more than 40% of food from the ground
- 70% of ground foraging occurs within 25m of tree cover

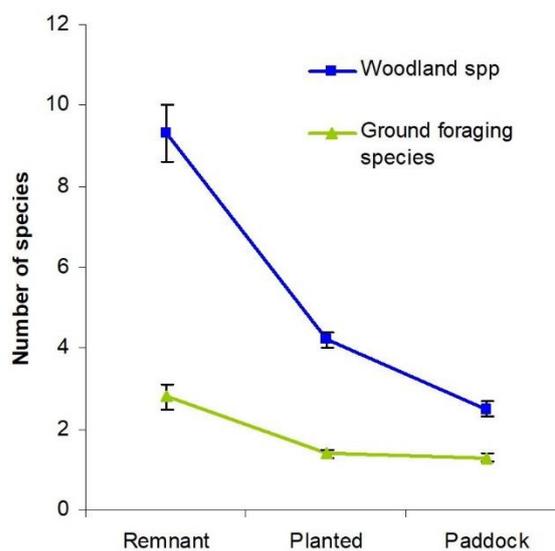


Fig 14

That's why we're really wanting to look after that ground layer. It has the invertebrates and reptiles, the tussocky structures which are a good habitat, and ecosystem functions and soil processes happening. So plenty of food and resources - plus the wildflowers. Having those functional and diverse systems is incredibly important if you want to keep your bird species.

Transforming open paddocks to diverse systems

The big question is: how do we get from these more-or-less open paddocks into more diverse systems?

One way is revegetation. At our CSIRO farm in Canberra, we have done a lot of planting of a shrubby, patchy mosaic layer, in patches of about 25m by 25m, occupying 5-10% of the total area. Within a year of planting, we started getting the Scarlet Robins in. These shrubby patches provide a refuge for the birds - there they can find insects, nectar and nest sites, and hide from the Noisy Miners. It's almost like there's not many magic recipes in how you manage a woodland, but putting

shrubs in makes such a difference, especially these sort of patch areas. But they're connected enough so that the birds can move in between them as well.



Fig 15

Of the 35 species we checked in the revegetation sites in Holbrook, 24 of them showed evidence of breeding. So, you really do get great bang for your buck when you start putting plants in the ground. And where large remnant trees were within revegetation sites, bird activity in these trees increased by 50% within two years.

So one recommendation for integrating the management of bird diversity into farm management is to have as many different habitats as possible – a mosaic with patches all over the place.

A second recommendation is to provide really nice ground layers with lots of leaf litter, bare patches, wildflowers, logs and shrubs. Control of foxes and cats is also important - they will also like those complex ground layers as harbour. And we also want to encourage tree and shrub recruitment.

Finally, we need a variety of grazing management strategies on farms and regionally across the landscape. This could be continuous grazing at low levels, selective patch grazing or rotational grazing.

Recommendations for integrating management of bird and reptile diversity into farm management

Maintain or increase areas of different habitat – from trees and woodland patches to open pasture & large dead trees

Provide ground cover with good leaf litter but also with some bare patches, rocks and rocky outcrops as well as fallen timber, grasses, wildflowers and shrubs

Control feral predators such as foxes and cats

Encourage tree and shrub recruitment

Provide a variety of grazing management strategies on farm and regionally

- selective patch grazing through continuous grazing at low stocking rates can provide a variety of ground cover types and grass structures
- grazing at low stocking rates can help maintain a diversity of plant types - shrubs, tussocky grasses, herbaceous plants such as wildflowers and orchids, perennial grasses. Each is a potentially different source of food for animals
- use long rests to favour less common birds that use long grasses

Linking across landscapes

I was fascinated to look at the landscape of Euroa. Around 3.6% of the Euroa landscape is remnant vegetation but with lots of good linear patches. How are we going to manage for biodiversity as well as production in these fragmented agricultural landscapes?

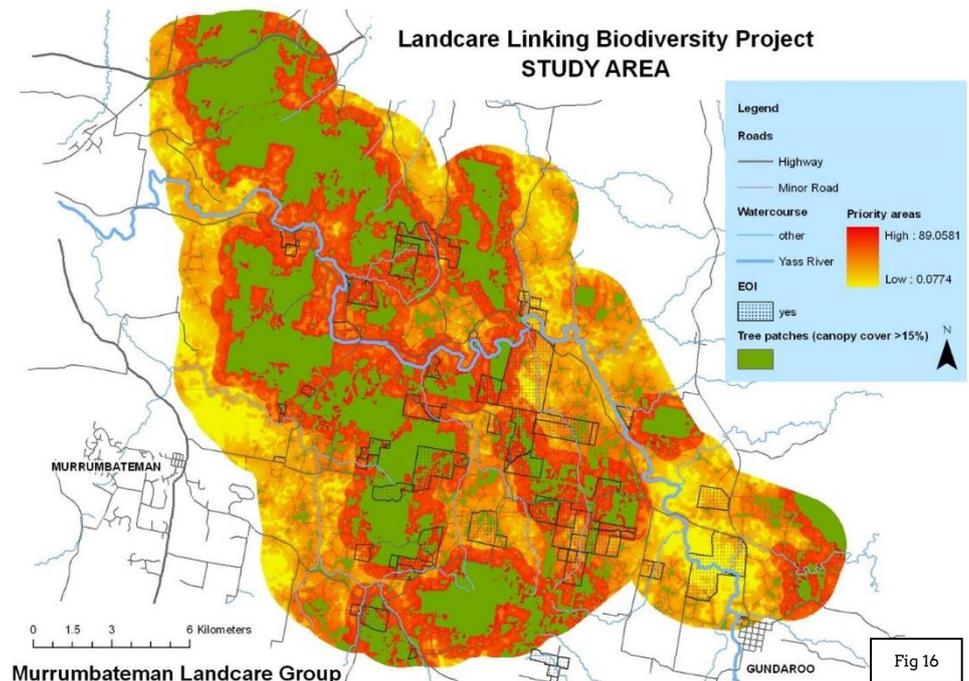
Research from the Australian National University shows that, to get a bang for your buck when you are putting trees back in the landscape, you want those revegetation plantings to be close to other plantings or remnant vegetation, and to include those mid-storey shrubs -they're incredibly important. Best results come from plantings that intersect with other plantings, that makes a big difference. Gullies are far more resource-rich than up on the dry hilltops, so are a good place to get a bang for your buck. Blocky plantings are better than linear plantings; linear strips are more subject to invasion from Noisy Miners and all the other elements coming in from the edges. And including old paddock trees as planting nodes is very valuable. So plantings are very important - but they're still not as important as remnant vegetation.

Vegetation also needs to be connected. Biolinks Alliance had a whole program on connectivity as part of a symposium in 2017 (see [here](#)). There's lots of really big-

scale projects going on, but keep in mind how we do this at a local scale so that the birds and the vegetation can be hooked up.

I run the local [Murrumbateman Landcare Group](#) between Canberra and Yass, and we used our CSIRO friends to develop a prioritisation of revegetation to try and get some funding. We got \$400,000 to run a fantastic funded project over six years, focussing on high priority areas connected to remnant patches. These sorts of programs, where you think about how to connect everything together, start at the big scale and can go to the landscape scale and then to the site scale. At the site scale, we need to ask what are we going to do, and where are we getting our plants from, and so on? Having local people involved is important.

We know corridors are very helpful. The wider the better. If we can, paddock trees and plantings need to be less than 100m apart for woodland birds. That's one of the key distances - they don't like to fly too much more than that. And we want all those other things in our corridors and paddocks - scattered trees, shrubs, rocky areas and logs.



We can have all that with grazing as well.

Linking the larger remnants works, concentrating on patches of ten hectares or more. If there aren't two remnants of that size, look at how you might be able to enlarge and replant existing smaller patches. Also concentrate on remnants that aren't more than one kilometre apart. Because, all of these are key for woodland bird connectivity.

Adaptive strategies

We've also got to think about adaptive capacity of the plants. There's a number of different ways we can think about making use of the adaptive genetic variation that's already present in plant species to facilitate the persistence of plantings. There are a lot of new climate-ready revegetation strategies out there. And our Landcare group is actually one of the first groups that's trying to pull these together with the scientists as well.

We really want to start thinking about these adaptive strategies on the ground. You can do it fairly simply. Suzanne Prober has done this with Greening Australia, mixing plants of local provenance and plants from elsewhere. We can incorporate a bit of scientific design using mixed provenances in whole of paddock plantings.

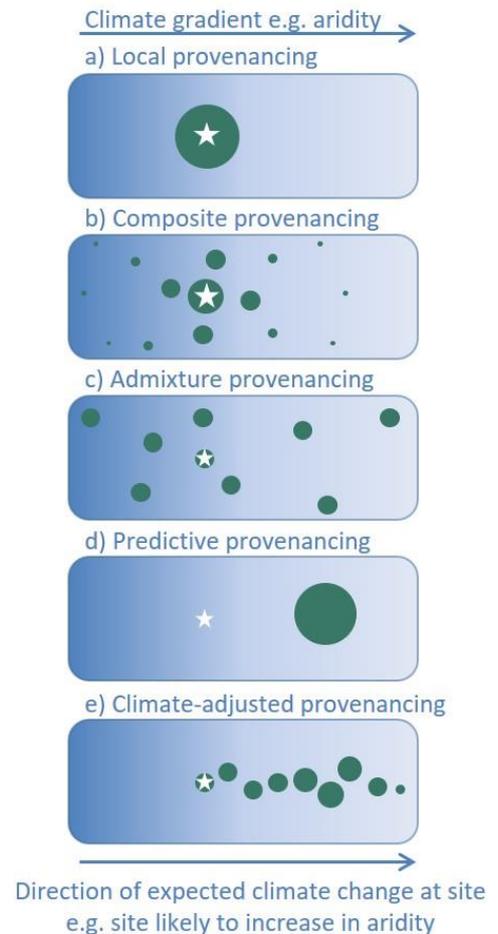


Fig 17

Tree health and regeneration

Something else that's really important is to protect our existing paddock trees.

Don't worry about mistletoe too much. It's a great habitat. We can have up to 50 plants of mistletoe on a Yellow Box (Fig 18). It'll still be healthy, and the birds love it. It's a great resource.

Where the trees are, truffles are as well. We're a megadiverse truffle nation - if you have truffles in your landscape where there's deep leaf litter, you will generally have healthier, more functioning systems. They are really common, but nobody really knows about them - they only know about the ones we can eat. So, truffles are part of having a healthy system, and keeping healthy paddock trees as well.



Fig 18

But how do we keep paddock trees healthy? Many actions can potentially reduce levels of nitrogen and phosphorus and decrease soil compaction particularly around the roots - all the things that impact on your healthy paddock trees. Actions could include fencing for rotational grazing or seasonal exclusion, and surrounding trees with new plantings.

Key actions can improve tree health

- Consider undertaking rotational grazing and / or fencing and seasonal grazing exclusion to:-
 - Reduce stock camps / levels of nitrogen and phosphorus
 - Foster greater chance of natural regeneration
 - Improve soil capacity for nutrient cycling,
 - Decrease soil compaction and improve water infiltration and soil stability by decreasing stock trampling;
 - Resulting increase in ground litter and understorey grass and forb cover & soil biota and activity;
 - Provides more habitat for predator insects (parasitic wasps and flies) to larvae of scarab beetles which feed on eucalypt leaves providing better microsites and conditions for tree/shrub/grass seedling establishment and germination & attracting birds to increase their predation on insects;
- Surround trees with new plantings that include a diversity of understory shrubs to attract an abundance of small insectivorous birds and encouraging wildlife which feed on insects that defoliate eucalypt leaves
- Avoid drift from fertilisers and herbicides

Natural processes can also be used to get the trees back, by simply controlling grazing around patches in particular seasons. Josh Dorrough was one of the people who did this work. We commonly don't get great conditions for tree establishment for 15 to 20 years because you need half a dozen things to happen together. We need lots of good seed produced in good flowering seasons and not all taken away by insects (we can't do too much about insects but hopefully there will be plenty of seed to start with). We also want a bit of bare ground - after a drought is a fantastic time when there's lots more bare areas. Then drought-breaking rains are often a key trigger point for these trees coming in. Around 2010, when the millennium drought was finishing, was an amazing time for regeneration. We've seen it all around the

Seasonal guides show how you can use grazing, and at which time of year, in order to promote restoration of that ground layer.

Seasonal grazing guide as a tool for biodiversity in grassy ecosystems

Native Grassland/ Pasture type	Summer			Autumn			Winter			Spring		
	Dec	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov
1a) High Conservation Value (HCV) grassland grassy woodland – very diverse range of native species (60-110) incl. orchids, lilies, wildflowers and sub-shrubs. Grasses incl. Kangaroo, Snow, Weeping, Native Sorghum. Many grazing sensitive species – avoid grazing when native forbs and grasses germinating, growing & flowering 1b) High Diversity Native Pasture – diverse range of native species (40-60) incl. native wildflowers and legumes. Grasses - Kangaroo, Weeping, Red-leg and Wallaby Grasses. Graze as above 2) Moderate Diversity Native Pasture – range of native spp. (20-40) including some wildflowers and legumes. Grasses - Red-leg, Wallaby, Spear, Wire. Some exotic annuals 3a) Low Diversity Native Pasture – some grazing tolerant native plants (1-20) primarily grasses - Spear, Redleg, Wire. Main grazing in late winter & early spring to reduce exotic annual grasses - Brome, Annual Ryegrass, Silver Grass, Barley Grass, Wild Oats. 3b) Fertilised Native Pasture – mostly annual exotics (Ryegrass, Silver Grass, Brome, clover/medics) with some phosphorus tolerant native grass spp. - Wallaby, Weeping and Red-leg. Graze as per low diversity pasture	Native grasses seeding and establishing											
	No grazing (X)			SHORT DURATION grazing to reduce bulk, only if native perennial grass sward very dense. Grasses generally more palatable to stock earlier rather than later in this phase or consider burning, slashing/mowing.			No grazing (X)			Native forbs germinating and establishing/seeding		
No grazing (X)			graze or rest to maintain high perennial pasture cover and to restrict annual exotics growth and seeding			No grazing (X)			graze or burn every 1-3 years as needed to reduce exotic annuals			
Exotic annuals germinating												
No grazing (X)			Preferably rest to build up perennial native grasses, ground cover and seed reserves, and to restrict growth and seeding of annual exotic grasses						Exotic annuals seeding			
No grazing (X)			No grazing (X)			graze or burn annually to reduce exotic annuals			No grazing (X)			



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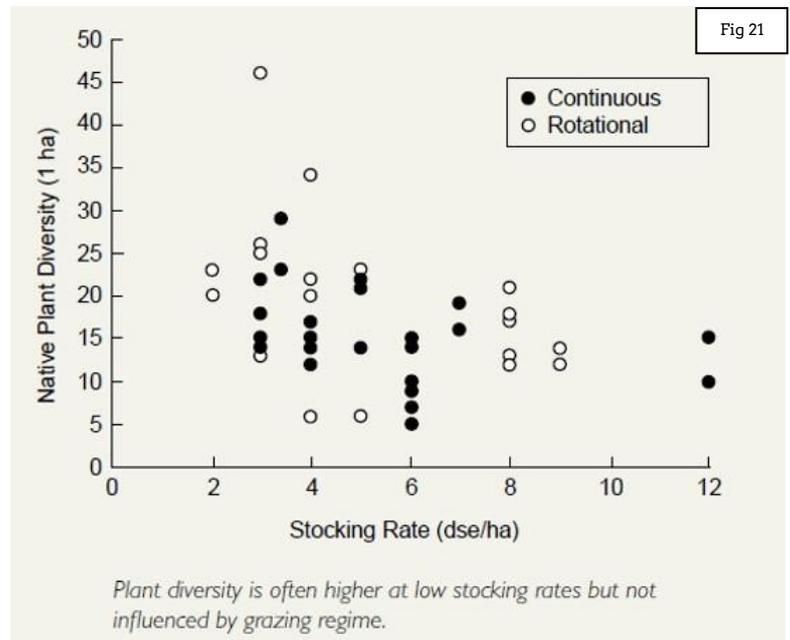
Fig 20



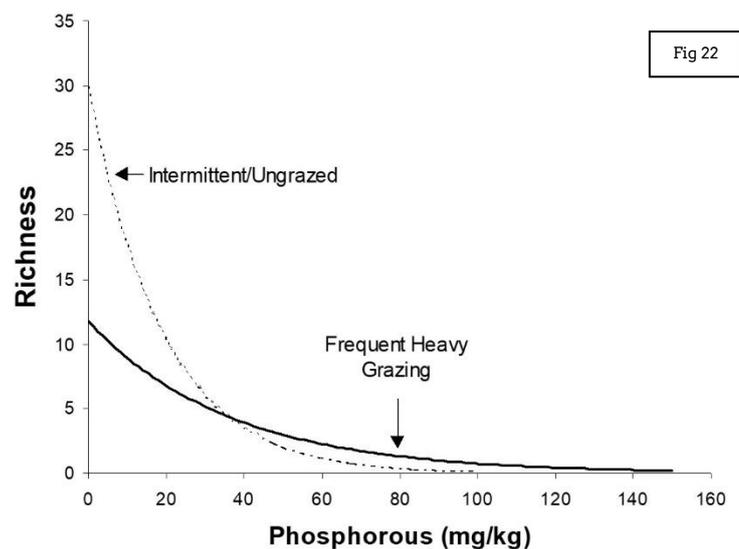
Stocking density is really important. It doesn't matter whether it's rotational or a set stocking regime. There is a decrease in native plant diversity as the stocking rate increases above 1-4 Dry Sheep Equivalents. A lot of this information is in the *Biodiversity in the Paddock* booklet that I wrote with Josh Dorrrough and Sue McIntyre.

Continuous grazing at low density can provide important habitat and plant diversity eg. more structural diversity and habitat resources incl. sub-shrubs, tussocks, fallen timber.

Frequent, sustained, heavier stocking rates (> 6 DSE) eliminates grazing-sensitive plant species (“ice-cream plants”!) and simplifies habitat for animals by removing tall tussocks, shrubs and preventing tree regeneration.



Soil fertility is also important. Phosphate fertilisers and high nitrogen don't bode well for our native plants. Native plants are very well adapted to low phosphorus, but they get outcompeted by exotic species where nutrients are high. Species richness rapidly plummets as levels of phosphorus go up, particularly in combination with grazing. Some species are really vulnerable to those higher levels of fertiliser and nutrients.



Paddocks will be managed differently according to what starting point you are at. You can use the seasonal guide above (Fig 20), and the Euroa Arboretum site also has a more specific grazing tool from the North East CMA - see [link](#).

When we graze high conservation-value sites or high diversity native pastures for biodiversity, we're not grazing most of the year, except for a very short period at the end of summer with short pulses of grazing. If we've got moderate diversity native

pastures, we're also looking at pulse grazing during autumn, but also grazing in early spring to hammer back all those exotic annual grasses and herbs to knock the seed heads off before they ripen. That will have a big impact on how your native plants respond. Low diversity and fertilised native pastures are more common out in the landscape, and require a different range of grazing regimes across the year.

Fertilisers are best used on the sown pastures where you get best bang for your buck. I won't talk about enriched grasslands.

The key message for maintaining and restoring grassy ground layers is that we can have significant diversity in these pastures with:

- low stocking rates,
- strategic grazing at different times that limit the stock pressure and grazing times to allow for rest during times of active growth and times of flowering and seeding of native species,
- reduced fertiliser application in the high conservation-value areas; put fertiliser on the good sown pastures and recognise that other pastures won't respond so well to fertilisers.

To do this, we need to know our paddocks – their plant diversity, when they are actively growing, flowering and seeding (needed to build up the seed bank), and which paddocks are best to use for either native plant diversity or production and fertilisation.

And we need to time our grazing strategies according to the seasons. For example,

- limit stock pressure in dry seasons and dry years, and when plants are recovering after good summer and autumn rain
- apply heavier stock pressure during early spring to target annual weeds, particularly grasses, to reduce their competition with the native perennial grasses that grow and flower later in the season.
- use grazing management to increase the health of native perennial grass cover and allow opportunities for trees and shrubs to establish.

Finally

Today we are trying to pull science into practical land management. Ecological indicators can help you know whether your management is doing what you want. *Checking for Change* is a new monitoring guide designed specially for land managers.

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