NATURAL ASSET FARMING

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www.sustainablefarms.org.au

Sustainable Farms

@SusFarms_ANU

Farm Context…


Fenced Dam

Farms cover **61% of the Australian continent**

…therefore crucial for right balance between production & environment.

Many challenges

- Increased food demand
- Farm productivity vs degradation
- Farm profitability
- Farmer mental health
- Carbon emissions & climate change
- Biodiversity loss
- Animal welfare
- Urbanizing human population

Many ways to improve the natural assets on farms

- Regenerative agriculture
- Natural Sequence Farming
- Etc
- All approaches focus on natural assets (or subsets thereof)
- This is PRECISELY what LANDCARE does !!

Sustainable Farms Projects to Improve Natural Assets on Farms

Farm Dam Enhancements

Revegetation for Biodiversity

Native Shelterbelts

Rocky Outcrops

Scattered Paddock Trees

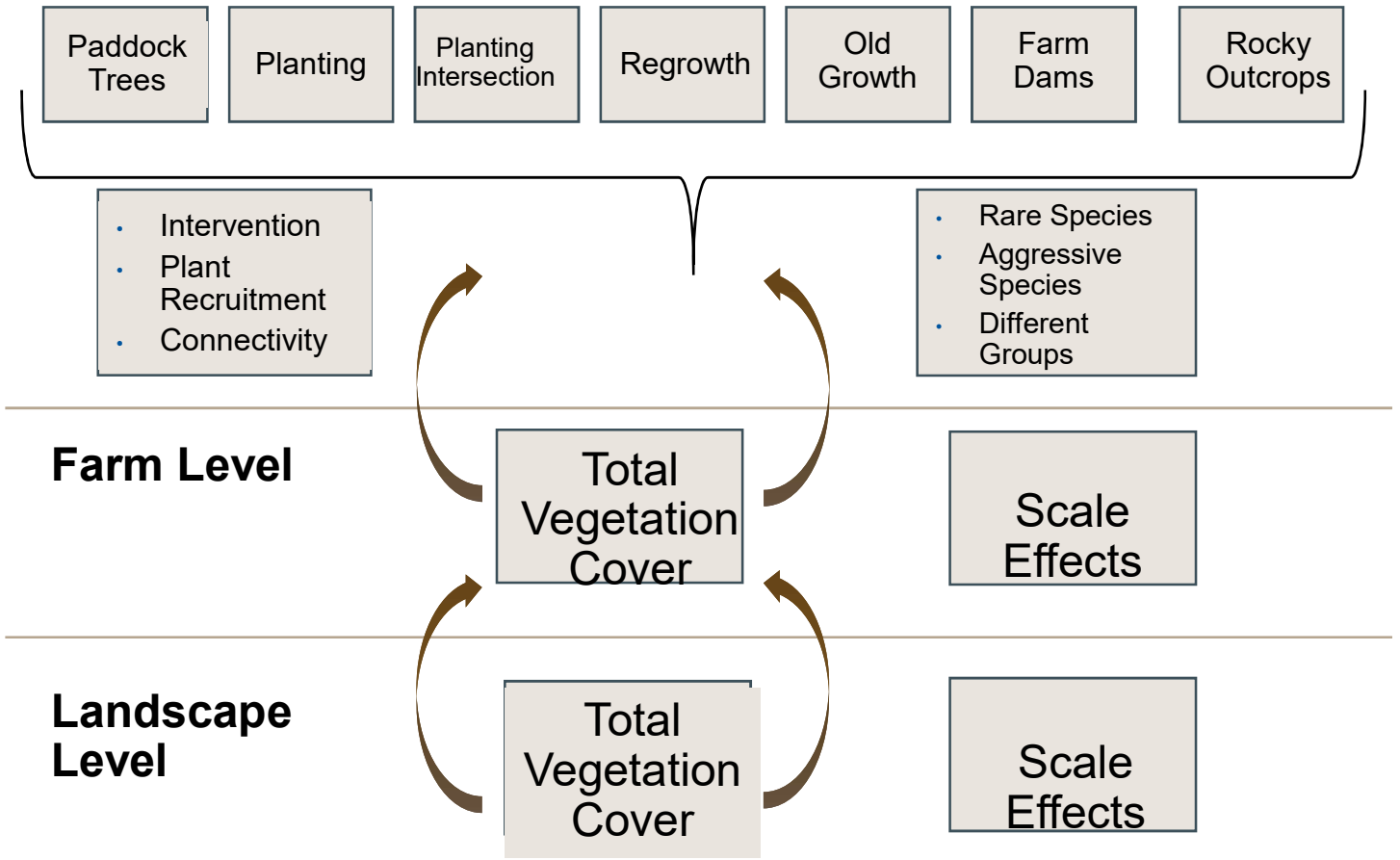
Riparian Restoration

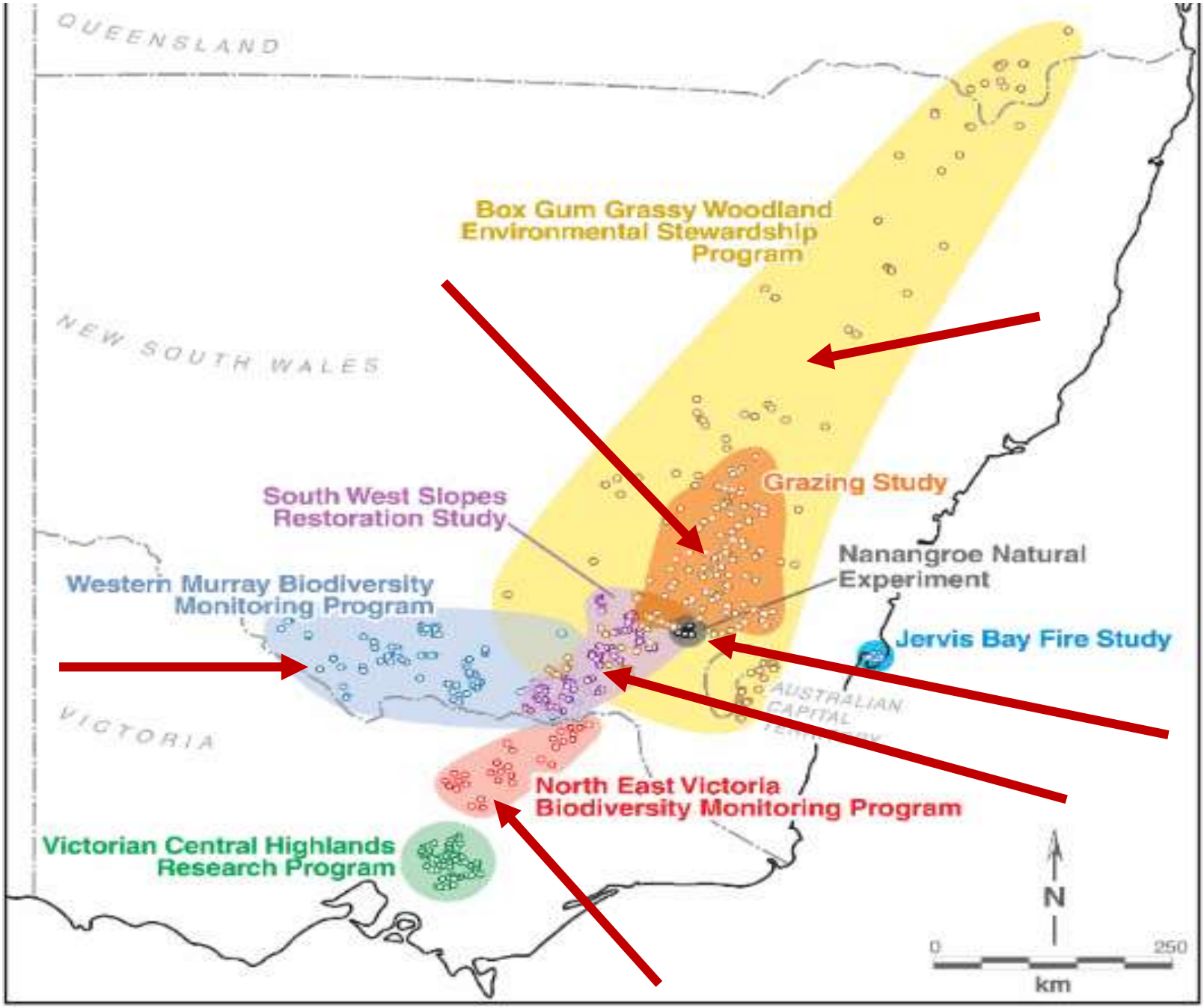
Natural asset approach

- All farms have natural assets
- Way to engage with change – generally agnostic approach
- Can start small
- Some assets overlooked – e.g. rocky outcrops

Engagement process in Sustainable Farms

- Partner with (not replace) Landcare, LLS, CMA
- Demonstration Farm Days
- Target key assets – farm dams or shelterbelts
- Farmer-led, ANU with backup science
- Attendance at multiple days = confidence to begin to make changes
- LANDCARE = environmental AND social


Paddock Trees
Planting
Planting Intersection
Regrowth
Old Growth
Farm Dams
Rocky Outcrops
Intervention
Plant Recruitment
Connectivity
Rare Species
Aggressive Species
Different Groups
Farm Level
Total Vegetation Cover
Scale Effects
Landscape Level
Total Vegetation Cover
Scale Effects


QUEENSLAND
NEW SOUTH WALES
VICTORIA
Box Gum Grassy Woodland
Environmental Stewardship
Program
Grazing Study
South West Slopes
Restoration Study
Western Murray Biodiversity
Monitoring Program
Nanangroe Natural
Experiment
Jervis Bay Fire Study
North East Victoria
Biodiversity Monitoring Program
Victorian Central Highlands
Research Program
N
0
250
km

23 years – 745 sites, varying in condition & management


Tree planting


Mixed farming landscape


Protecting remnant trees


Enhancing remnants with plantings


Protecting waterways


Remnant paddock trees

Growth types

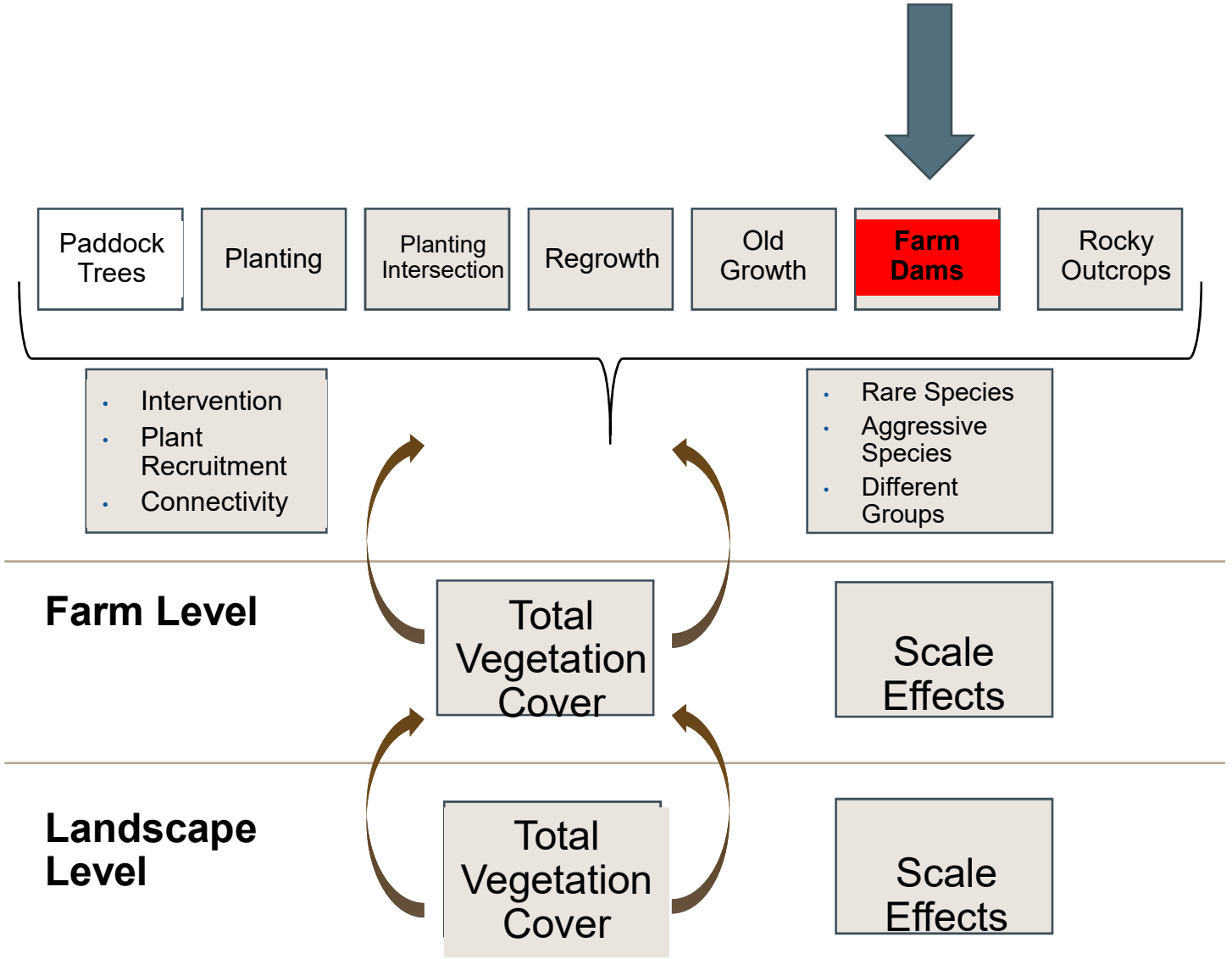
Biodiversity data

Vegetation:
- Plant species richness
- Vegetation structure
- Tree inventory

Animals:
- Birds
- Reptiles
- Mammals

Habitat attributes:
- Hollow trees
- Bare ground
- Rocky outcrops
- Course woody debris
- Litter layer
- Area of woody vegetation


New insights
into
restoration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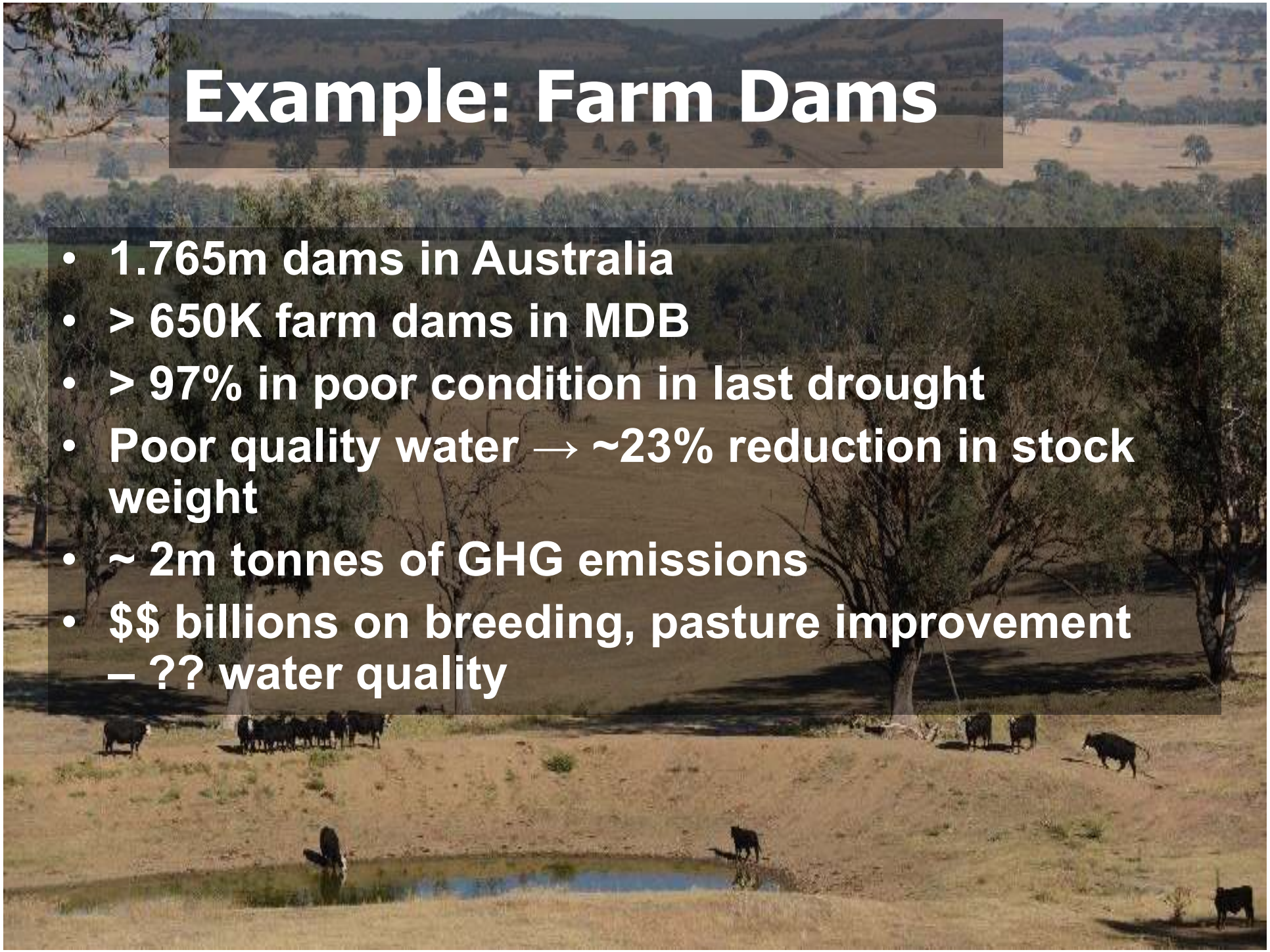


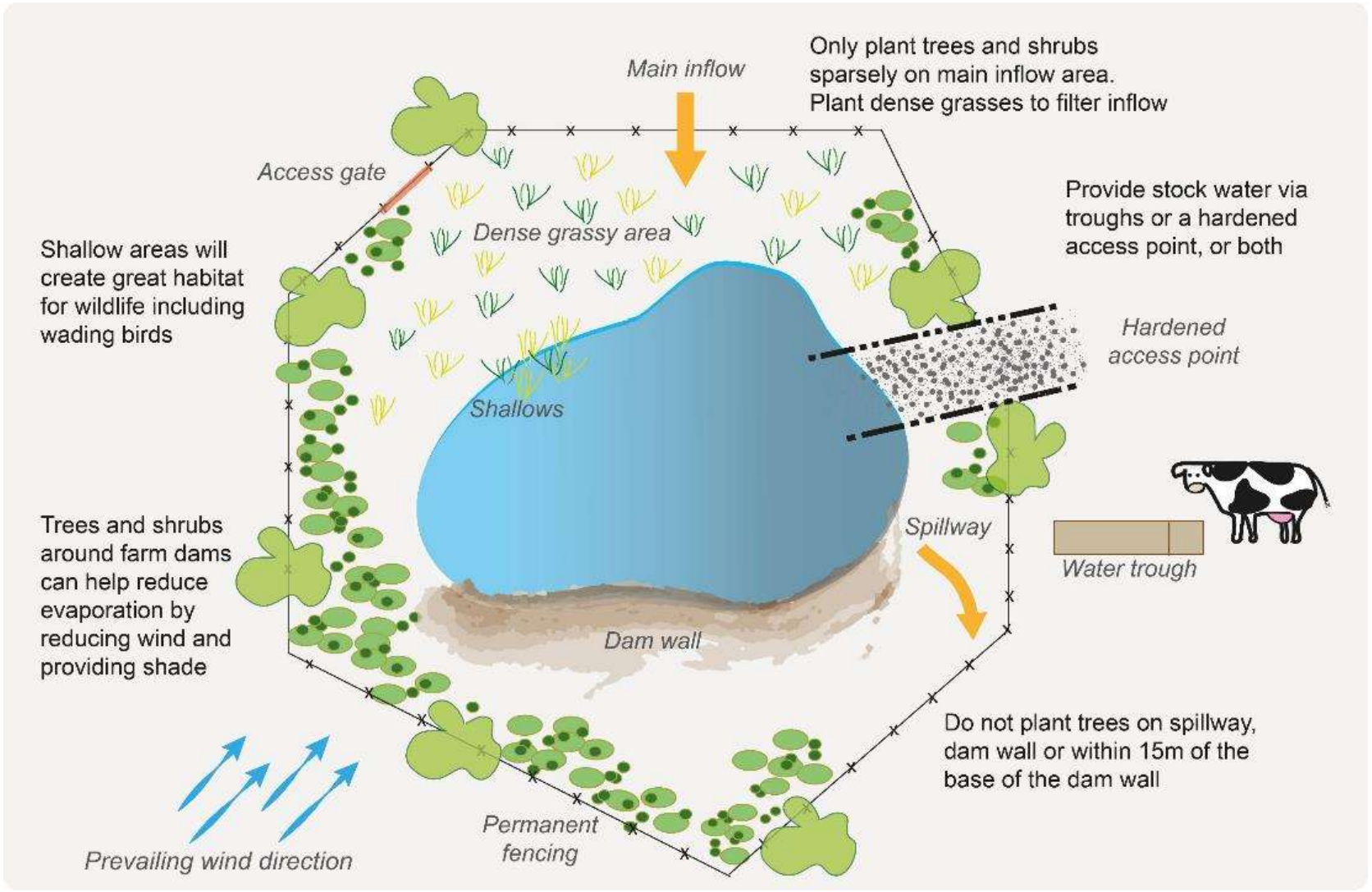
Example: Farm Dams

- 1.765m dams in Australia
- > 650K farm dams in MDB
- > 97% in poor condition in last drought
- Poor quality water → ~23% reduction in stock weight
- ~ 2m tonnes of GHG emissions
- $$ billions on breeding, pasture improvement – ?? water quality

Better management of farm dams

Results in water persistence, drought resilience, improved biodiversity profitability and mental health outcomes

Westgate et al. 2021 in review


Main inflow
Only plant trees and shrubs sparsely on main inflow area. Plant dense grasses to filter inflow
Access gate
Provide stock water via troughs or a hardened access point, or both
Dense grassy area
Shallow areas will create great habitat for wildlife including wading birds
Hardened access point
Shallows
Trees and shrubs around farm dams can help reduce evaporation by reducing wind and providing shade
Spillway
Water trough
Dam wall
Do not plant trees on spillway, dam wall or within 15m of the base of the dam wall
Permanent fencing
Prevailing wind direction

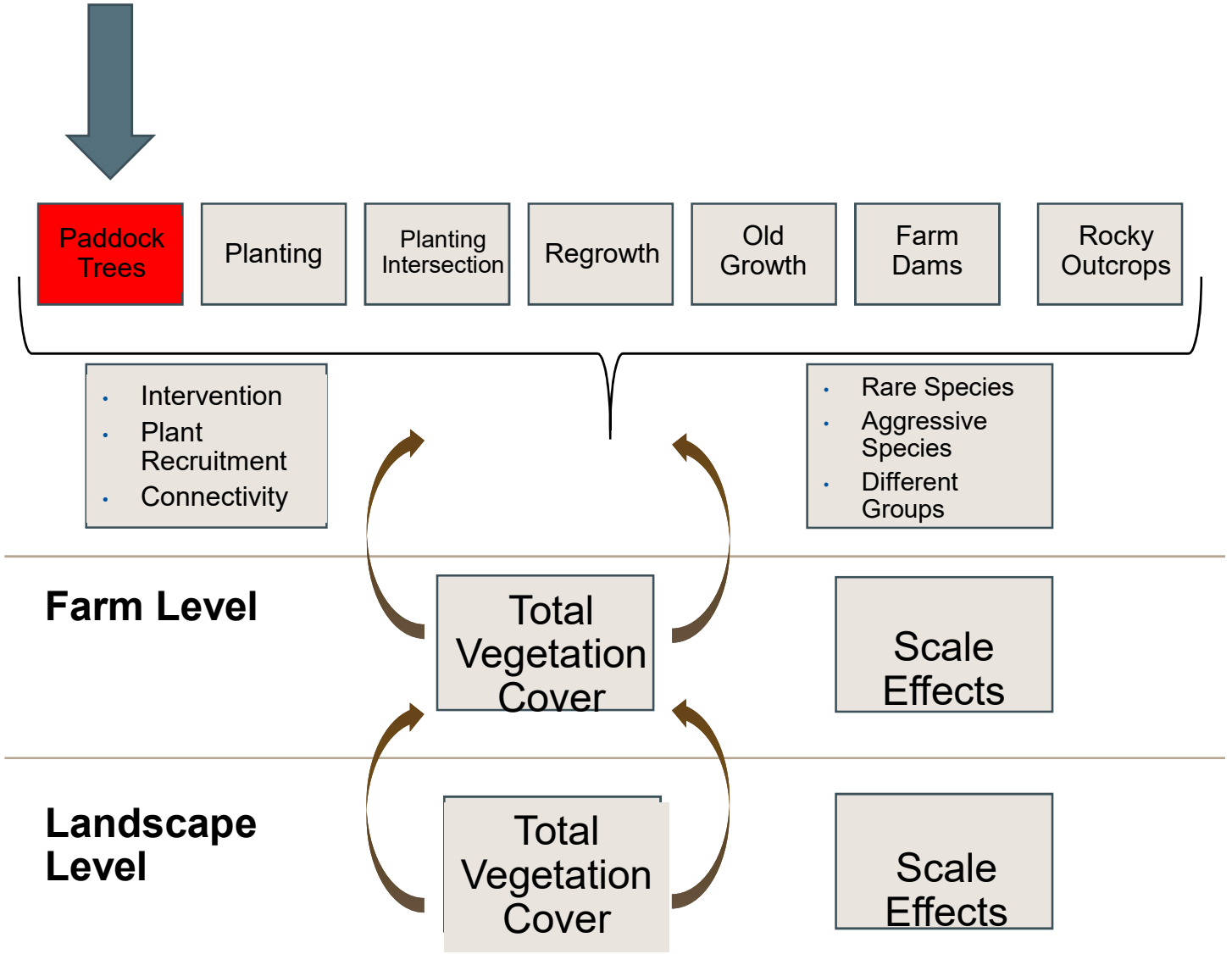
Key insights

- Vegetation around dams = improved water quality + lower temp
- Less sediment (less cleaning)
- Up to 23% weight gain of livestock (water temp effects for Nth breeds)
- Better biodiversity – birds/frogs – micro-hotspots for biodiversity
- Picnic tables etc = mental health

Cost Benefit Analysis

- **Significant financial gain thru better productivity**
- **Average per farm Benefit-Cost Ratio = 1.5 (NSW), 3.0 (Vic) @ > 600mm/year**
- **Weight gain needed for clean water switch = 1.8% per annum**
- **Prob. Benefit > cost = 70%**

Dobes et al. (2021) (PLOS One in press)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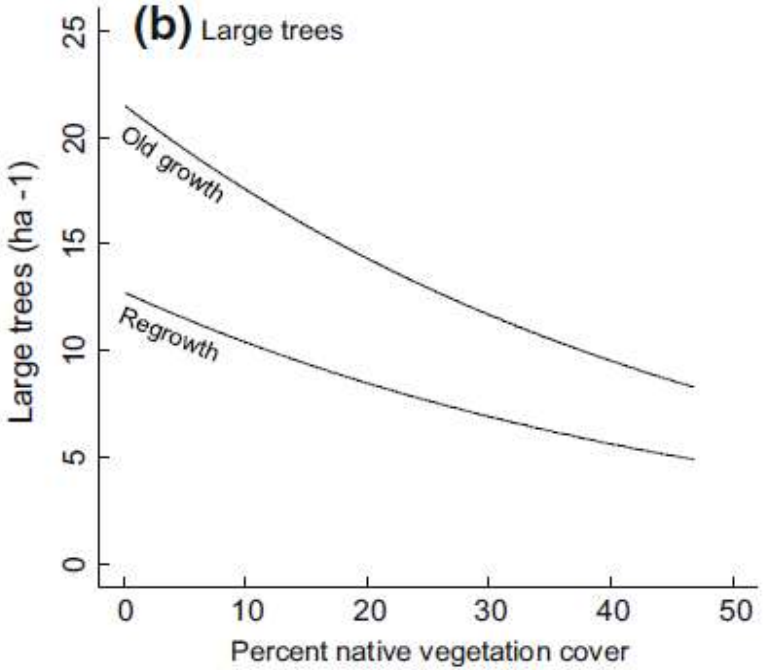
Paddock trees

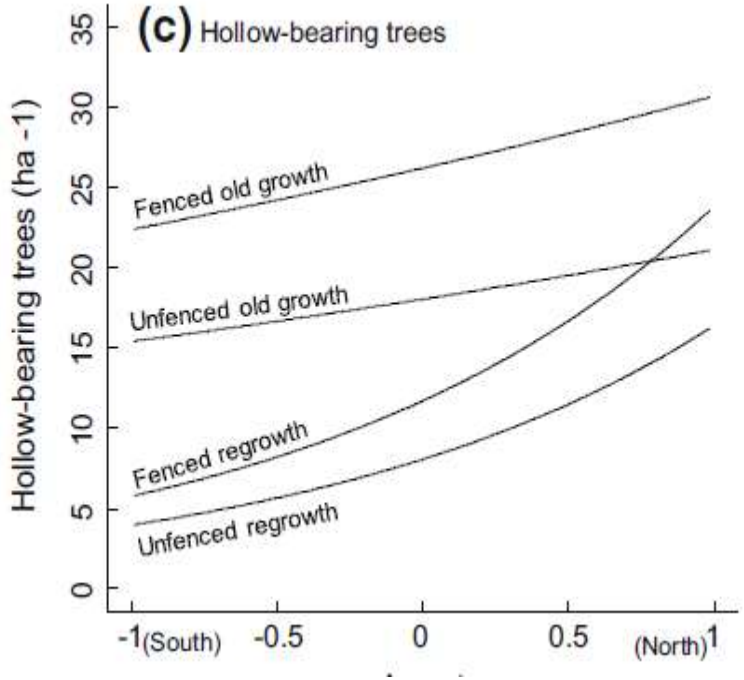
- Largest
- Oldest
- Most vertically structured countryside elements in agricultural landscapes

Paddock trees

- Most flowers
- Most seeds
- Support other structures = mistletoe
- Most, largest and most diverse range of hollows
- Most carbon

Where are large old (paddock) trees found? (Ikin et al. 2015; *Landscape Ecol*)





Landscape Ecol (2015) 30:1387–1403
DOI 10.1007/s10980-015-0193-5

RESEARCH ARTICLE

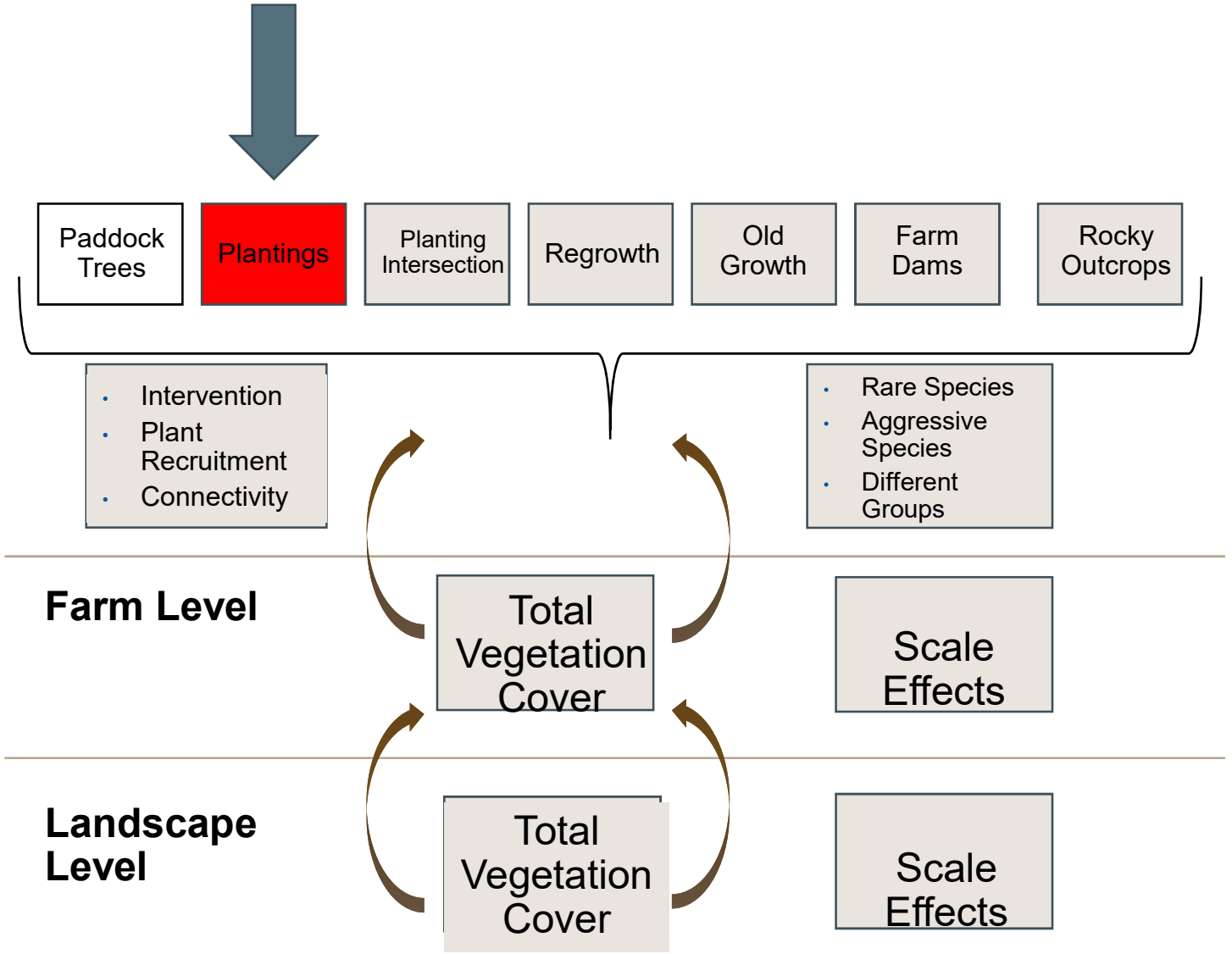
Woodland habitat structures are affected by both agricultural land management and abiotic conditions

Karen Ikin · Alessio Mortelliti · John Stein · Damian Michael · Mason Crane · Sachiko Okada · Jeff Wood · David Lindenmayer

Habitat structure		*Management prescription*
Canopy depth		To increase average canopy depth, managers should conserve south-facing remnants with fertile soils in low-lying areas of the landscape.
Large trees		To manage for current and future large trees, managers should preserve large tree abundance by retaining existing trees and conserving old growth remnants, especially in highly fragmented landscapes.
Hollow-bearing trees		To preserve hollow-bearing tree abundance, managers should conserve north-facing old growth and regrowth woodland. They also should limit removal of trees in later stages of senescence.

Re-creating paddock tree landscapes

- Microplantings – limits productive land lost
- Existing paddock trees as nodal points for restoration
- Strategic plantings in key areas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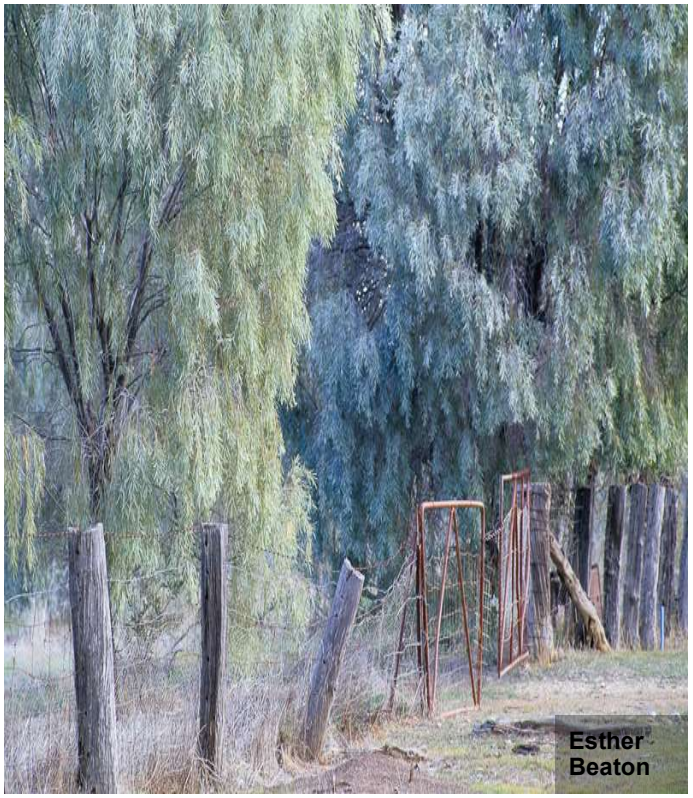
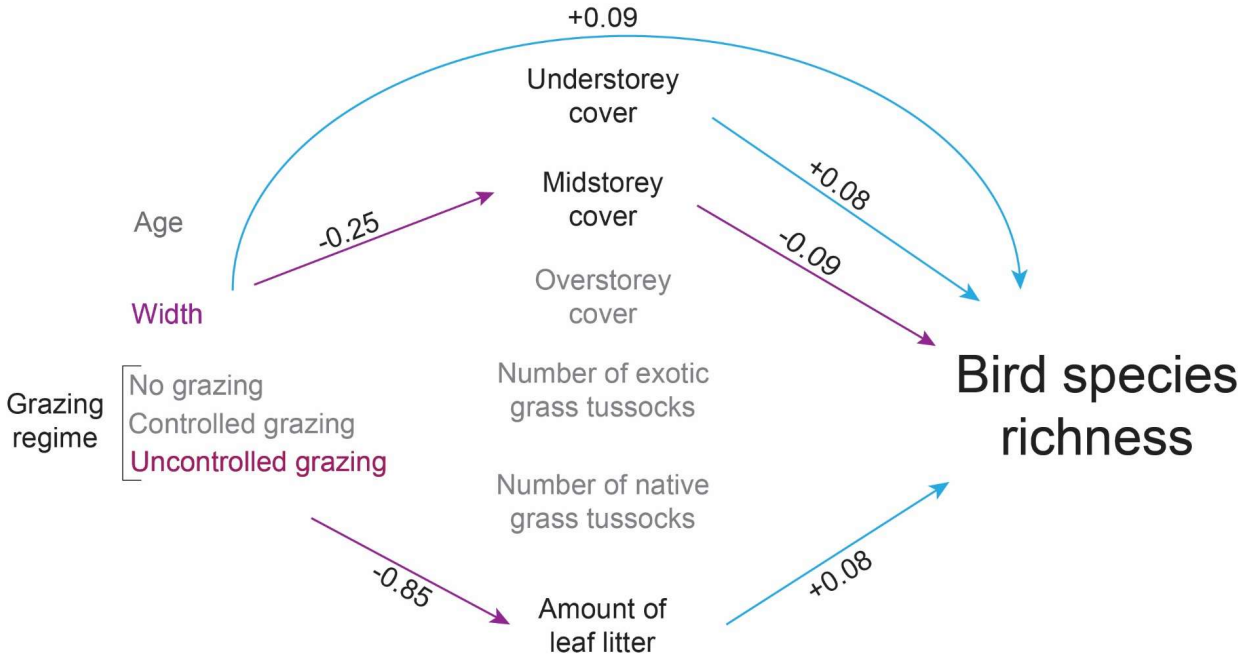
Plantings, biodiversity
and grazing

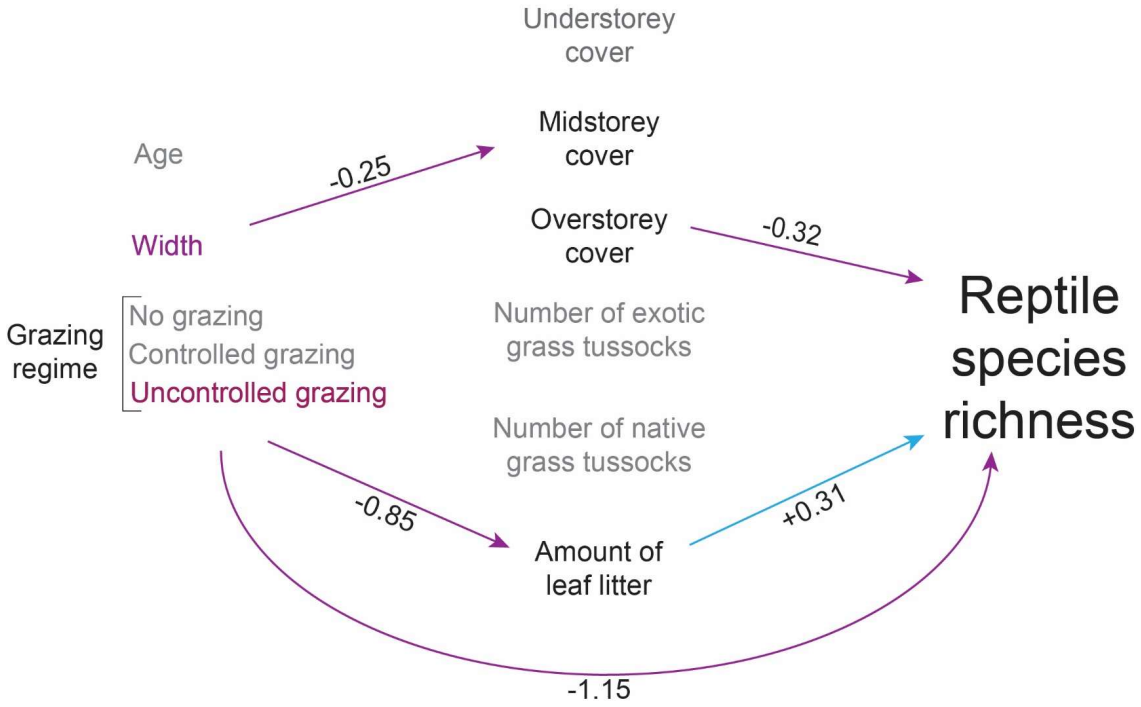
Plantings, biodiversity and grazing

- Grazed vs ungrazing plantings over time
- As plantings age = loss of fences/or removed
- Grazing alters leaf litter & midstorey cover
- Path analysis shows –ve impacts on birds and reptiles

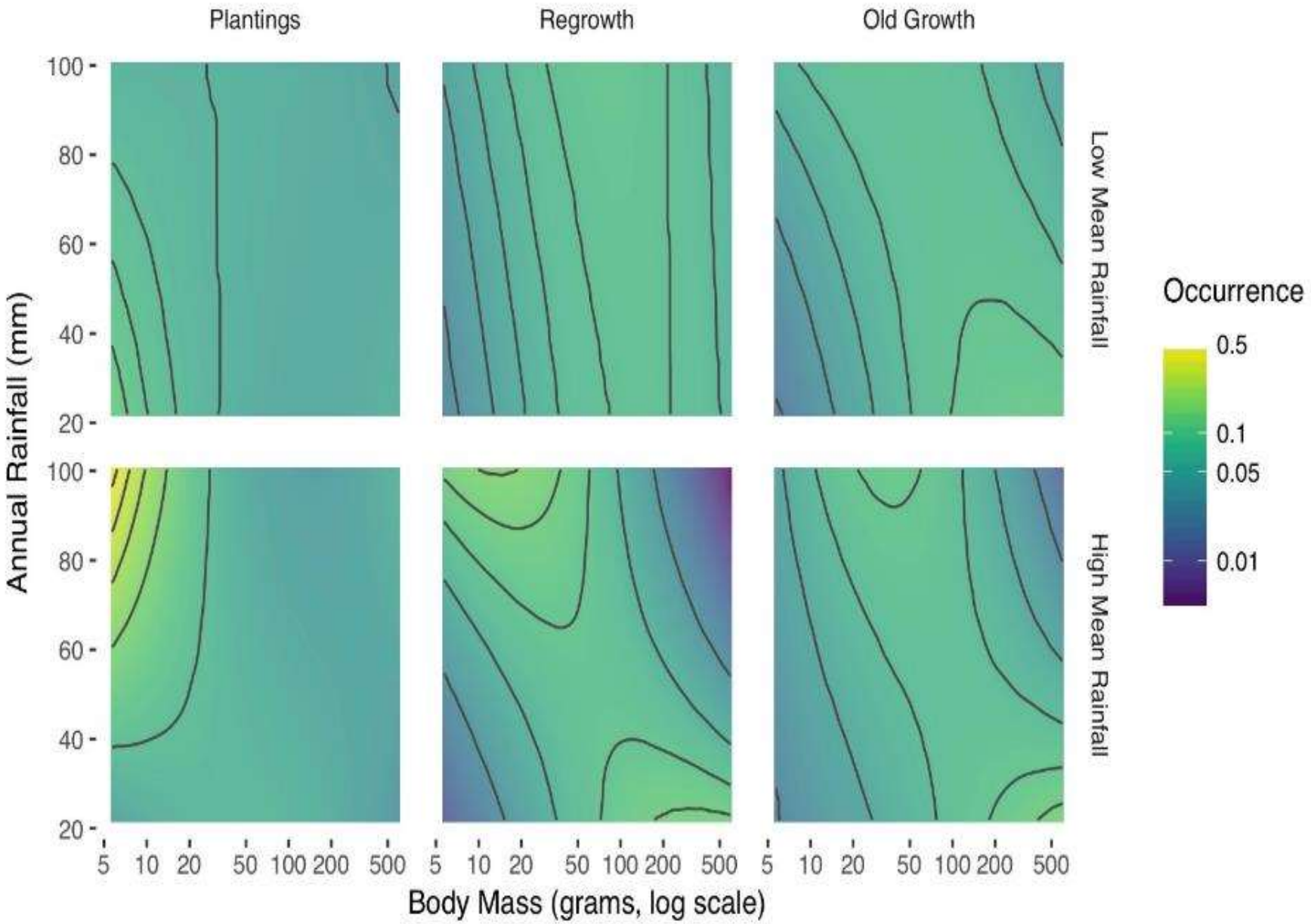
Lindenmayer et al. (2018) (Restoration Ecol) doi: 10.1111/rec.12676

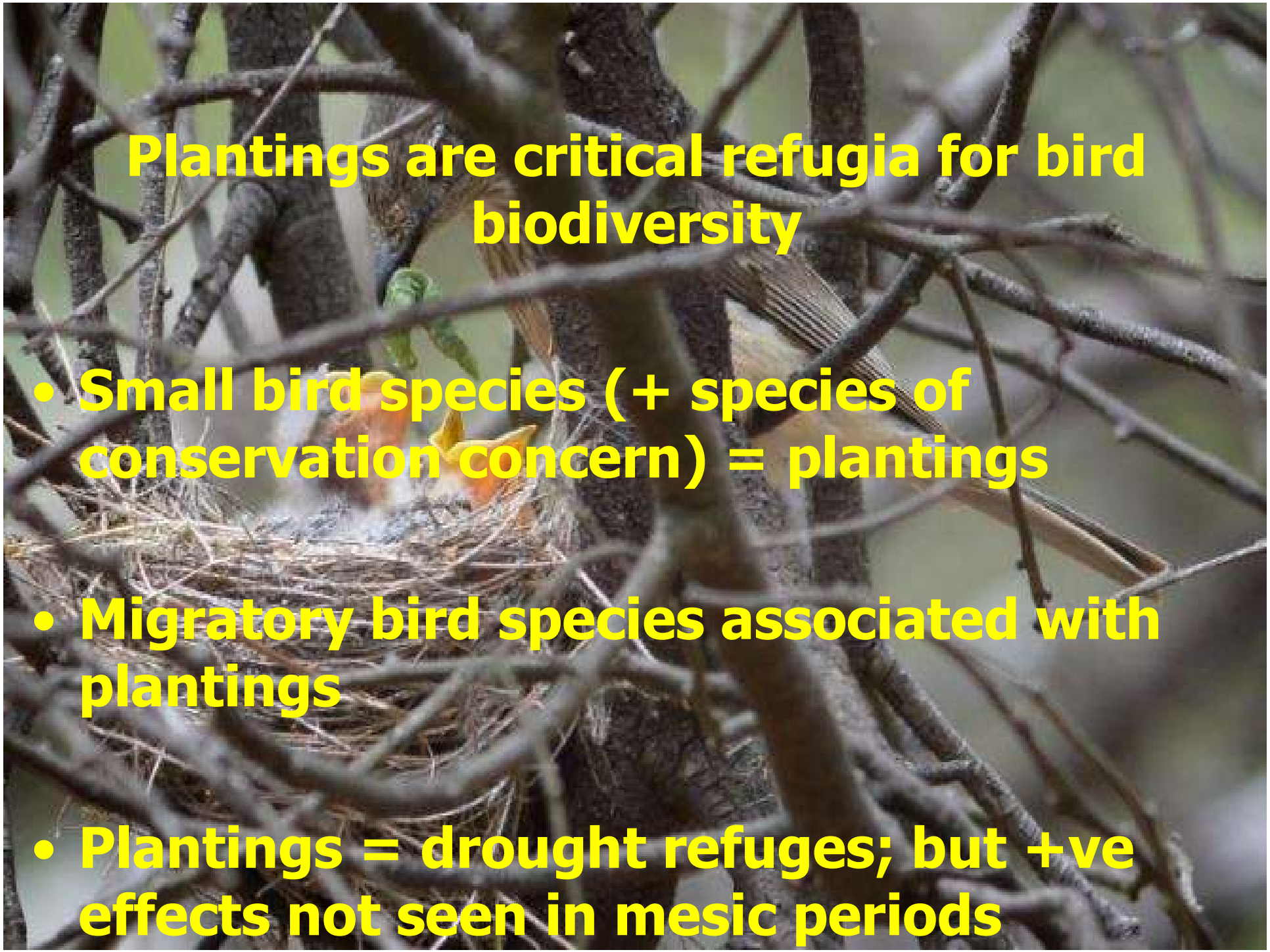



+0.09
Understorey cover
+0.08
Midstorey cover
-0.09
Overstorey cover
Age
-0.25
Width
Grazing regime
No grazing
Controlled grazing
Uncontrolled grazing
Number of exotic grass tussocks
Number of native grass tussocks
Bird species richness
-0.85
Amount of leaf litter
+0.08


Understorey cover
Midstorey cover
Age
-0.25
Overstorey cover
-0.32
Width
Reptile species richness
Grazing regime
No grazing
Controlled grazing
Uncontrolled grazing
Number of exotic grass tussocks
Number of native grass tussocks
-0.85
+0.31
Amount of leaf litter
-1.15


Climate, weather, plantings and resilience


Plantings
Regrowth
Old Growth
Low Mean Rainfall
High Mean Rainfall
Annual Rainfall (mm)
100
80
60
40
20
5
10
20
50
100
200
500
Body Mass (grams, log scale)
Occurrence
0.5
0.1
0.05
0.01


Plantings are critical refugia for bird biodiversity
• Small bird species (+ species of conservation concern) = plantings
• Migratory bird species associated with plantings
• Plantings = drought refuges; but +ve effects not seen in mesic periods

Received: 9 May 2018 | Revised: 17 October 2018 | Accepted: 31 October 2018
DOI: 10.1111/gcb.14524

PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

Weather effects on birds of different size are mediated by long-term climate and vegetation type in endangered temperate woodlands

David B. Lindenmayer[1,2,3] | Peter Lane[1] | Mason Crane[1,3] | Daniel Florance[1,3] | Claire N. Foster[1] | Karen Ikin[1] | Damian Michael[1] | Chloe F. Sato[1] | Ben C. Scheele[1,2] | Martin J. Westgate[1]

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[2]Threatened Species Recovery Hub, National Environmental Science Program, Fenner School of Environment & Society, The Australian National University, Canberra, ACT, Australia
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Funding information
National Environmental Science Program, Threatened Species Recovery Hub, Grant/Award Number: Threatened Species Recovery Hub; The Australian Research Council; The Ian Potter Foundation; The Vincent Fairfax Family Foundationn; Murray Local Land Services; Riverina Local Land Services; John Mitchell

Abstract

Species occurrence is influenced by a range of factors including habitat attributes, climate, weather, and human landscape modification. These drivers are likely to interact, but their effects are frequently quantified independently. Here, we report the results of a 13-year study of temperate woodland birds in south-eastern Australia to quantify how different-sized birds respond to the interacting effects of: (a) short-term weather (rainfall and temperature in the 12 months preceding our surveys), (b) long-term climate (average rainfall and maximum and minimum temperatures over the period 1970–2014), and (c) broad structural forms of vegetation (old-growth woodland, regrowth woodland, and restoration plantings). We uncovered significant interactions between bird body size, vegetation type, climate, and weather. High short-term rainfall was associated with decreased occurrence of large birds in old-growth and regrowth woodland, but not in restoration plantings. Conversely, small bird occurrence peaked in wet years, but this effect was most pronounced in locations with a history of high rainfall, and was actually reversed (peak occurrence in dry years) in restoration plantings in dry climates. The occurrence of small birds was depressed—and large birds elevated—in hot years, except in restoration plantings which supported few large birds under these circumstances. Our investigation suggests that different mechanisms may underpin contrasting responses of small and large birds to the interacting effects of climate, weather, and vegetation type. A diversity of vegetation cover is needed across a landscape to promote the occurrence of different-sized bird species in agriculture-dominated landscapes, particularly under variable weather conditions. Climate change is predicted to lead to widespread drying of our study region, and restoration plantings—especially currently climatically wet areas—may become critically important for conserving bird species, particularly small-bodied taxa.

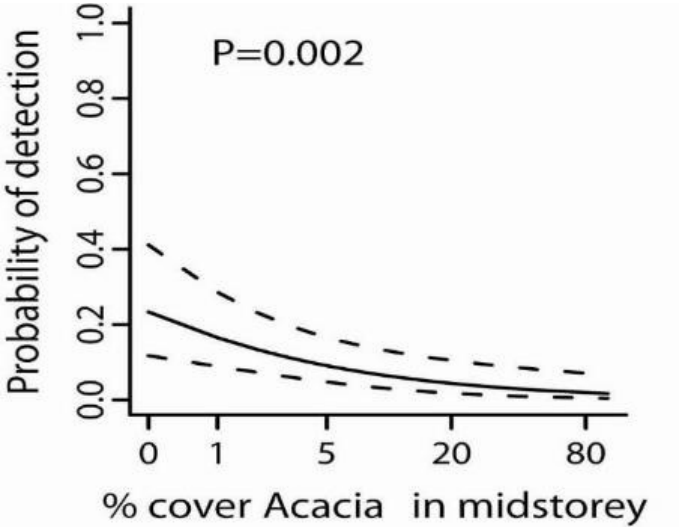
KEYWORDS
birds, climate change, rainfall and temperature effects on biodiversity, revegetation, south-eastern Australia, weather

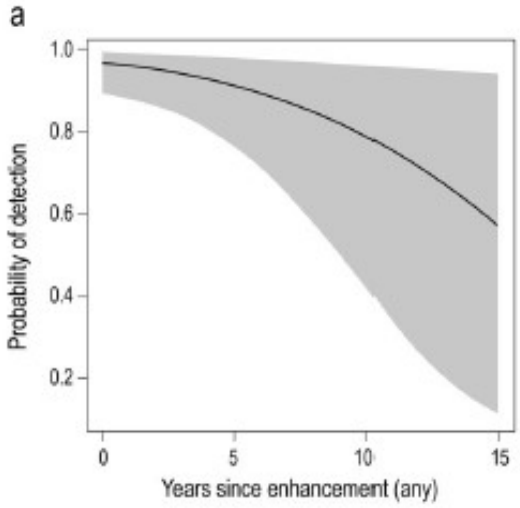
Plantings & key threatening processes

- Noisy Miner
- Hyper-aggressive native species
- Listed as a KTP in woodlands
- Long-term data - replantings with understorey = few miners
- Understorey interventions = drives down Miners over time – takes > 8 years

Lindenmayer et al. 2010 (Biol Cons); Lindenmayer et al. 2018 (Rest. Ecol)

Woodland enhancement = less Miners





Lindenmayer et al. 2010, Biol. Cons, Lindenmayer et al. 2018 Austral Ecology, 43, 798-806

Tackling despots – using trees not guns

The Noisy Miner does not act alone

- Species co-occurrence patterns
- Noisy Miner has negative effects
- Grey and Pied Butcherbirds have no effects in isolation
- Strong synergistic effects when together
- Combined effects strongest on small birds
- Effects reduced when high midstorey cover

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DOI: 10.1111/1365-2664.13838

RESEARCH ARTICLE

Journal of Applied Ecology | BRITISH ECOLOGICAL SOCIETY

Synergistic impacts of aggressive species on small birds in a fragmented landscape

Martin J. Westgate[1,2,3] | Mason Crane[1,2,3] | Daniel Florance[1,2,3] | David B. Lindenmayer[1,2,3]

[1]Fenner School of Environment and Society, Australian National University, Acton, ACT, Australia

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Funding information
Australian Government National Environmental Science Program; Australian Research Council; Murray and Riverina Local Land Services

Handling Editor: Cristina Banks-Leite

Abstract

1. Attempts to conserve threatened species in fragmented landscapes are often challenging because factors such as habitat loss, habitat degradation and dominant species interact to reduce threatened species' capacity to survive and reproduce. Understanding how threatening and mitigating processes interact is critical if conservation measures are to be effective.
2. We used data from long-term monitoring of bird populations and multivariate latent variable models to quantify how Australian woodland birds respond to the presence of the Noisy Miner, a despotic species known to exclude other bird species. We then investigated the extent to which the presence of other aggressive species exacerbates the impacts of the Noisy Miner, and to what extent these impacts can be mitigated by dense midstorey plantings.
3. We found strong synergies between the Noisy Miner and two other aggressive species (Grey Butcherbird and Pied Butcherbird), despite weak effects of butcherbirds in isolation.

Attributes of a good planting …

- **Location (gullies)** - 3.2 bird species increase cf midslopes & ridges
- **Size** – increased richness but not as important as context
- **Shape** (block/strip) - important for some species
- **Contains** logs, large old trees, dams, understorey, mistletoe
- Fenced and **not** grazed

Summary points

- Riparian restoration = critical for biodiversity responses
- Maximizes species gains – but only when replantings not grazed
- Biomass is greater (carbon implications) + animal breeding is greater
- Plantings in wetter climates do better – especially during droughts
- Only know this thru proper monitoring!!!

Why on-farm Landcare efforts matter

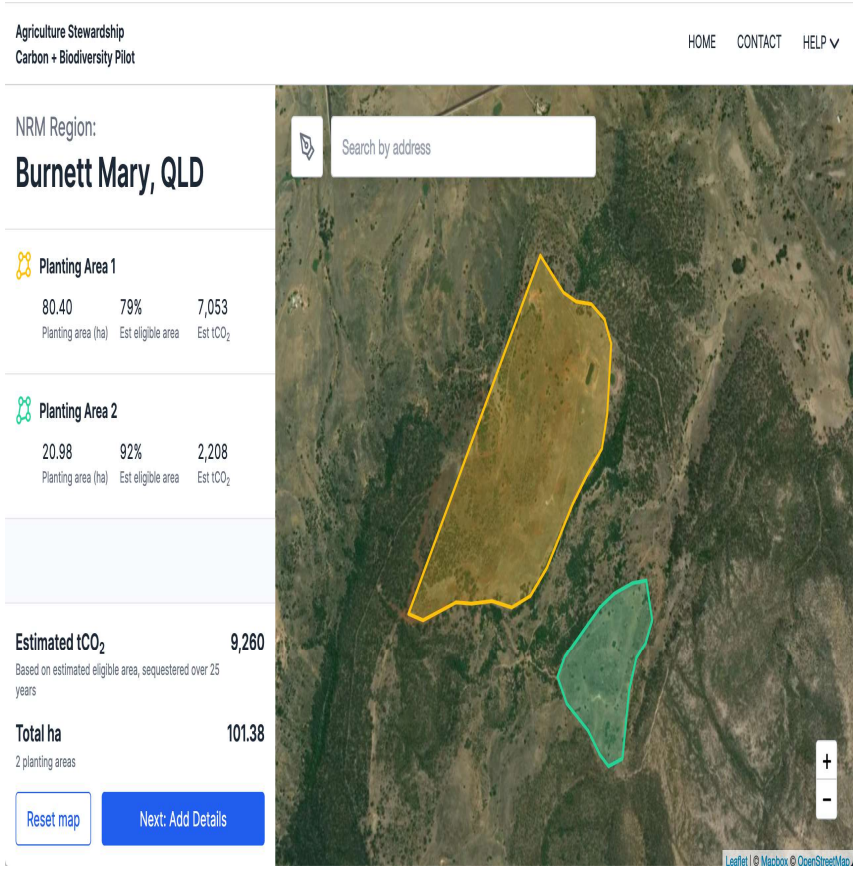
- New trading platforms
- Carbon and biodiversity incentive schemes at State and Federal levels
- ANU-DAWE partnerships to develop methods and schemes

Carbon + Biodiversity Pilot

- Component of the Australian Government's Agriculture Stewardship Package
- 6 Natural Resource Management (NRM) Regions chosen (one in each state)
- Environmental planting projects eligible to receive:
  - Cash payments for biodiversity benefits they provide (also reduces establishment costs for farmers)
  - Carbon credits for CO2 sequestration (free to trade via the Emissions Reduction Fund)

Carbon + Biodiversity Pilot

- Key features to reduce application difficulties for farmers:
  - Initial contract is an options contract (option to initiate project within 6 months)
  - Application via a web portal = quick calculations of planting area size, and CO2 sequestered per annum (to allow financial planning)



Biodiversity scores

Projects ranked and awarded based on biodiversity benefit, higher scores for projects that:

- plant larger areas;
- are located in areas important for threatened species and ecosystems;
- involve local vegetation community plantings (vs simple native plantings);
- retain and protect mature native trees;
- are closer to, or incorporate to fresh water (rivers, streams);
- set 100-year permanence periods (vs 25 years)

In summary

- Whatever its name – improving the condition of natural assets on farms is key
- LANDCARE has been doing just this for several decades
- Still much to learn –evidence is critical – monitoring and knowledge exchange
- Scientist-practitioner partnerships crucial – need to be long-term (change takes time)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SUSTAINABLE FARMS
Ten ways to improve the natural assets on a farm

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