



Biolinks Alliance 2019 Symposium

Box Gum Grassy Woodlands: restoration, grazing and woodland birds

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Jacqui Stol | Biodiversity, Ecosystem Knowledge and Services Program | 24th May 2019

The original Box Gum Grassy Woodlands – the diversity is in the groundlayer (not just trees!)

- in very high conservation condition woodland and grassland remnants could have 60-110 spp of native wildflower and grass species
- Key grasses are Kangaroo Grass and 'Snowgrass' (Poa) Tussock



Kangaroo Grass (above)

Creamy Candles amongst Poa tussocks (below)



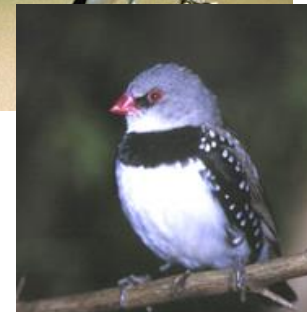
Key woodland tree species are
White Box (below)
Yellow Box (right) &
Blakely's Red Gum (below right)



The original Box Gum Grassy Woodlands - wide diversity of wildlife

Intact woodland and grassland remnants in good condition have many uncommon, rare or declining species of grassland & woodland birds, reptiles, mammals and invertebrates

The common species such as galahs, cockatoo's or eastern grey kangaroos are more generalist and so are increasingly common in open farming country



Hooded robin (above)
Diamond Firetail (below)

Rufous Fantail





Having bare ground and spaces between grassy tussocks allows the wildflowers to germinate and grow – grazing and fire traditionally kept and can continue to keep the groundlayer system functioning



The original Box Gum Grassy Woodlands - high diversity

- Woodland tree numbers average around 30 trees per hectare with gaps between the canopy over a diverse grassy wildflower groundlayer
- In-between the trees & groundlayer is a patchy mosaic of native shrubs (5-10% of area)
- not overlapping like a forest – remember if doing revegetation more shrubs than trees eg. 7 shrubs : 1 tree
- You CAN have trees and a grassy groundlayer together !!

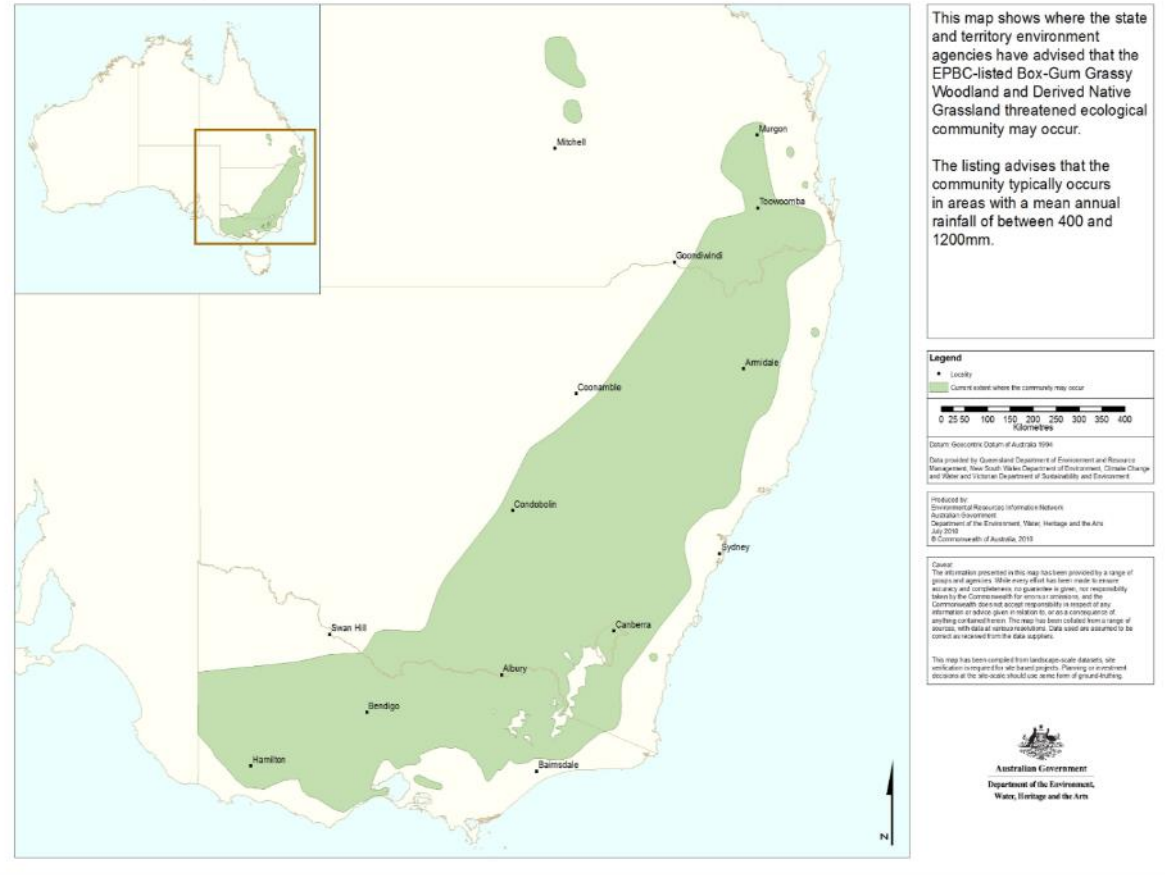


Where are the woodlands & grasslands (and what's left?)

Historical context

- prime grazing sheep-wheat belt
- typically occurs on undulating to flat terrain with moderate to high fertility soils and with mean annual rainfall between 400 and 800 mm at altitudes of 170-1200m above sea level

Box-Gum Grassy Woodland and Derived Native Grassland



Iconic images of pastoral Australia



"Droving into the Light" Hans Heyson 1921

Iconic paddock tree – the Yellow Box

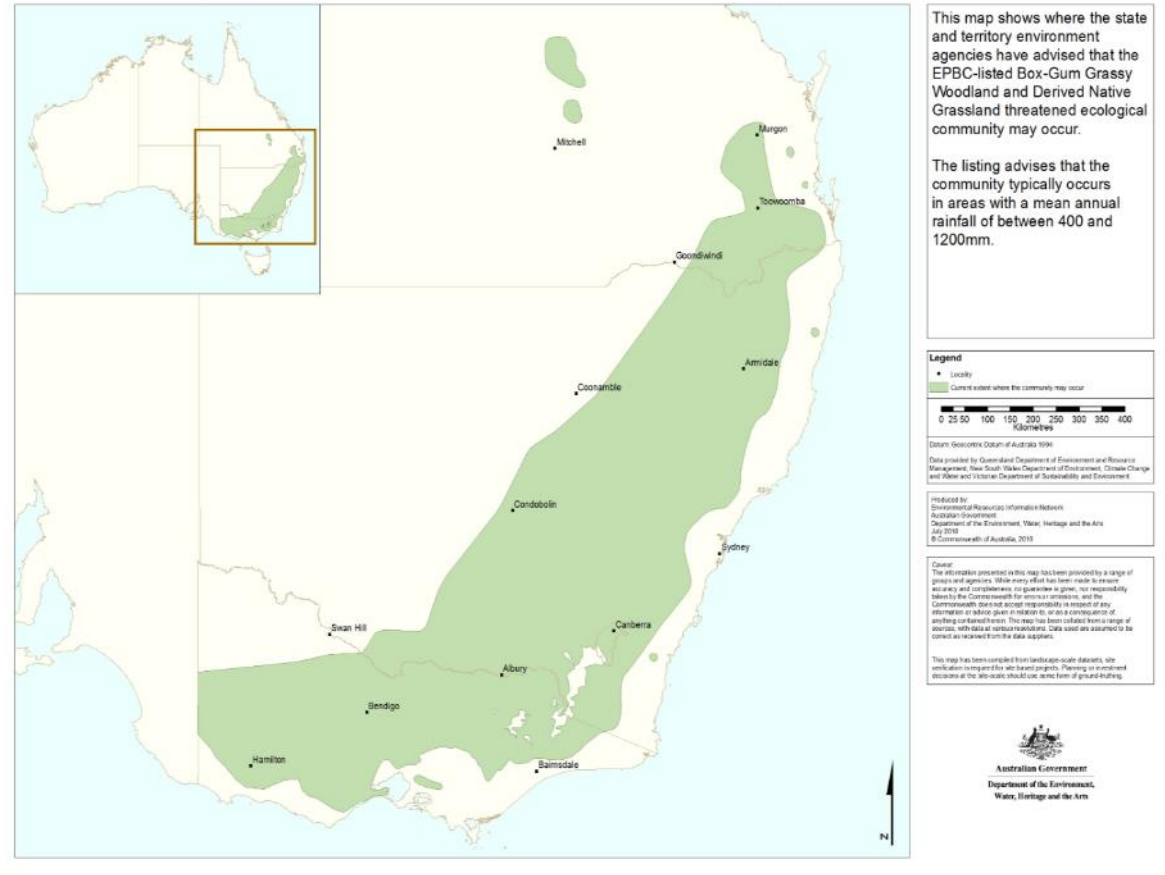


Where are the woodlands & grasslands (and what's left?)

Historical context

- more than 90% of its pre-European distribution is estimated to have been cleared
- Federal and state listing as critically endangered / threatened ecological community
- less than half of the remaining 10% is considered likely to meet the minimum condition criteria of the listed ecological community

Box-Gum Grassy Woodland and Derived Native Grassland

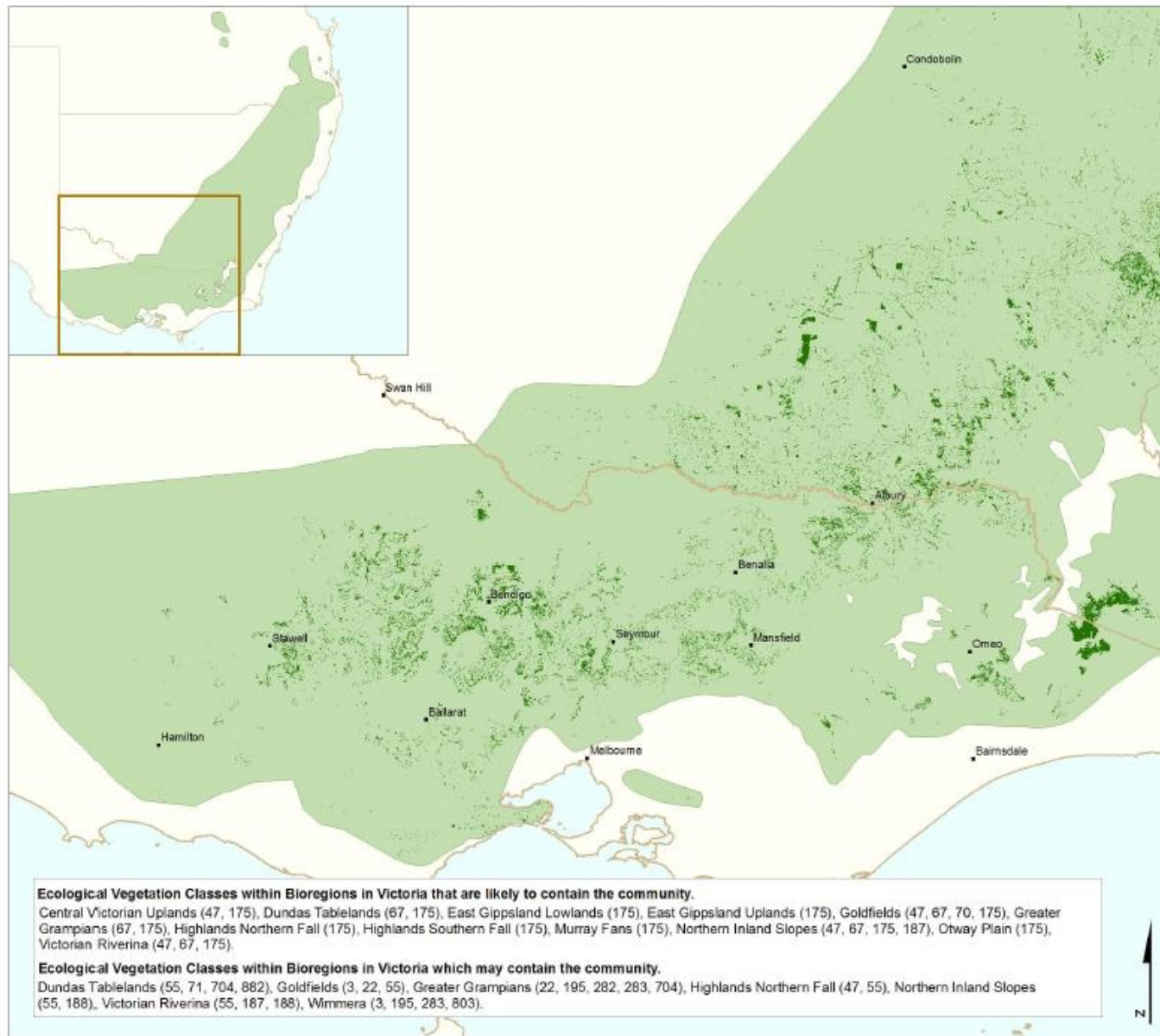


Woodland remnants are diverse but vulnerable so native paddocks and property are hugely important for biodiversity in these grasslands and woodlands :-

- Of the remaining 10% of BGGW less than 5% meets the minimum condition criteria of the listed ecological community
- That is more than 50% cover is native understorey plus 12 native non-grass species in 0.1ha patch or 20 mature trees in 2ha patch
- less than 0.5% fall in the High Conservation Value condition category



Box-Gum Grassy Woodland and Derived Native Grassland - Victoria





Woodland paddocks with sown and native pasture have only 1 - 10 species in the plant groundlayer

The original woodlands may have had up to 50-60 plant species in any one area





You may have trees (above) or open grassland but what's in your groundlayer?
Keep in mind as we explore options for restoring your remnant.....

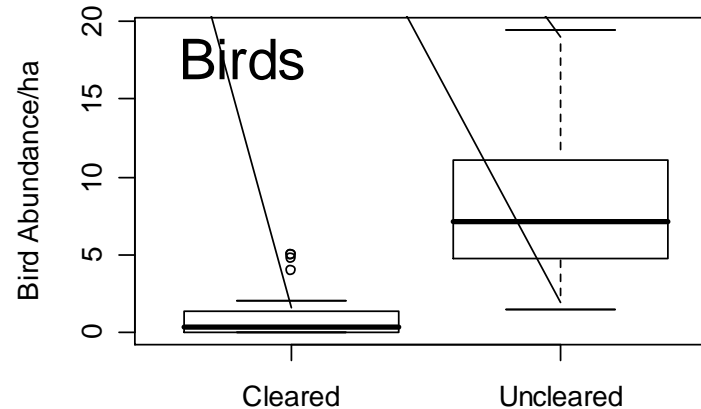
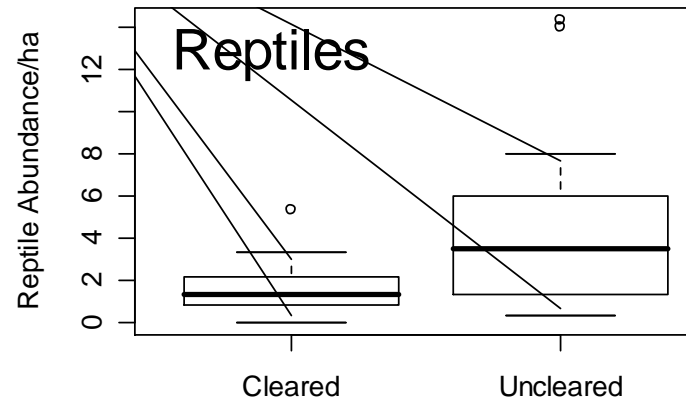


Remnant patches = more reptiles and birds

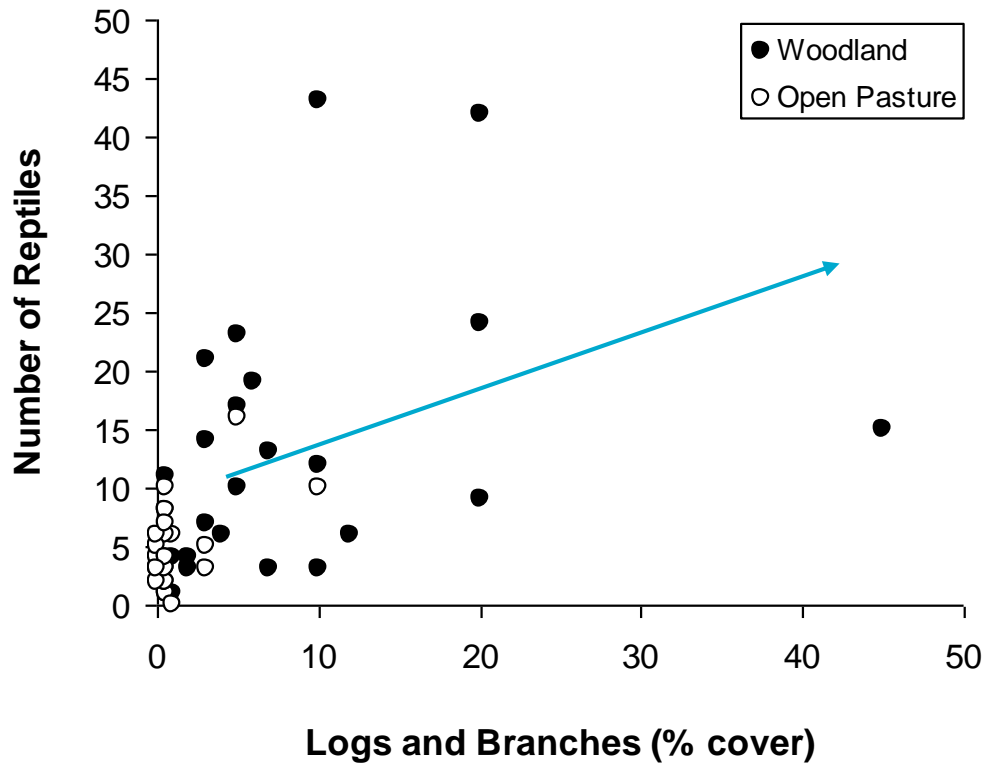
Remnant trees

- greater resources eg. invertebrates, + shade, shelter, leaf litter, moisture etc

- less management impacts in uncleared treed woodland remnants with limited cultivation, fertiliser sown pasture



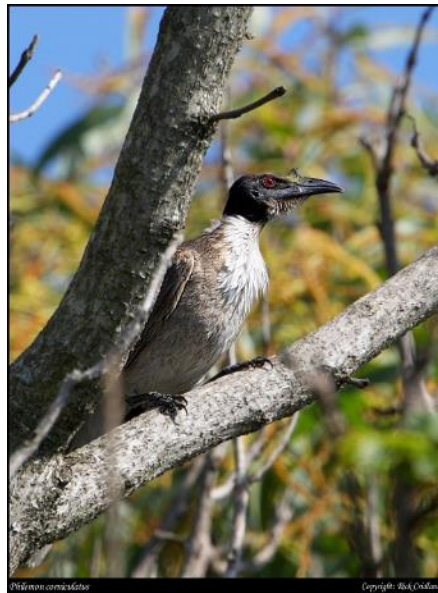
Reptile abundance and fallen timber



Holbrook NSW example – birds in paddocks/farms, revegetation and remnant woodlands*

- 110 bird species were recorded across farms and remnant vegetation.
- Similar numbers of species occurred across sites - 76 species occurred in revegetation sites, 73 species in remnant woodland sites, and 68 species in the paddock sites.
- However each of these groups (reveg, woodland, paddock) also contained different types of bird species ie. the woodlands by the rarer woodland specialists such as Eastern Yellow Robin, paddocks by more common open country birds such as Sulphur crested cockatoo and magpies , and the revegetation mix including shrub dependent birds such as superb fairy wren

* Barrett G.W., Freudenberger, D, Drew, A., Stol, J., Nichols, A.O., Cawsey, E.M. (2008) Colonisation of native tree and shrub plantings by woodland birds in an agricultural landscape. *Wildlife Research*, 35, 19–32



These are NOT the bird species we are worried about !!



Diamond Firetail

Striated Thornbill



Hooded robin

Restless Flycatcher



Scarlet Robin

Superb Parrot



These ARE the types of woodland bird species that are more vulnerable!!

These ARE the types of woodland bird species that are more vulnerable and are declining.....



Rufous Whistler



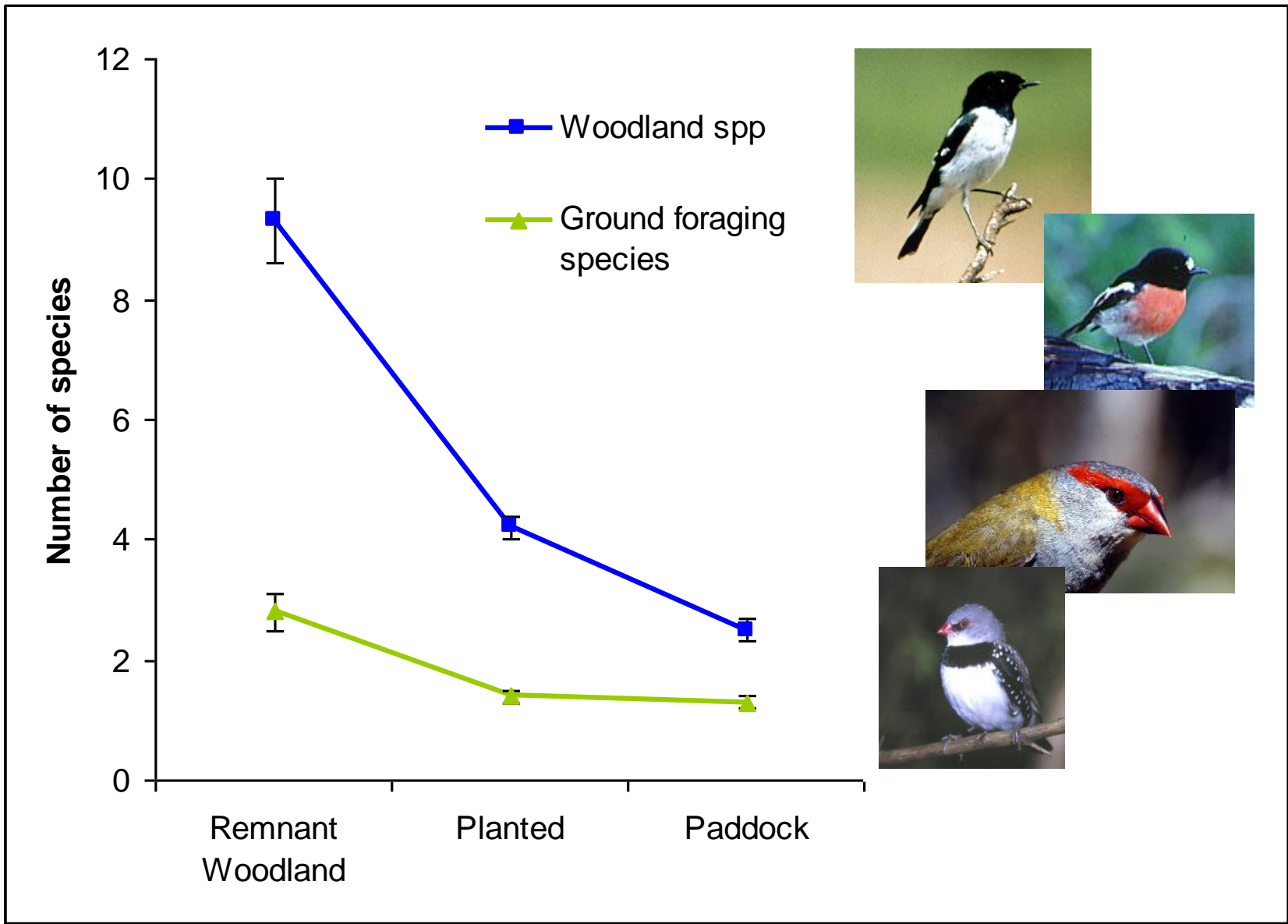
White-throated Warbler
(Gerygone)



even the Laughing Kookaburra ☹️

Bird Abundance





Why are birds foraging or found in the groundlayer?

- Over 200 bird species occur regularly in grassy woodlands:
 - 5% true grassland (matrix) species
 - 95% 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



Invertebrates and reptiles

Wildflowers

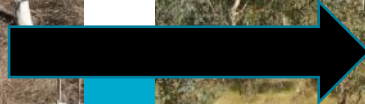


Leaf litter and bare earth

Tussocks



So how do we get to these more favourable habitats and diversity of species?



Box Gum Grassy Woodlands: restoration, grazing and woodland birds

And also mid-storey layer ie. shrubs = birds!!

A place to find insects, nectar, refuge from Noisy Miners and building nests and raising chicks



Box Gum
Grassy
Woodland –
key element
is a patchy
mosaic of
shrubs

Typically
occupies
only 5-10%
of the area

(25m x 25m
'patches')





Of the 35 species checked for brood patches in revegetated sites, 24 species showed evidence of breeding.

The most common were the white-plumed honeyeater (72 individuals), rufous songlark (26), superb fairy-wren (23), red-browed finch (18) and striated pardalote (15).



Box Gum Grassy Woodlands: restoration, grazing and woodland birds



Bird activity in large trees within revegetation sites increased by 50% in 2 years in Holbrook



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

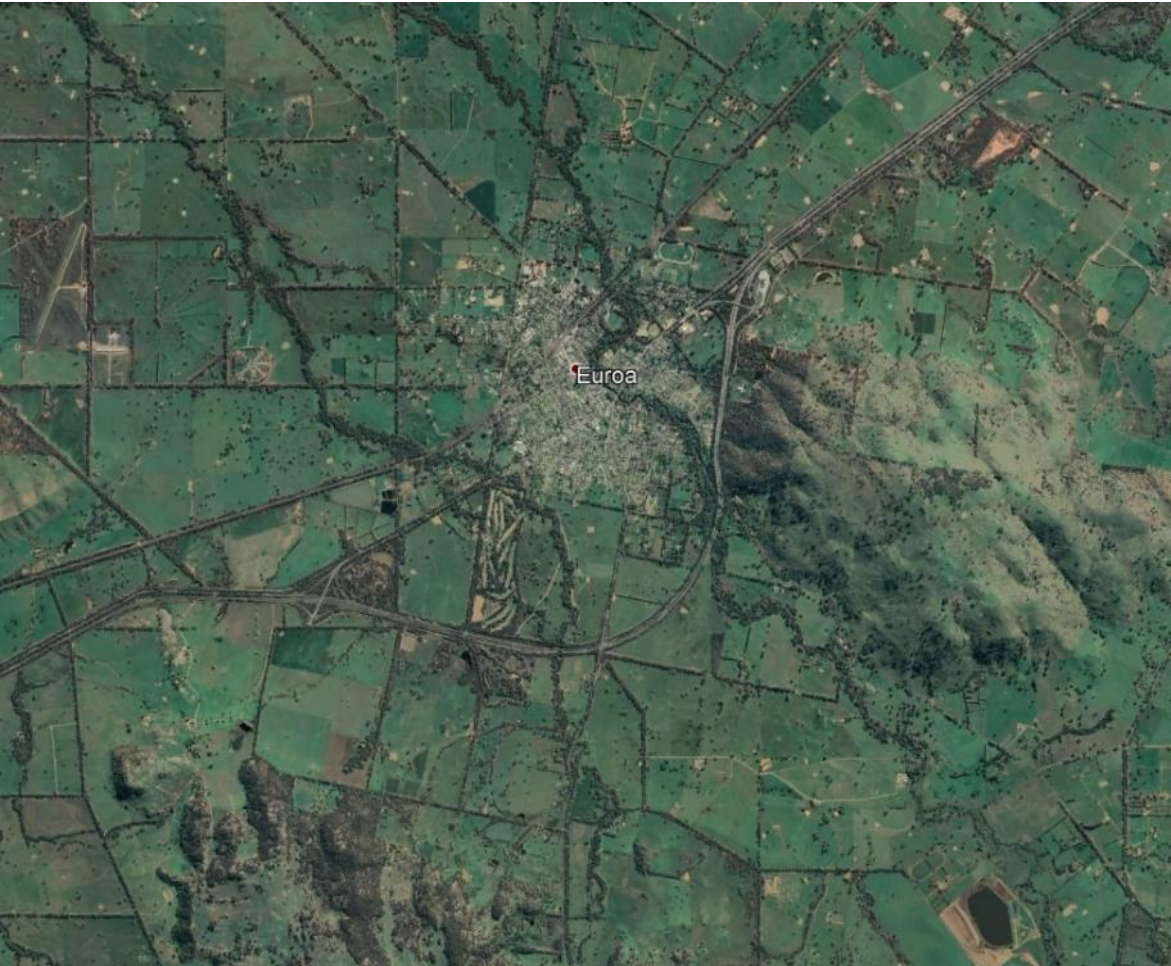
Control feral predators such as foxes and cats

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

So how do we manage for biodiversity as well as production and grazing in these fragmented agricultural landscapes?



Revegetation – research from the Australian National University

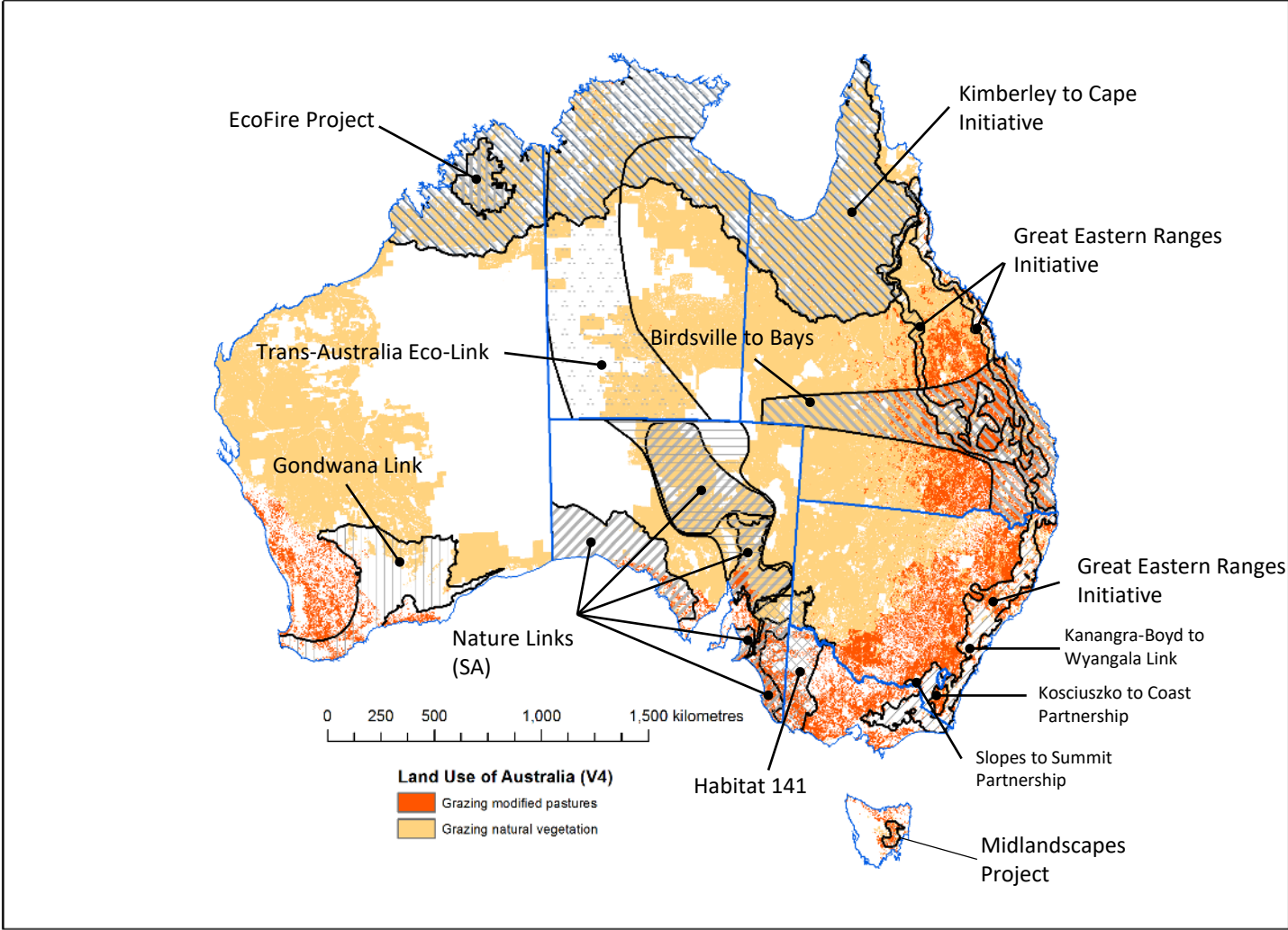
From a birds perspective the best revegetation plantings are:

- close to other plantings or remnant vegetation;
- include mid-storey shrubs (those that don't are likely to be dominated by the aggressive Noisy Miner)
- intersect with other plantings;
- are in gullies rather than on hill tops;
- are block rather than linear in shape; and
- incorporate old paddock trees as planting nodes

Plantings have great value for many bird species but in terms of woodland birds they are 3 times less effective than remnant vegetation

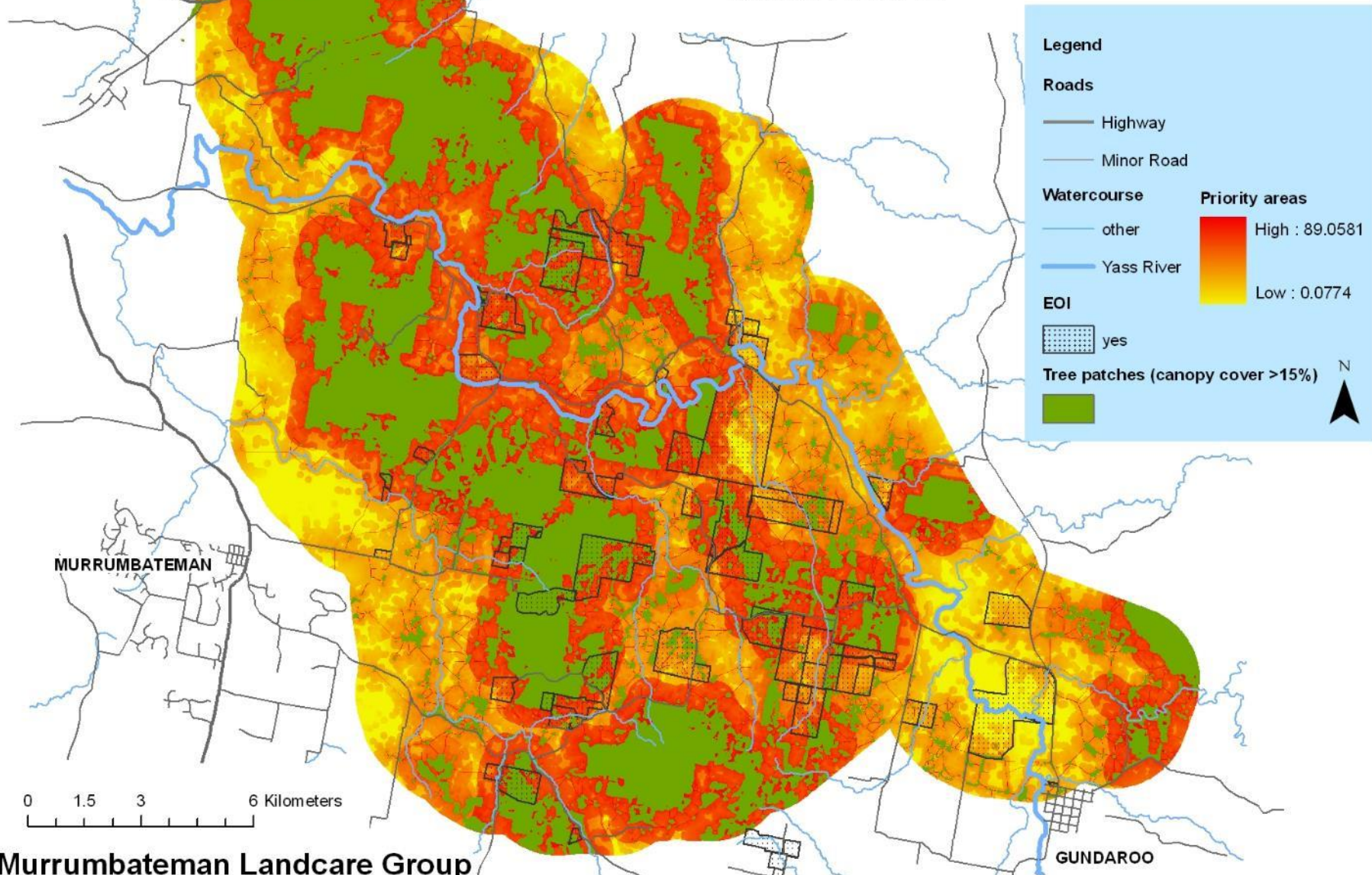


Corridor initiatives in Australia



Source: Godfree, Firn, Johnson, Knerr and Stol (in review)

Landcare Linking Biodiversity Project STUDY AREA



Murrumbateman Landcare Group



MURRUMBATEMAN LANDCARE GROUP COMMUNITY NURSERY

Established with assistance from:

- Murrumbateman Agricultural Bureau
- Murrumbateman Rural Fire Service
- Murrumbateman Lions Club
- Kelly & Co. Rural Centre
- Shaw Vineyard Estate
- Yass Valley Council



Connectivity:

Restoring Links in our Landscapes

- Corridors of any width can be helpful, but particularly concentrate on protecting and restoring scattered paddock trees over whole paddocks
- Protect and plant paddock trees so they are no more than about 100 metres apart—many of our native birds and mammals may not be able to hop across gaps bigger than that
- Try to ensure that corridors and paddocks with scattered trees also contain some shrubs, rocky areas & logs, which may be especially important for reptiles

Connectivity: Restoring Links in our Landscapes

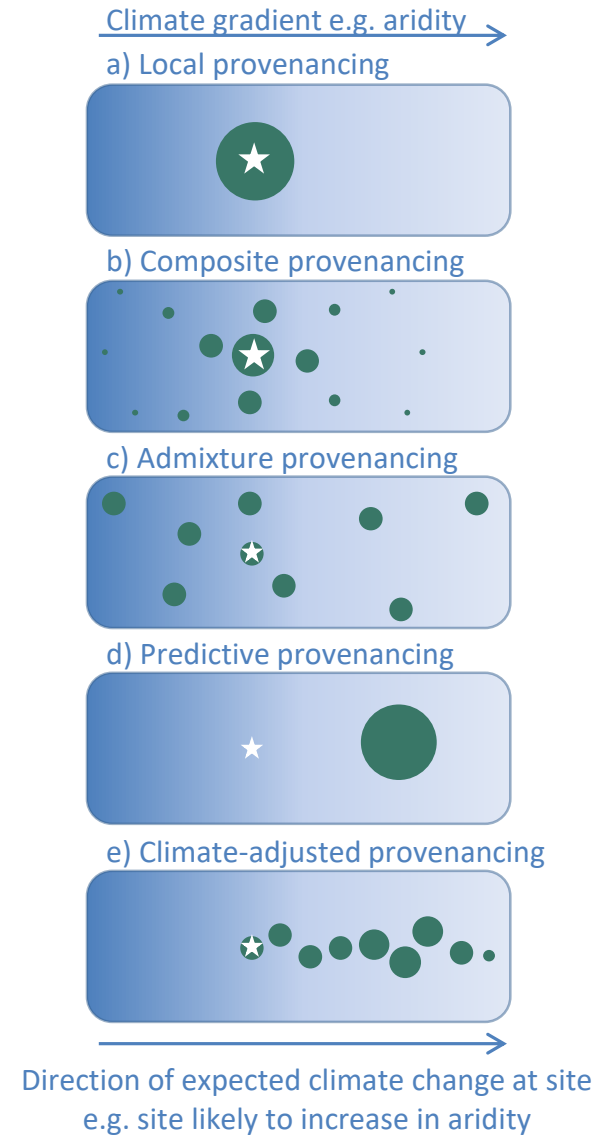
- Concentrate on linking remnant woodlands that are at least 10 hectares (25 acres) in size
- If there aren't two remnants that large in your area, enlarge an existing remnant or replant a patch of woodland or forest instead
- Concentrate on linking remnants that are no more than about 1 km apart
- If remnants are not that close together, replant a patch within 1 km of an existing remnant if possible



Capitalising on adaptive-capacity within plant species

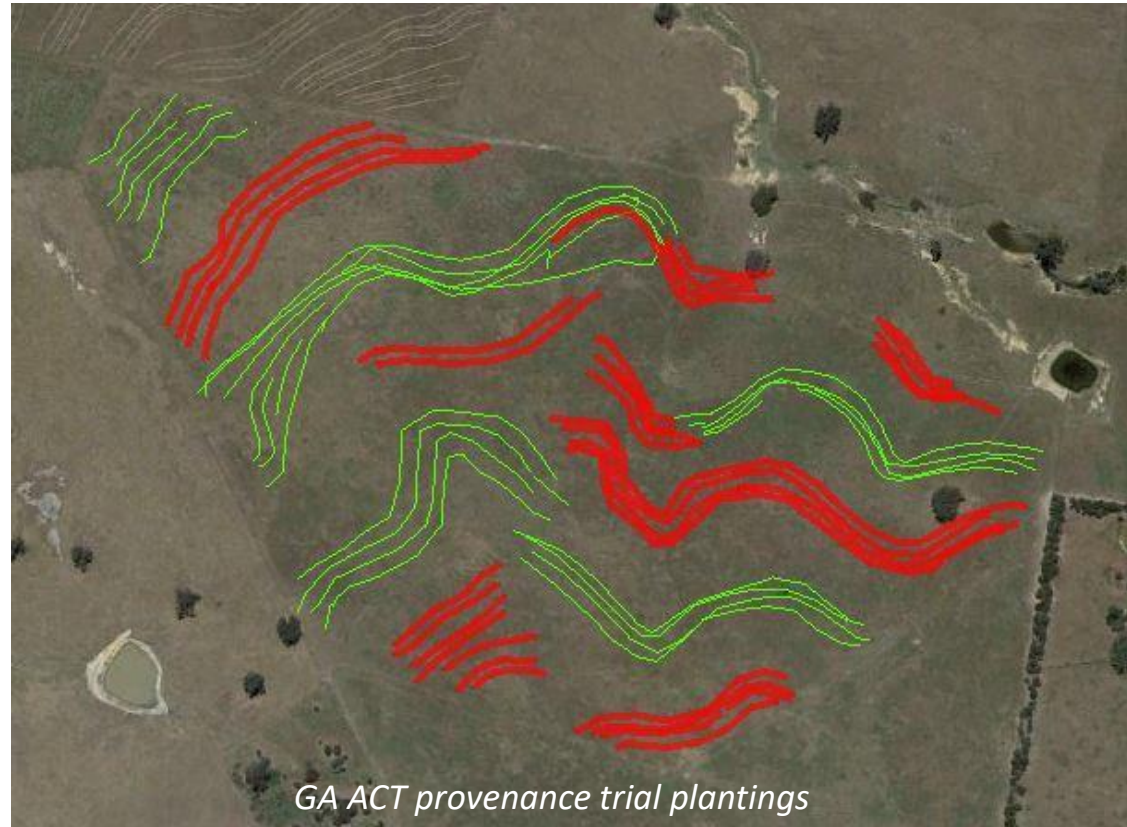
Can we use the adaptive genetic variation that is already present in plant species to:

- facilitate persistence of restoration or other plantings
- facilitate broader biodiversity conservation
- maintain the services ecosystems provide?



Science Infrastructure Component

- Working with Greening Australia to compare local provenancing with climate-adjusted provenancing
- Three species planted in each of three locations
 - *Eucalyptus blakelyi*
 - *Eucalyptus melliodora*
 - *Acacia dealbata*



Protect existing paddock trees

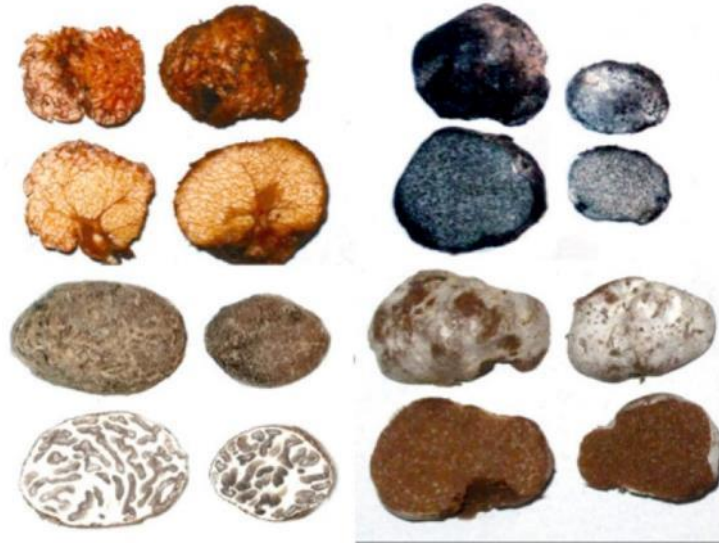
A healthy Yellow Box.....



And don't worry too much about mistletoe – trees can have + 50 and still be healthy

Mistletoe is a great habitat and food resource for birds and other wildlife – studies show sites lose >50% of birds when removed

And Australia is a megadiverse native truffle nation with up to 10 truffle species growing in symbiosis with a eucalypt tree (on roots) in a mutually beneficial relationship



4 undescribed truffle species ACT woodlands

Hydnoplicata convoluta



Professor Jim Trappe with a truffle fork at the tree base where most truffles can be found

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

We can also use natural processes to get patches of trees back



You can combine your

- 1) grazing management with
- 2) seasonal conditions

to hugely increase the chances of getting seedlings established

(& don't forget as per earlier slide - you **CAN** have trees and a grassy groundlayer together !!)

But the conditions for tree establishment typically only occurs every 15-20 years and requires the confluence of different factors:-



- Plenty of good high quality seed (healthy trees in good numbers)
- Minimal seed predation eg. ants and insect larvae
- Some bare ground - after drought along with drought breaking rains is often a ideal time
- Good summer rains –think about timing in terms of breaking of drought into wet La Nina year eg. 2010 in south-eastern Australia
- Allow time for regen to establish -no grazing - provide longer periods of rest if tree or shrub recruitment is evident

Grazing , biodiversity and native pastures



Key messages:

- Birds, mammals, reptiles and insects require habitat that includes a diverse ground layer
- Biodiversity on the ground results from management decisions affecting this ground layer habitat
- Manage for production and biodiversity with 70-100% cover of native grasses, litter, logs etc.
- A diverse range of ground layer structures is the best underpinning for long-term low input, low risk grazing

The maintenance, restoration and management of these areas is important for the successful recovery of the ecological community as well as for production.

How to move Box-Gum Grassy Woodland (BGGW) between condition states through changed management is best illustrated in the State and Transition Model

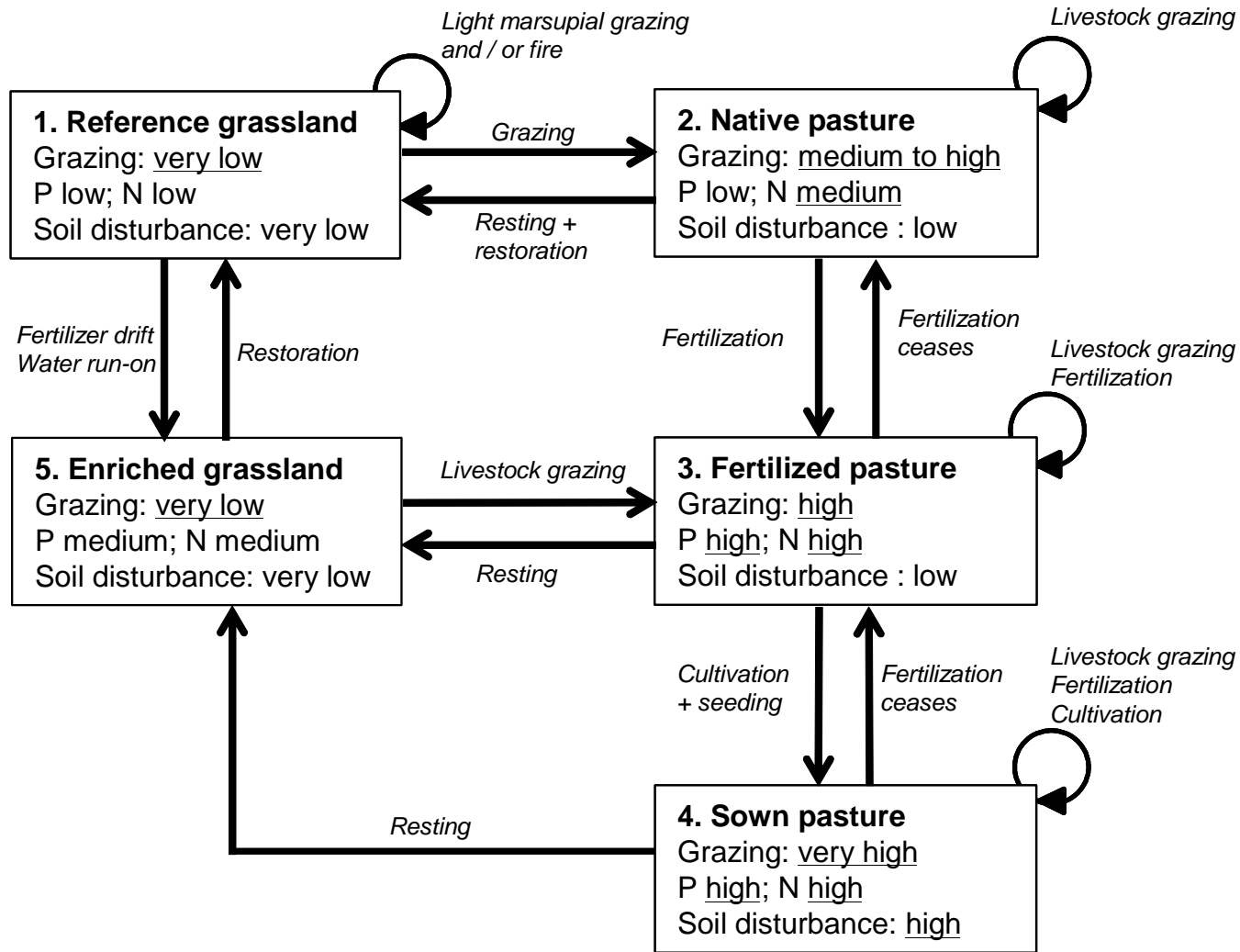


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State-and-transition model

McIntyre & Lavorel 2007



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					
<p>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</p> <p>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</p>	Native grasses seeding and establishing																
				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.													
<p>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</p>	Native forbs germinating and establishing./seeding																
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				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			graze or burn <u>annually</u> to reduce exotic annuals				

High Conservation Value (HCV)
(high forbs, low exotic annuals)

High Diversity
(high forbs, low exotic annuals)

Moderate Diversity
(mod. forbs, mod. exotic annuals)

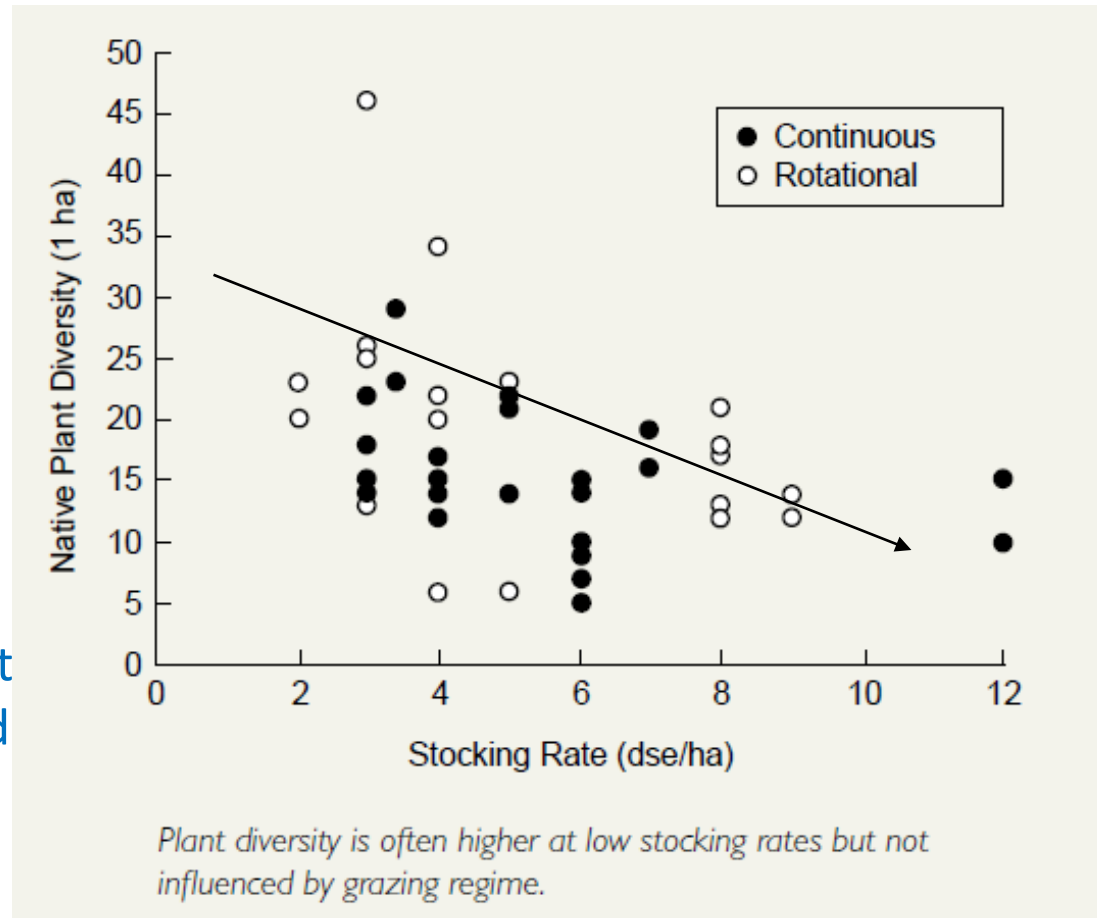
Low Diversity
(low forbs, high exotic annuals)

Fertilised
(low forbs, high exotic annuals)



STOCKING DENSITY is important part of management strategies to restore native plant diversity

- 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.



STOCKING DENSITY is important part of management strategies to maintain & restore native plant diversity.

Different paddocks will have different plant diversity so for paddocks with higher plant diversity:-

- Low- medium stocking density is best – more than 6DSE/ha typically reduced plant and animal diversity
- The most diverse pastures tended to be continuously grazed, but at light stocking rates (no more than 4 DSE/ha)

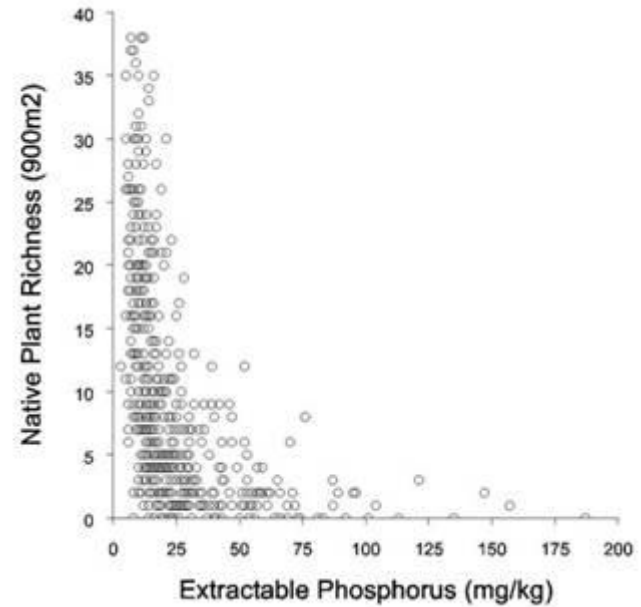
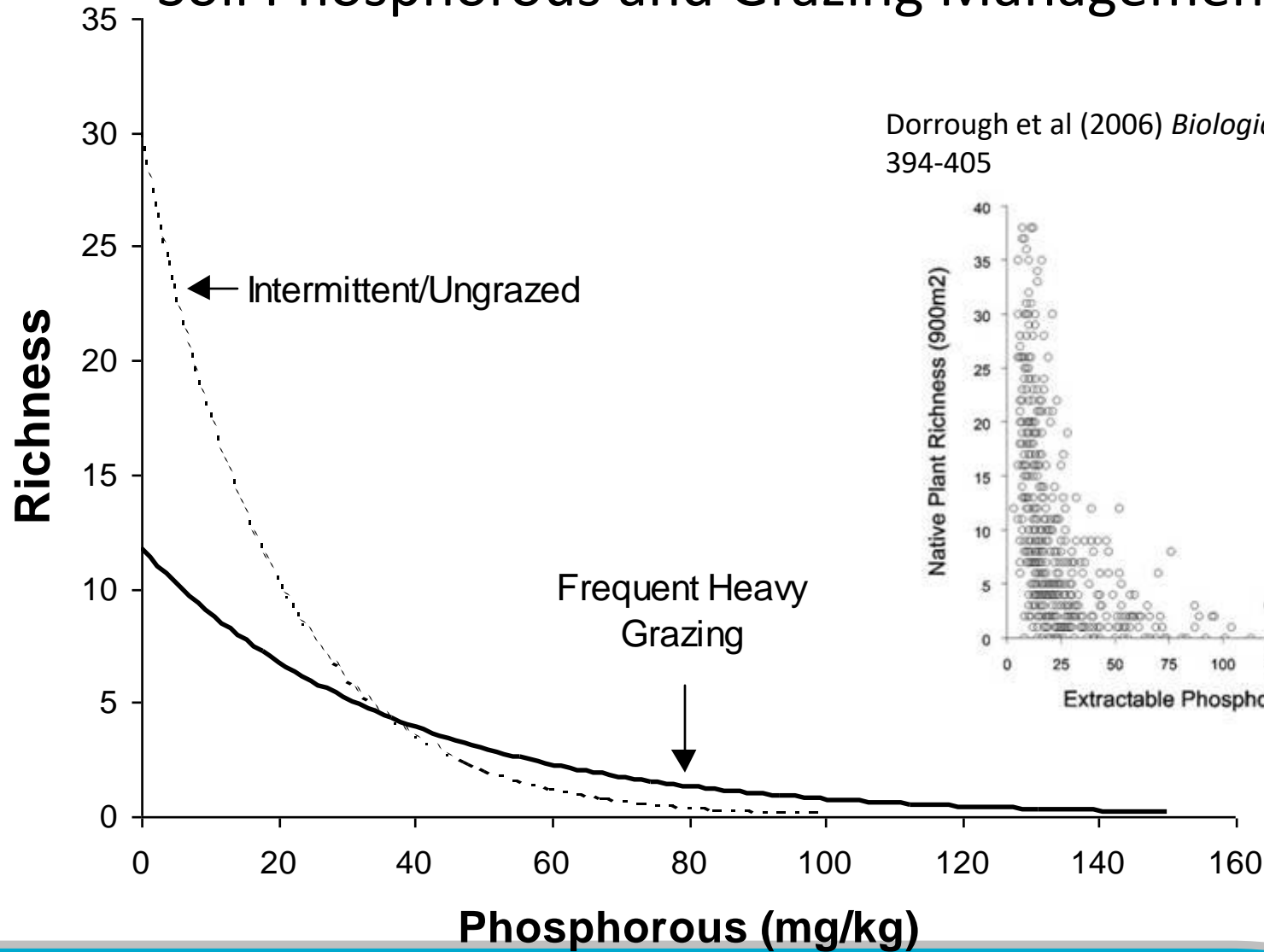
Biodiversity in the paddock

a land managers guide



Native Plant Richness:- Soil Phosphorous and Grazing Management

Dorrough et al (2006) *Biological Conservation*, **130**,
394-405



What about using superphosphate / fertiliser?

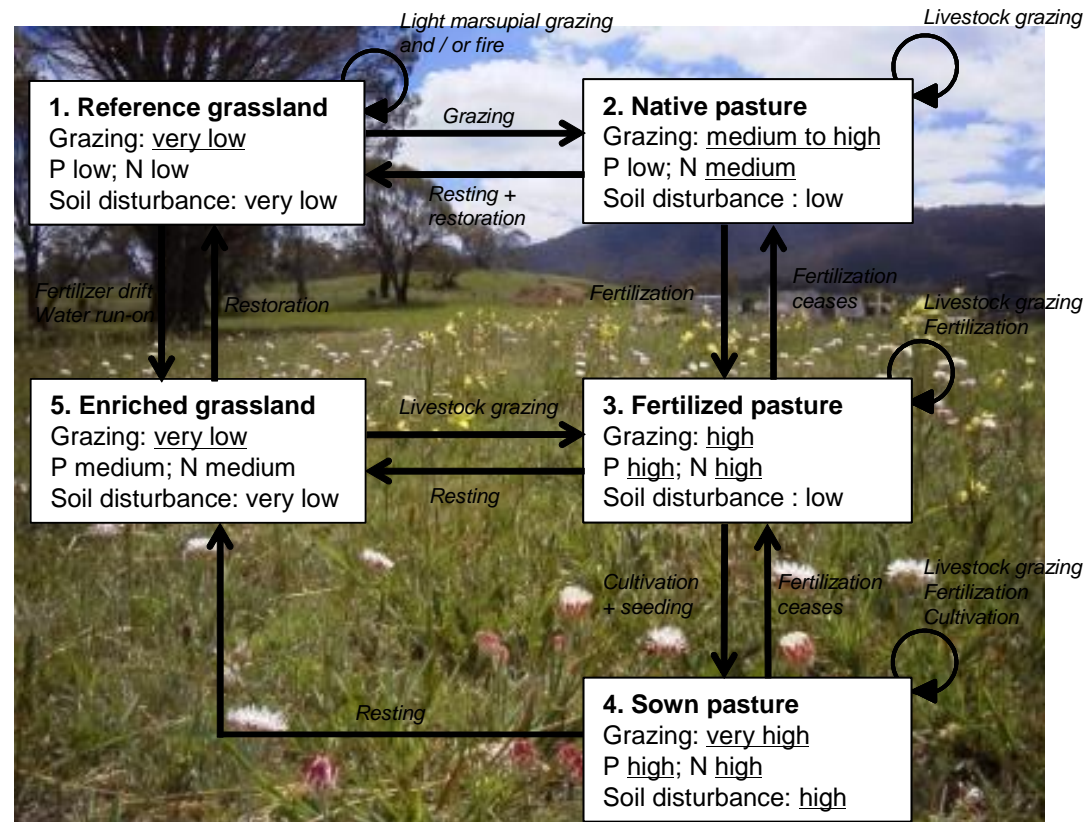
- *More delicate orchids, lilies, some sub-shrubs, tussocky grasses are impacted immediately*
- *the associated mycorrhizal fungi declines*
- *the fast growing exotics are favoured (often these can be weeds and annual grasses)*
- *resources eg. light and moisture are reduced to native plants*
- *Anything over 20mg/kg P = significantly reduced native plant diversity*



What is your starting point? We need to know because management for each will differ.....

1a) Reference Grassland - High Conservation Value grassland / grassy woodland

- History of marsupial grazing & no fertiliser
- Now mostly found in Travelling Stock Routes, cemeteries, crown reserve, commons, some private lands
- very diverse range of native species (60-110) incl. orchids, lilies, wildflowers, sub-shrubs & shrubs
- Approx. 10% max. shrub cover eg. western silver wattle, Indigofera
- Grasses incl. Kangaroo, Snow, Weeping, Native Sorghum










What is your starting point?

1b) High Diversity Native Pasture

- History of low stock grazing & low Phosphorus and Nitrogen
- diverse range of native species (40-60) incl. native wildflowers and legumes
- Grasses - Kangaroo, Weeping, Red-leg and Wallaby Grasses



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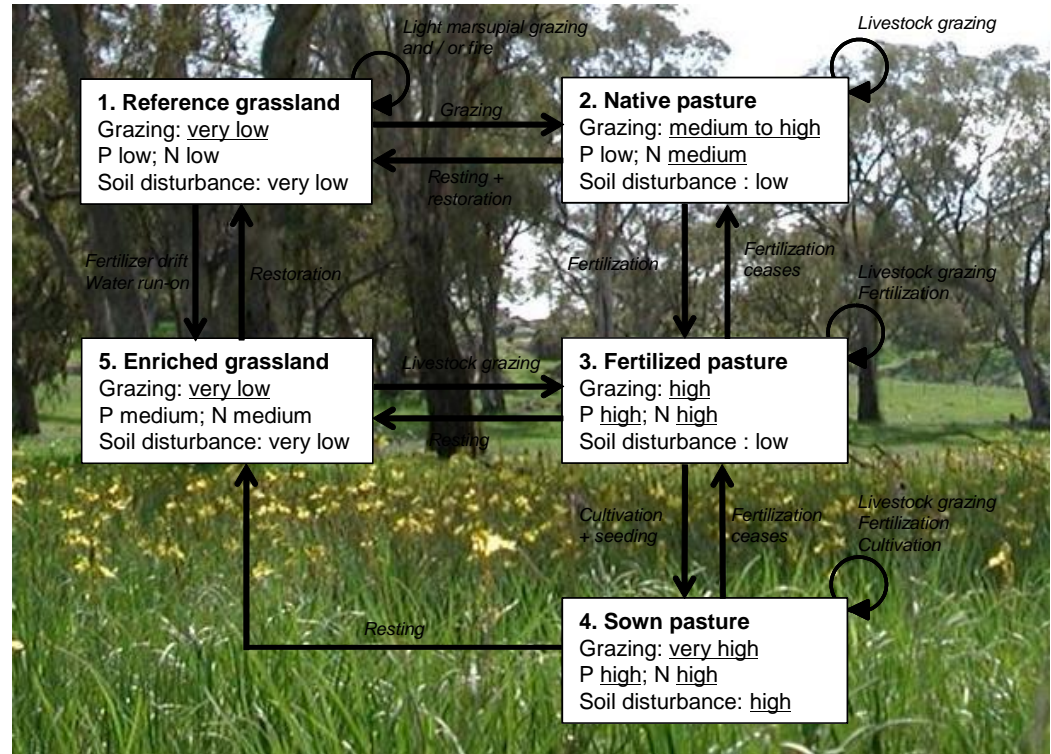
Fertilised
(low forbs, high exotic annuals)










What is your starting point?

2) Moderate Diversity Native Pasture

- Low-Moderate stock grazing
low P high N range of native spp. (20-40) including some wildflowers and legumes
- Grasses - Red-leg, Wallaby, Spear, Wiregrass and some exotic annuals



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(low forbs, high exotic annuals)

Fertilised
(low forbs, high exotic annuals)



What is your starting point?

3a) Low Diversity Native Pasture

- High grazing, moderate P & N
- some grazing tolerant native forbs (1-20) but primarily grasses
- Native grasses - Speargrass, Redleg grass & Wire grass
- Exotic annual grasses - Brome, Annual Ryegrass, Silver Grass, Barley Grass, Wild Oats










What is your starting point?

3b) Fertilised Native Pasture

- High grazing, P & N
- mostly annual exotic grasses - Ryegrass, Silver Grass, Brome, clover/medics
- some more phosphorus tolerant native grass spp.- Wallaby, Weeping and Red-leg grass



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Native Grassland/ Pasture type	Summer			Autumn			Winter			Spring			
	Dec	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	
<p>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</p> <p>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</p>	Native grasses seeding and establishing												
				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.									
<p>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</p>	Native forbs germinating and establishing./seeding												
				graze or rest to maintain high perennial pasture cover and to restrict annual exotics growth and seeding						graze or burn <u>every 1-3 years</u> as needed to reduce exotic annuals			
<p>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.</p> <p>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</p>	Exotic annuals germinating												
				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			

High Conservation Value (HCV)
(high forbs, low exotic annuals)

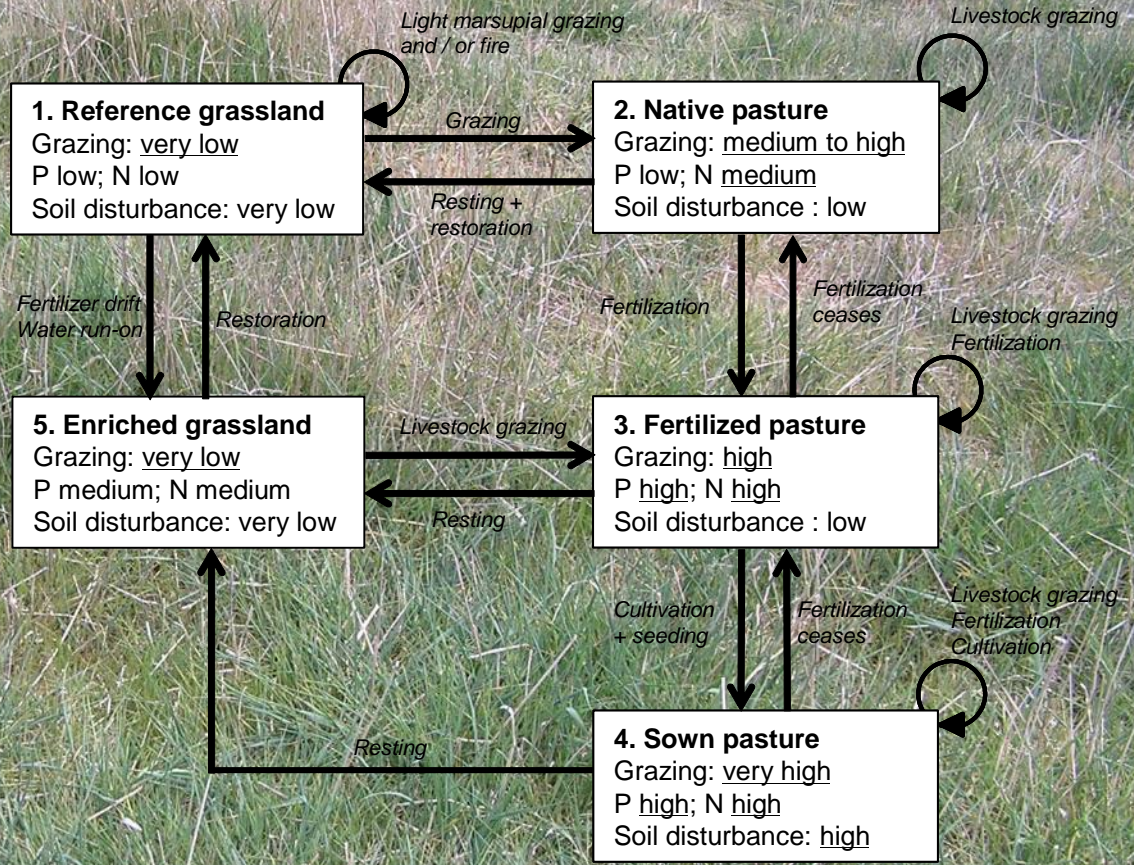
High Diversity
(high forbs, low exotic annuals)

Moderate Diversity
(mod. forbs, mod. exotic annuals)

Low Diversity
(low forbs, high exotic annuals)

Fertilised
(low forbs, high exotic annuals)





Sown pasture Often a key essential component of a whole farms production system but few, if any, native species....but keep it in mind as we explore seasonal timing and stocking densities.....



Enriched grassland occurs when grazing ceases on fertilised pasture; is dominated by sown species, mostly exotic annual species, some large perennials, very few native species – the most difficult restoration challenge but not a focus for this presentation

Key messages for maintaining and restoring grassy groundlayers:

- Grazed native pastures can have significant plant, bird and reptile diversity and help provide a stable productive resource particularly during low rainfall periods
- Highest diversity occurs with low stocking rates, low – medium stocking rates are best as sustained heavy stocking rates impact grazing sensitive species and wildlife habitat (tussocky structure, sub-shrubs etc)
- Seasonal grazing management includes strategically resting diverse native pastures from grazing during active plant growth, flowering and seeding
- Increased nutrients lead to decreases in native plant diversity – native plant diversity can only be increased when fertility is low



Use grazing management strategies to maintain & restore native plant diversity

Know your paddocks and plan your grazing:-

- identify areas on the property with low, medium & high native plant diversity and manage these areas through your stock grazing
(NB. pick up a copy of the seasonal grazing guide)
- TIMING - Strategically resting diverse native pastures from grazing during active plant growth, flowering and seeding can encourage the consolidation and spread of native plant species - use your sown pastures, more productive paddocks with higher nutrients / fertiliser addition when resting native paddocks
- *NB. Fire & burning, mowing and slashing are widely used alternative 'disturbance' tools to grazing particularly in high conservation value areas partic. due to potential weed issues*

Some more strategies to increase perennial grass cover and maintain plant diversity in native pasture:-

Limit stock pressure in dry times - Stock grazing pressure affects the ability of a plant to survive drought. Severe grazing reduces leaf area and impacts on carbohydrate storage and water acquisition. Perennial plants may be most susceptible just prior to severe drought or following light showers during drought. By making an early prediction of feed supply overgrazing can be prevented

Limit stock pressure following good summer and autumn rain – to allow plants to recover and encourage seedling establishment

Apply rest from grazing during periods of good flowering and seeding – to build up the seedbank

Apply heavier stock pressure during early spring - to target annual weeds and reduce competition on your native perennials, which begin growth later in the season

Summary of strategies to increase perennial grass cover and maintain and restore plant diversity in native groundlayers:-

- Reduce fertiliser use in areas of higher plant diversity and prevent fertiliser drift or run-on to areas with a low fertiliser history
- Limit total stock grazing pressure on areas of good diversity
- Provide regular rest from grazing, with varying seasons to maximise plant diversity
- Provide longer periods of rest if tree or shrub recruitment is evident to allow establishment



Biodiversity in the paddock

a land managers guide



by
Josh Dorrrough,
Jacqui Stol
and Sue McIntyre

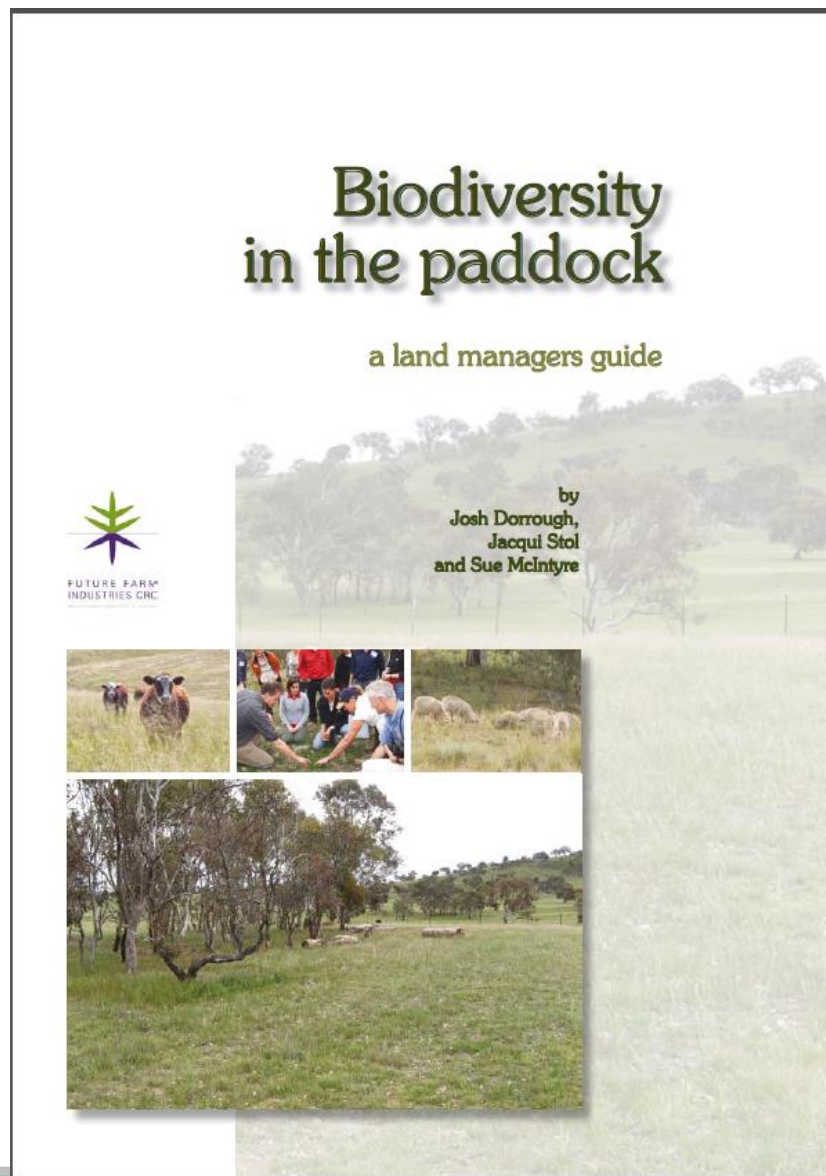
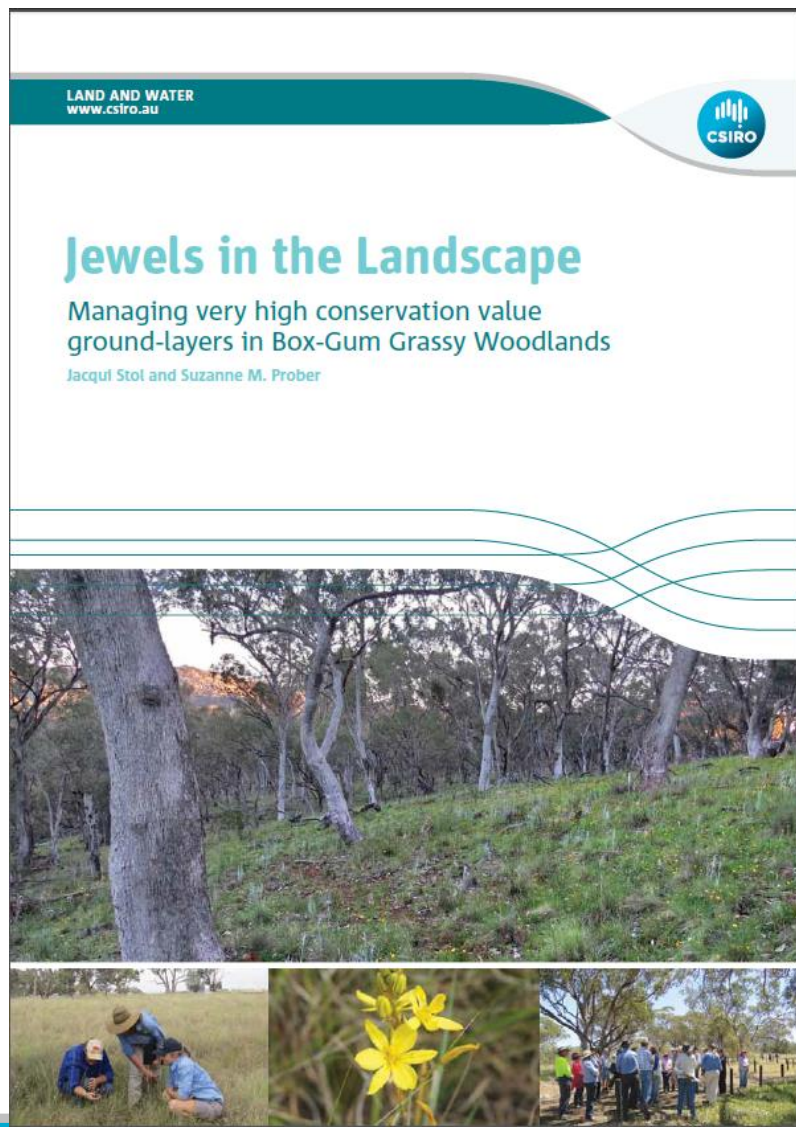


Woodlands: restoration, grazing and woodland birds

Downloadable PDF
available from
Future Farm
Industries CRC and
CSIRO website



Can use science guides in combination with practical guides to managing biodiversity on farms



Checking for Change

A practical guide to checking whether sites newly managed for conservation are on track to improve

Jacqui Stol, Veronica Doerr, Micah Davies and Erik Doerr

September 2016



NEW MONITORING GUIDE “CHECKING FOR CHANGE”

Ecological indicators to help you know whether your management for improved species diversity and other key functions are changing - specially designed for land managers

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Thank you & questions?

Jacqui Stol

t +61 2 6246 4058

e jacqui.stol@csiro.au

w www.csiro.au

LAND AND WATER CSIRO

www.csiro.au

