Effective Biodiversity Offsets:

Improving planning, valuation and monitoring practice

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Overview

- Offsets are required for development projects impacting on biodiversity values
- Collaborative presentation from practical experience:
  1. Biodiversity offset planning & governance
  2. Market valuation of offset land
  3. Ecological monitoring of biodiversity offsets
- Implications for policy and practice

Why biodiversity offsets?

- Offsets are increasingly used for development projects as a planning tool
- An “offset” means actions taken outside or within a development site to compensate for the direct, indirect and/or consequential effect of that development on native vegetation and biodiversity
- Important in mining approvals
- Limited experience in offset implementation and offset land management

Biodiversity offset principles

Generally accepted biodiversity offset principles are:

1. Biodiversity offsets will be used as a last resort, after consideration of alternatives to avoid, minimise or mitigate impacts
2. Offsets must be based on sound ecological studies and principles
3. Offsetting must achieve benefits in perpetuity
4. Offsets must be based on the principle of "net gain"
5. Offset arrangements must be enforceable

Biodiversity offset characteristics

- Different offset types and individual site issues
- Each offset arrangement is different
- Assume biodiversity values can be measure and compared
- Assume habitat loss will be offset by future gain
- Assume uncertainties of future management are acceptable
- Currently determined without a planning framework

Offset implementation stages & issues

Stage	Tasks
1 Quantifying biodiversity losses	• Identifying and measuring biodiversity values on development site
2 Quantifying offset gains	• Identifying and measuring biodiversity values on offset land • Identifying rehabilitation capacity and costs
3 Balancing losses and gains and determining $ value	• Determining offset ratios • Governance and financial arrangements • Offset feasibility
4 Establishing offsets & securing land	• Determining suitable land tenure • Providing in-perpetuity funding • Valuing offset land • Acquiring offset land
5 Managing offset land	• Management planning • Monitoring biodiversity values • Determining management costs

Planning for Hunter Region offsets - 1

1. High quality, reliable vegetation mapping underpins biodiversity assessment at the regional and local level, but is not necessarily useful for acquiring or managing offsets

2. Adopt regional biodiversity offset principles

3. Broad landscape planning objectives and parameters need to be agreed and applied (eg maintain 30% native vegetation to maintain landscape functioning across all landscape types, habitat corridors, and conservation areas)

Planning for Hunter Region offsets - 2

4 An independent regional biodiversity trust (along the lines of the NSW Nature Conservation Trust) established with a charter to own, trade in, manage, and monitor biodiversity offset lands would facilitate implementation of biodiversity offsets

5 Biodiversity offsets must link with regional land use planning and site specific project development approvals

Planning for Hunter Region offsets - 3

6 Management cost of offset land is significant and mostly overlooked or underrated

7 Appropriate ecological monitoring of offset sites is required for effective management

8 Governance must consider land valuation and market costs

Valuation of Biodiversity Offset Land

- Emerging market throughout NSW
- Transaction evidence becoming sufficient to make assessment
- Very dependent on supply and demand
- Sydney – demand-led
  Hunter Valley – equilibrium
  North Coast – supply-led

Conservation Management Agreements

- Purchase – CMA implemented, then sold
- Purchase prices can show 20% premium over alternative use, dependent on conservation value or demand
- Upon resale after CMA, shows between 20% and 50% drop in value
- Trust fund for ongoing maintenance popular with owners / managers

Biodiversity Credits

- Purchase credits from OEH website
- Hunter Valley $1,500 – $2,000 per credit
- Sydney fringe $9,000 – $13,000 per credit
- Sydney growth centres $30,000 – $40,000 per credit

Obtain Biodiversity Offset Credits

Purchase raw land	$5,000	per ha
Cost to obtain credits	$500	per ha
Management trust fund	$2,500	per ha
Total	$8,000	per ha
Sell credits	$10,000	per ha
Profit and risk	25%	

Why monitor biodiversity offsets?

- Requirement of project approvals
- To detect change in native ecosystems, & ensure threatened ecosystems are being returned and managed appropriately
- To record changes in threatened species populations
- To guide land managers

What to monitor?

- Flora, fauna, weeds, feral animals, erosion, threatened species, stock incursion, fence condition, bushfire, pollution, water levels, food resources, etc
- All facets are linked

➢ Today - monitoring of flora in offsets

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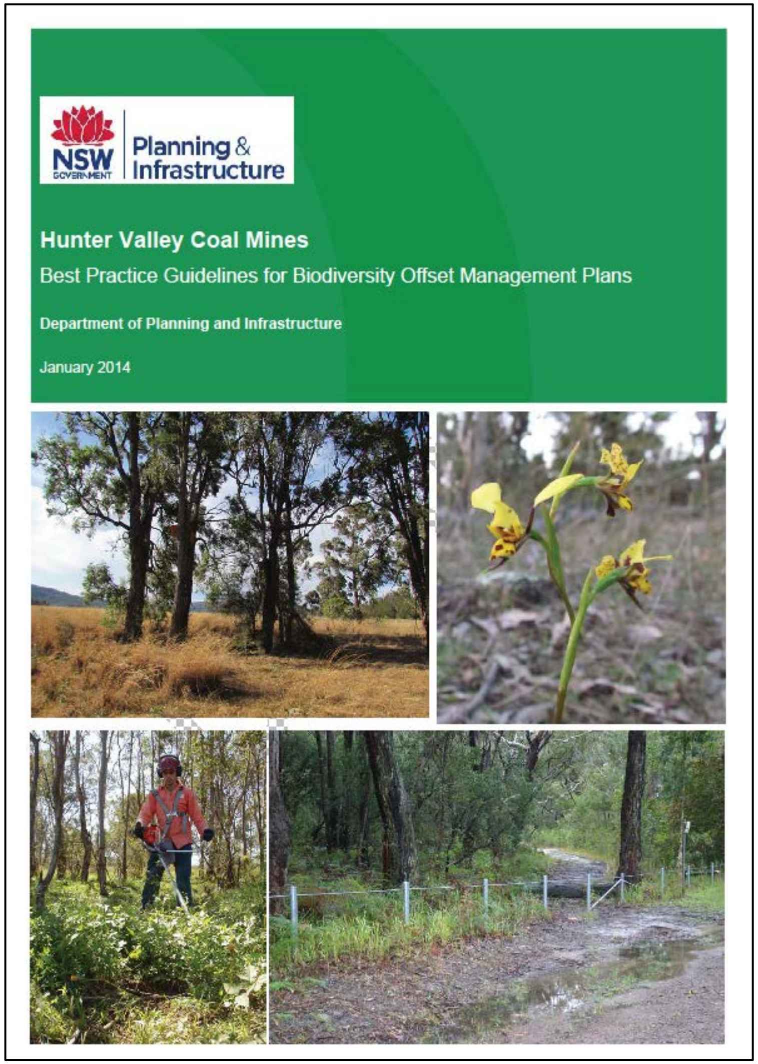
Best Practice Draft Guidelines (DPI)



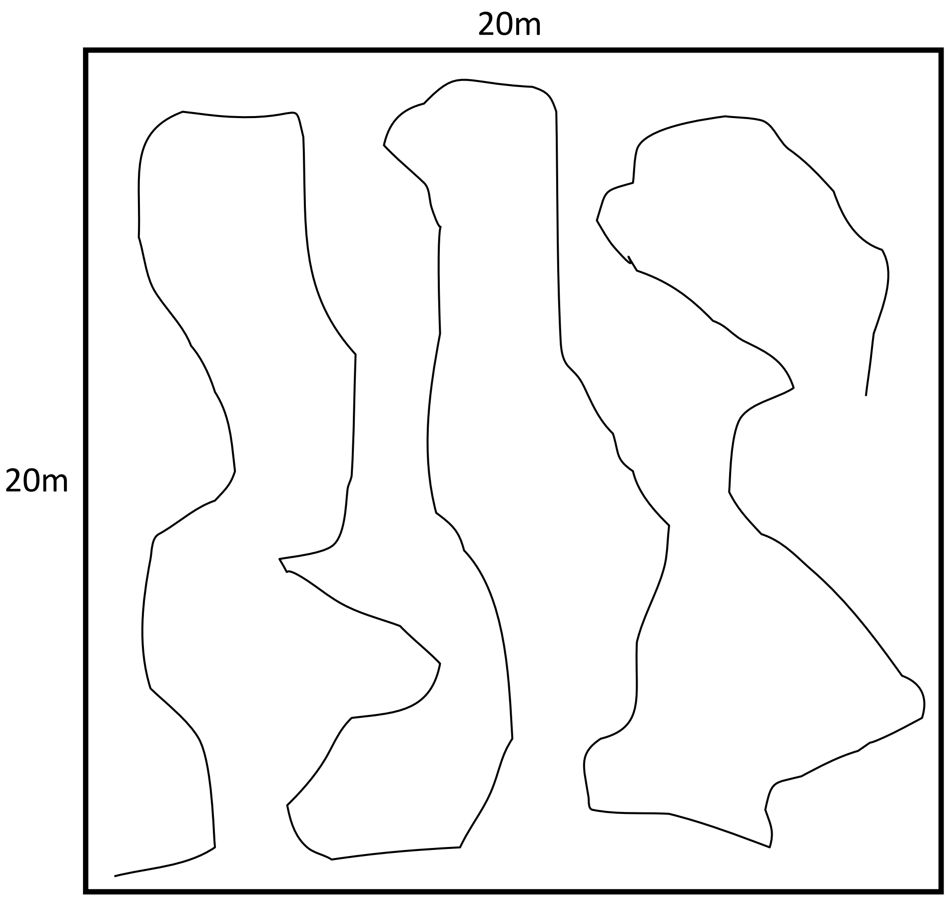
"Flora monitoring may include the use of methods such as vegetation structure profiles, full floristic surveys using cover abundance scores (e.g. Braun-Blanquet), Biometric based surveys (e.g. DECC 2008a) and photo monitoring." (p 26)

- '*Full floristic surveys using cover abundance scores*'
- '*Biometric*' (Biobanking)
- '*Photo monitoring*'

Some offset management plans

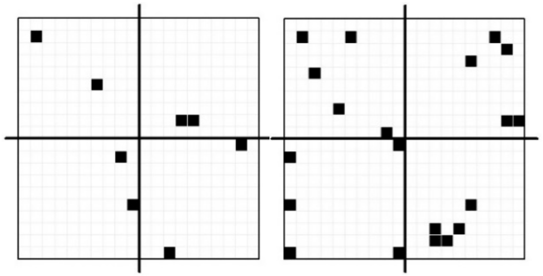
- *"Plots will be sampled using systematic, semi-quantitative, repeatable techniques, such as the modified Braun-Blanquet cover-abundance method, to ensure data are comparable over time with as little observer bias as possible"*
- *The monitoring approach will undertake systematic and repeatable surveys … to record species diversity and structural composition. Plots will be sampled using systematic, semi-quantitative, repeatable techniques, such as the Modified Braun-Blanquet cover abundance method……"*

Full floristic survey & cover abundance



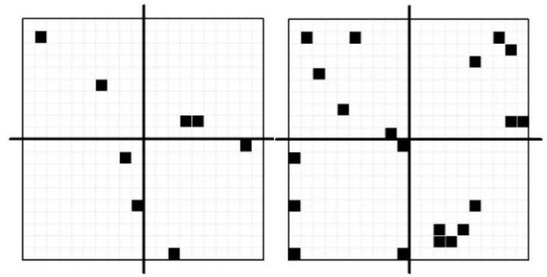
- 20 x 20m plot
- Systematic walk of whole plot, recording all species present
- Each species attributed a Braun-Blanquet cover abundance code (1 – 6 scale)
- Visually assessed

Braun-Blanquet (BB) cover scale



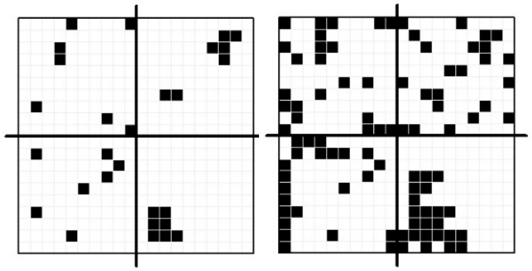
2% 5%

1
<5% cover, few



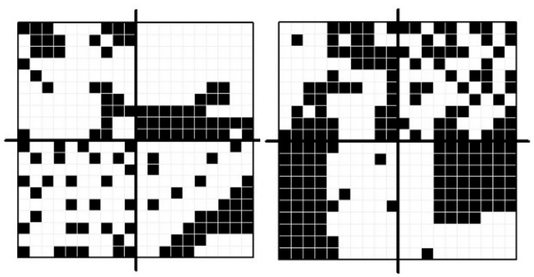
2% 5%

2
<5% cover, many



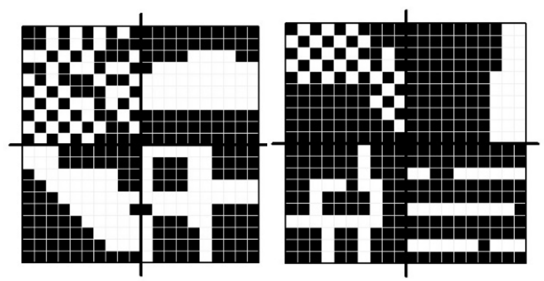
7% 23%

3
6-25% cover



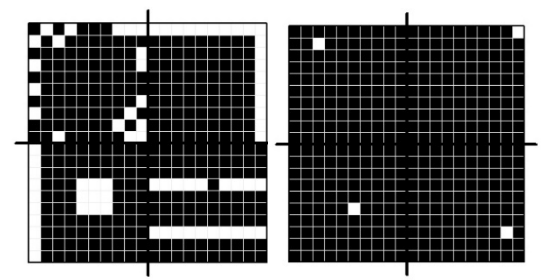
30% 47%

4
26-50% cover



57% 74%

5
51-75% cover



81% 99%

6
75-100% cover

What is wrong with this method?

- Designed for **vegetation classification** (*not* vegetation monitoring), where repeated replicates require rapid sampling & analysis
- Visually estimates cover abundance within 6 bands (class values) → prone to error
- High variability between observers and over time

➢ *Inappropriate* for monitoring projects

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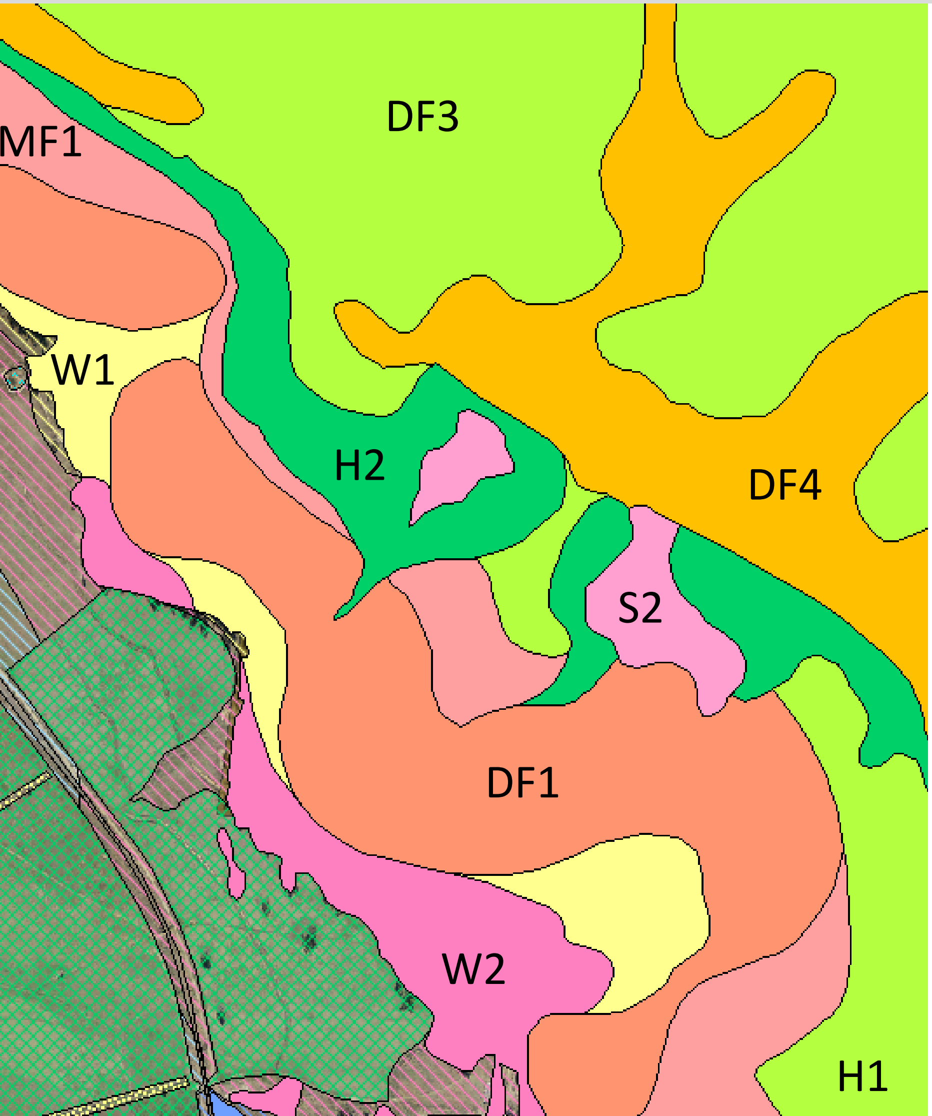
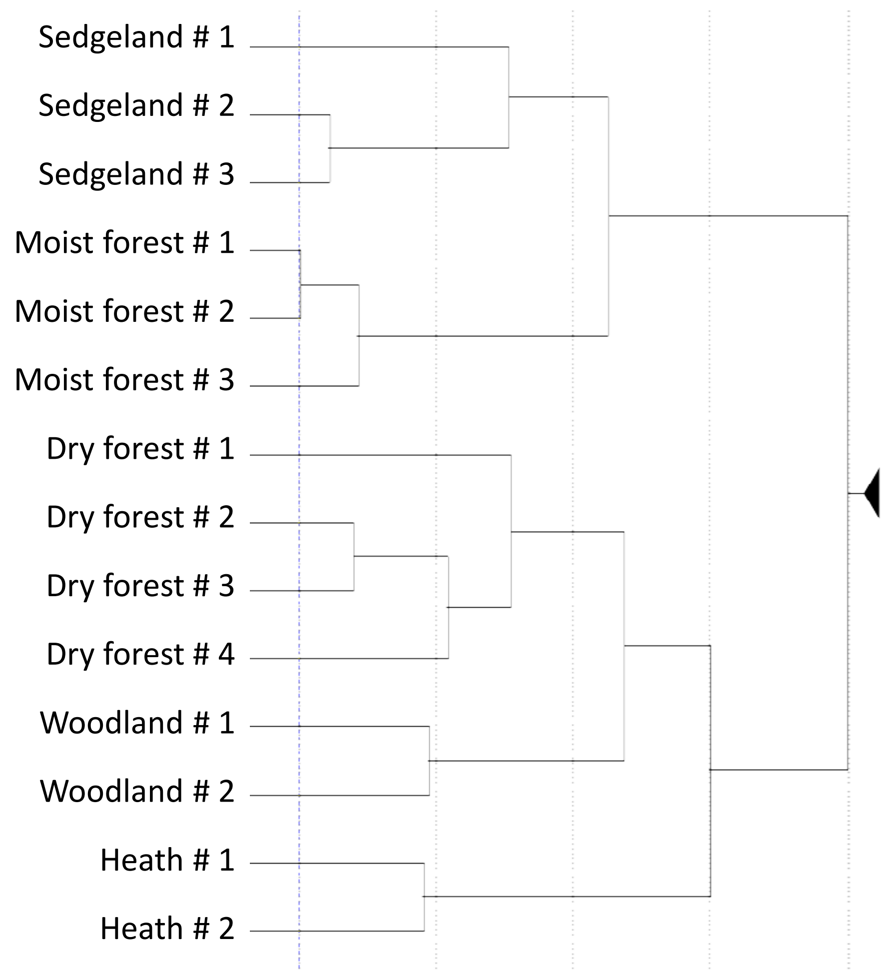
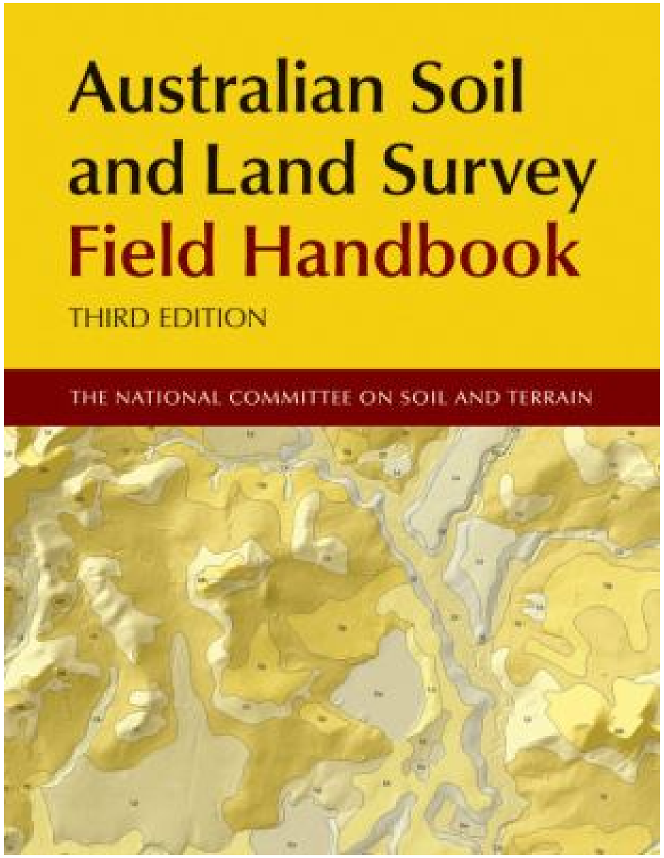
Vegetation map – distribution of a classification





Quantitative measurements



"If the objectives of the survey are narrowly focused and looking for fine levels of discrimination (e.g. site-based monitoring), then actual quantitative measurements are more appropriate than class values" (p 87)

Australian Soil and Land Survey Field Handbook, 3rd Edition, 2009, CSIRO

Case Study # 1

Offset A – Monitoring with Braun-Blanquet Method

Case Study # 1 – Offset A (BB method)

- Monitoring program 2008 to 2013 (6 years); Hunter Valley floor; grassy woodlands
- 38 monitoring plots, 20 x 20m
- Data collected: species diversity with Braun-Blanquet cover codes (1-6)

→ What does this data show us?

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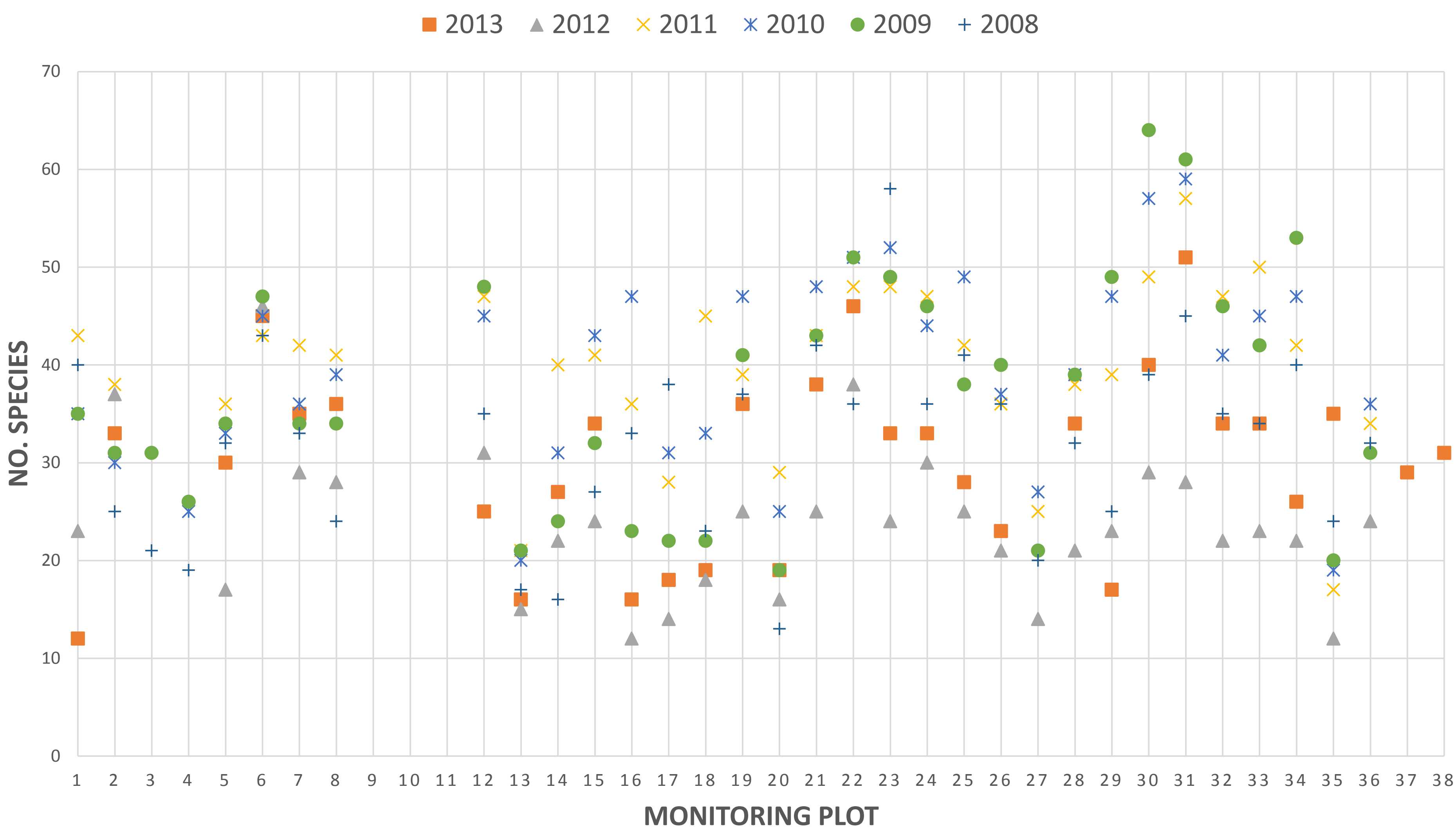
Case Study # 1 – Species diversity



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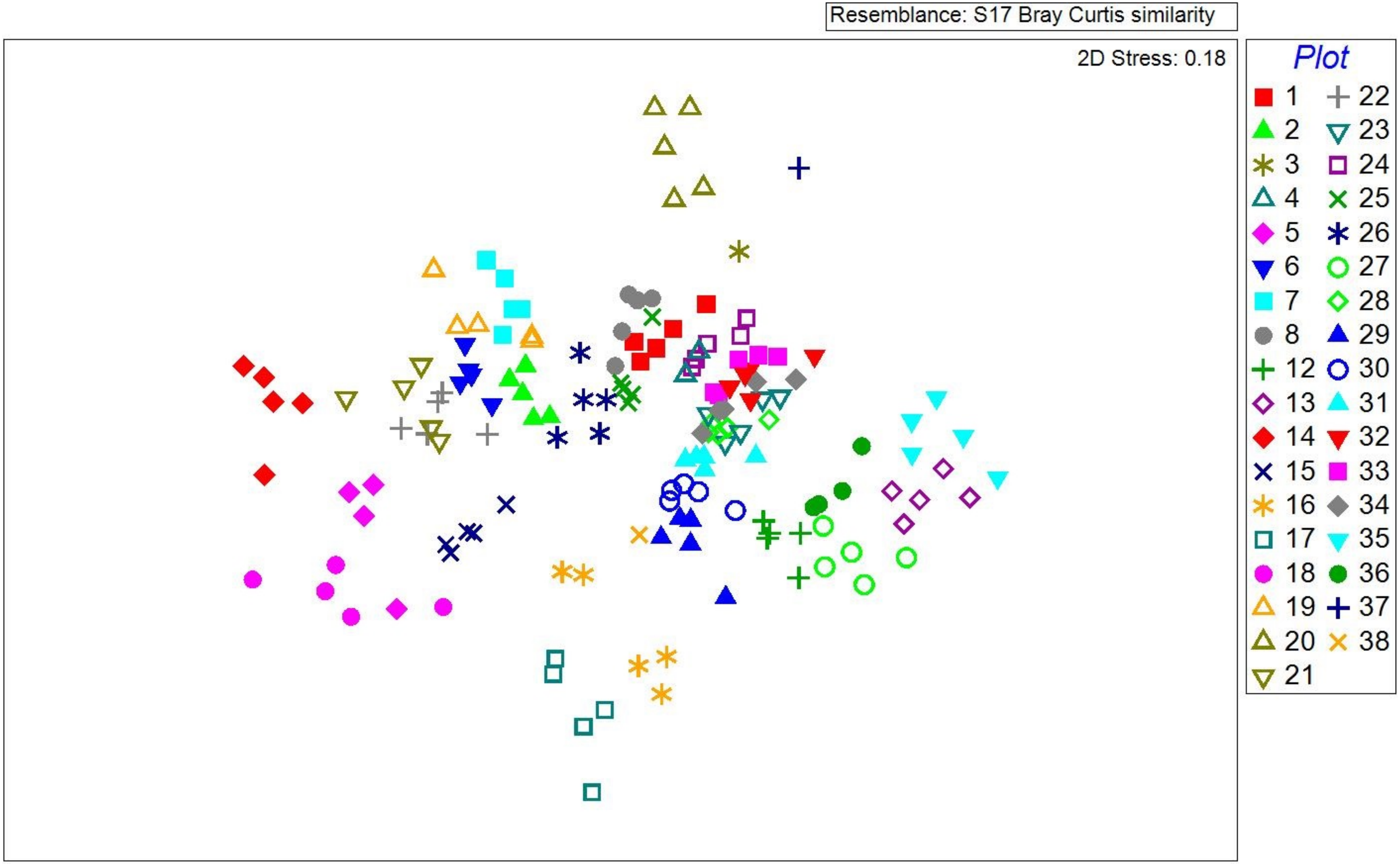
Case Study # 1 – Ordination of plots



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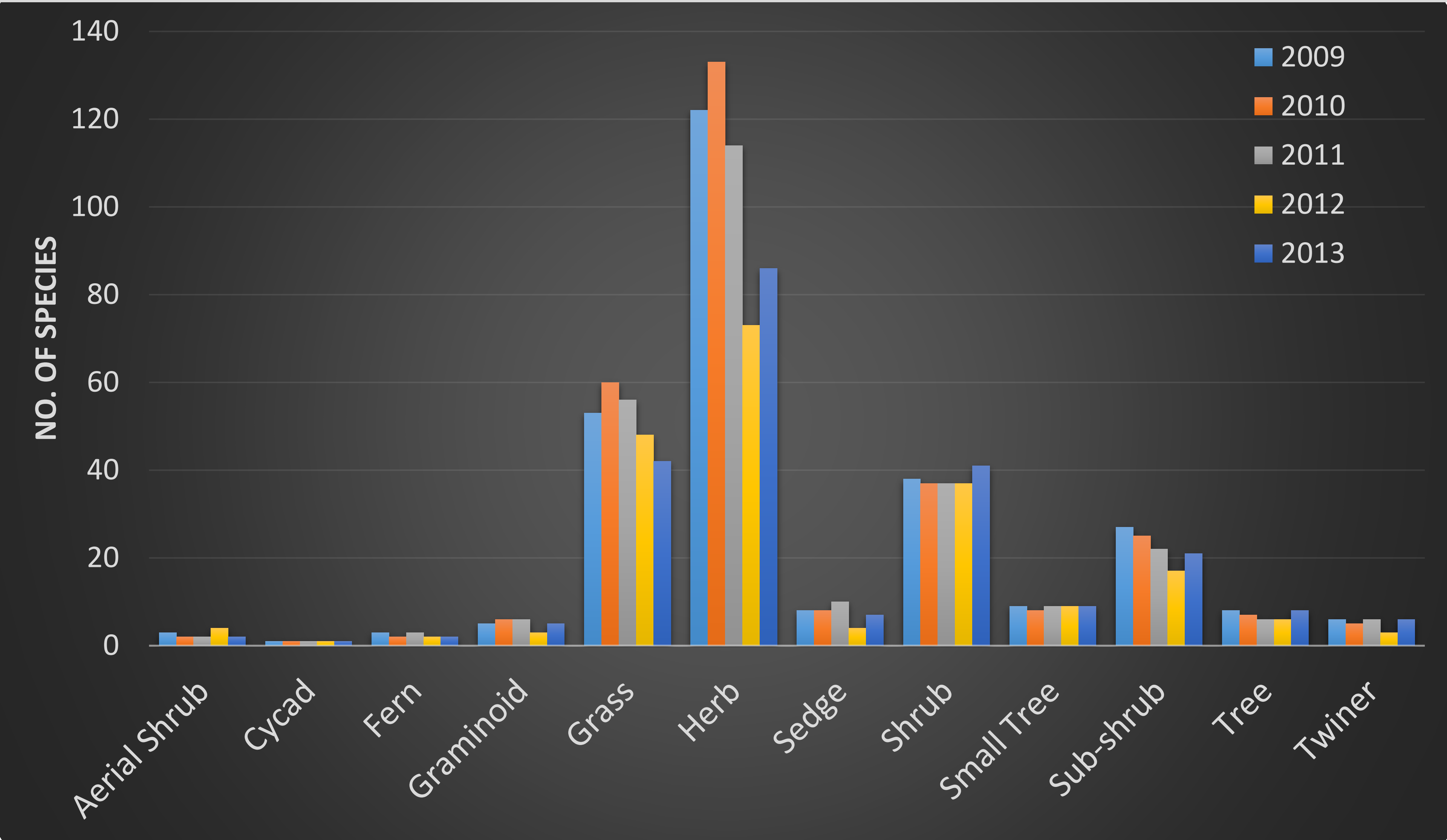
Case Study # 1 – Growth habit change



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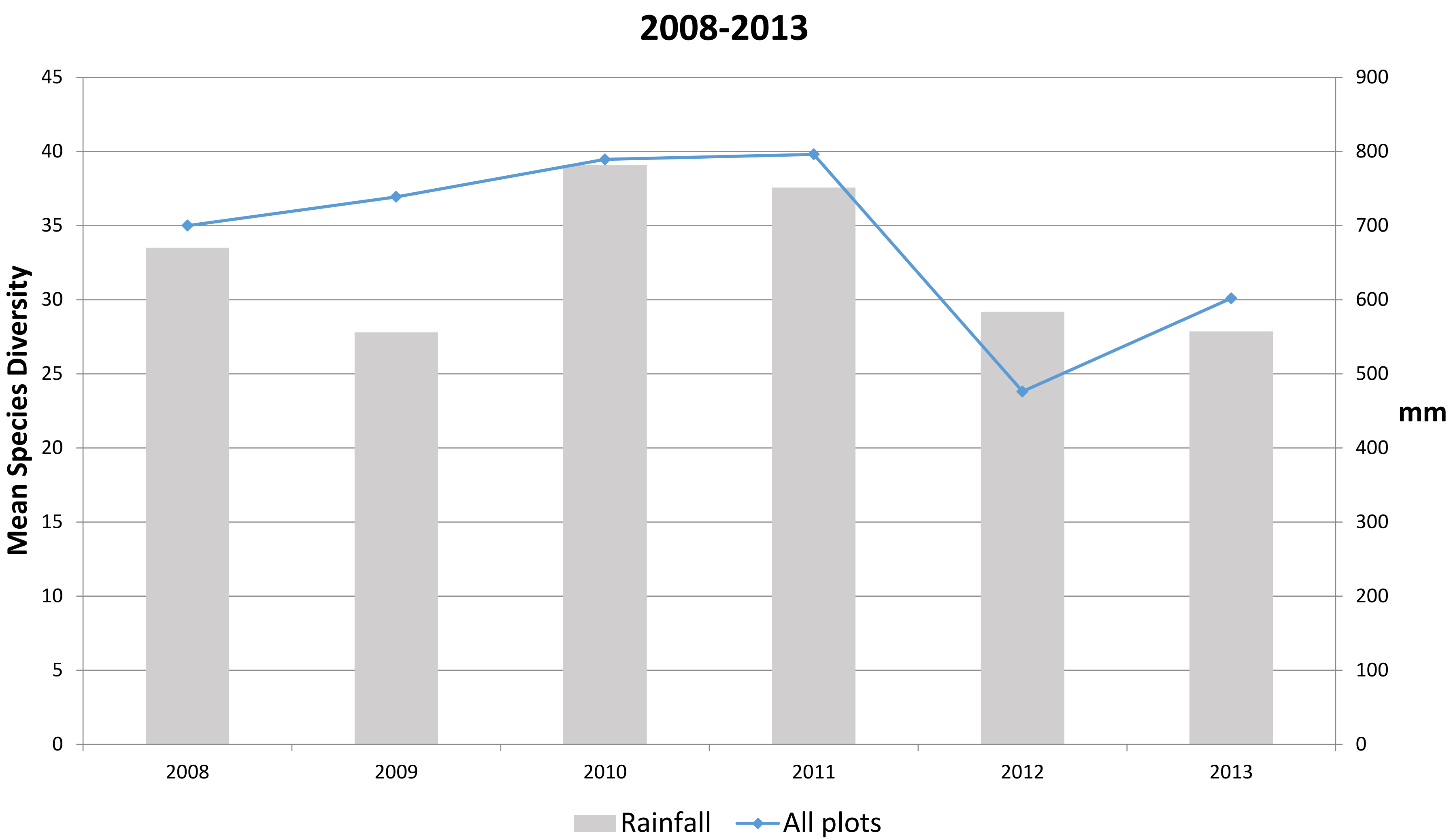
Case Study # 1 – Influence of rainfall



Case Study # 1 – Summary of results

- Species diversity changes from year to year, generally dictated by rainfall:
  - fluctuations in diversity provide no cause for active management, unless weed presence increases dramatically
  - long term trends may be more informative, but need to be carefully interpreted
- Grasses, herbs and sub-shrubs show the most variation from year to year

Case Study # 1 – What about photo monitoring?


2008


2009


2010


2011

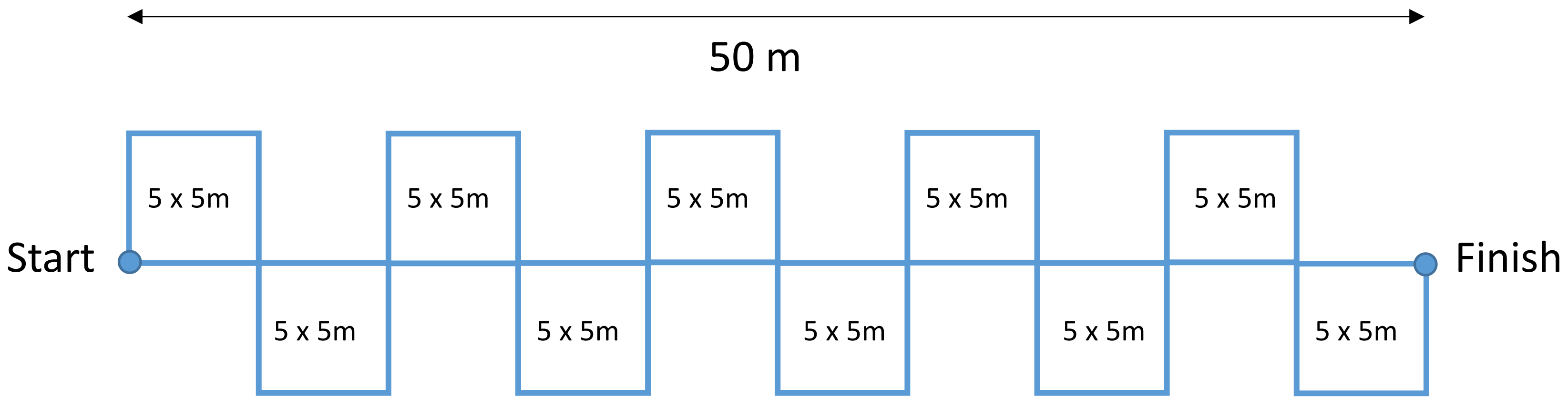

2012


2013

An Alternative Method

Increasing return for effort

Sampling design – Basic unit



- All transects and quadrats permanently marked for later relocation and sampling
- Allows for geographical spread of quantitative data collection

Adapted from Owen Nicholls (2005) *Development of rehabilitation completion criteria for native ecosystem establishment on the coal mines in the Hunter Valley*. ACARP Project No. C13048.

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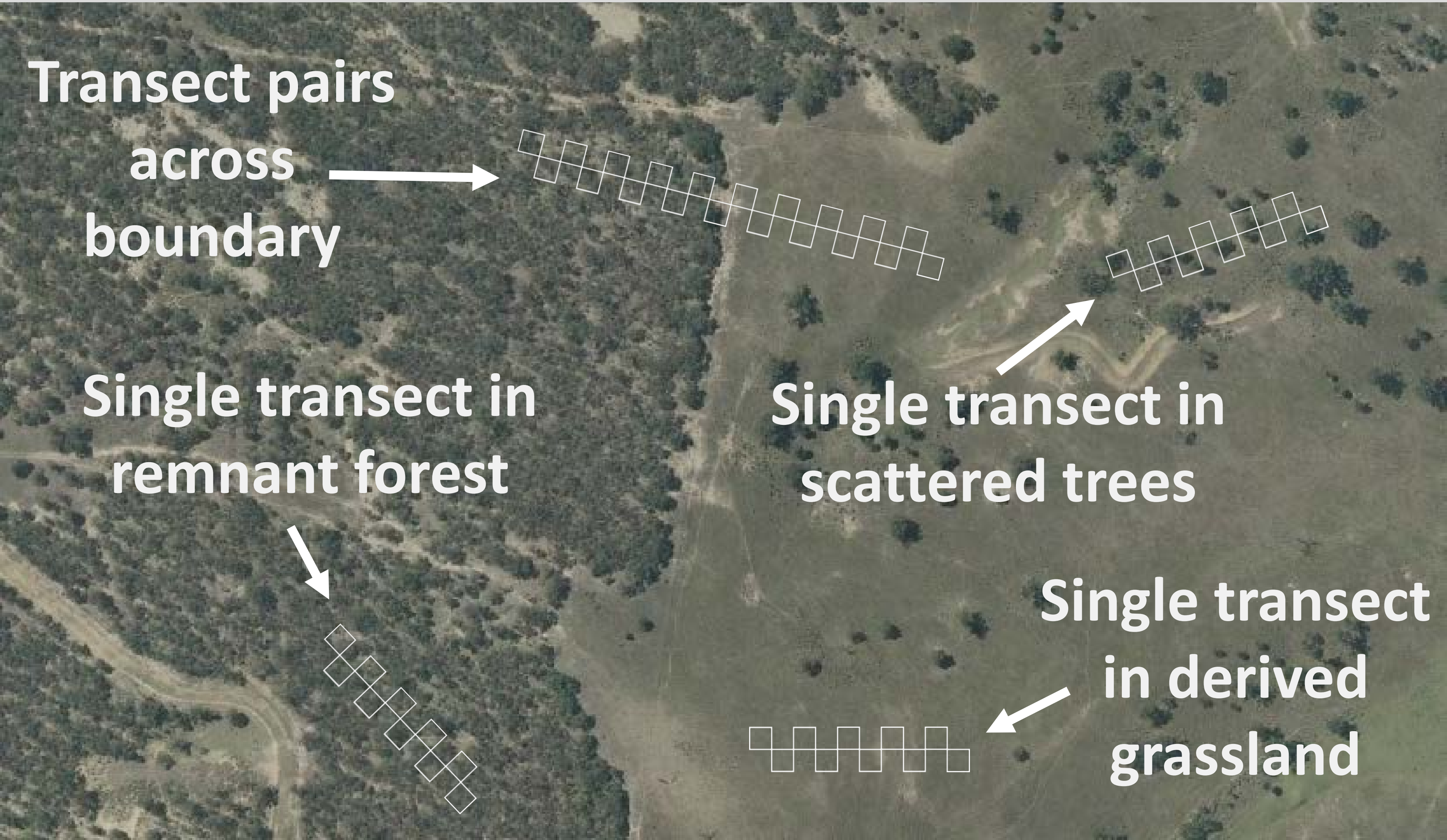
Sampling design – Field positions



Type of data collected

Attribute	5 x 5m quads	50m transect
Native spp diversity (pres / abs & rel. abun)	Count	Count (pooled)
Weed spp diversity (pres / abs & rel. abun)	Count	Count (pooled)
No. stems of canopy spp	Count	Count (pooled)
DBH canopy spp >1.6m tall	Measured	Measured (pooled)
No. stems of woody shrubs	Count	Count (pooled)
No. stems of wattles (*Acacia*)	Count	Count (pooled)
Extent of bare ground	% estimate	% estimate (pooled)
Extent of leaf litter	% estimate	% estimate (pooled)

- Data analysed quadrat x quadrat, or pooled for each transect
- Species abundance per transect based on presence in quadrats (= 1 to 10 scale), not estimated in cover classes

Case Study # 2

Offset B – Monitoring with the Alternative Method

Case Study # 2 – Offset B

- Monitoring program begun in 2013; Hunter Valley floor; grassy woodlands
- Areas of remnant vegetation and ‘derived native grassland’ following cessation of grazing

→ What can this data show us?

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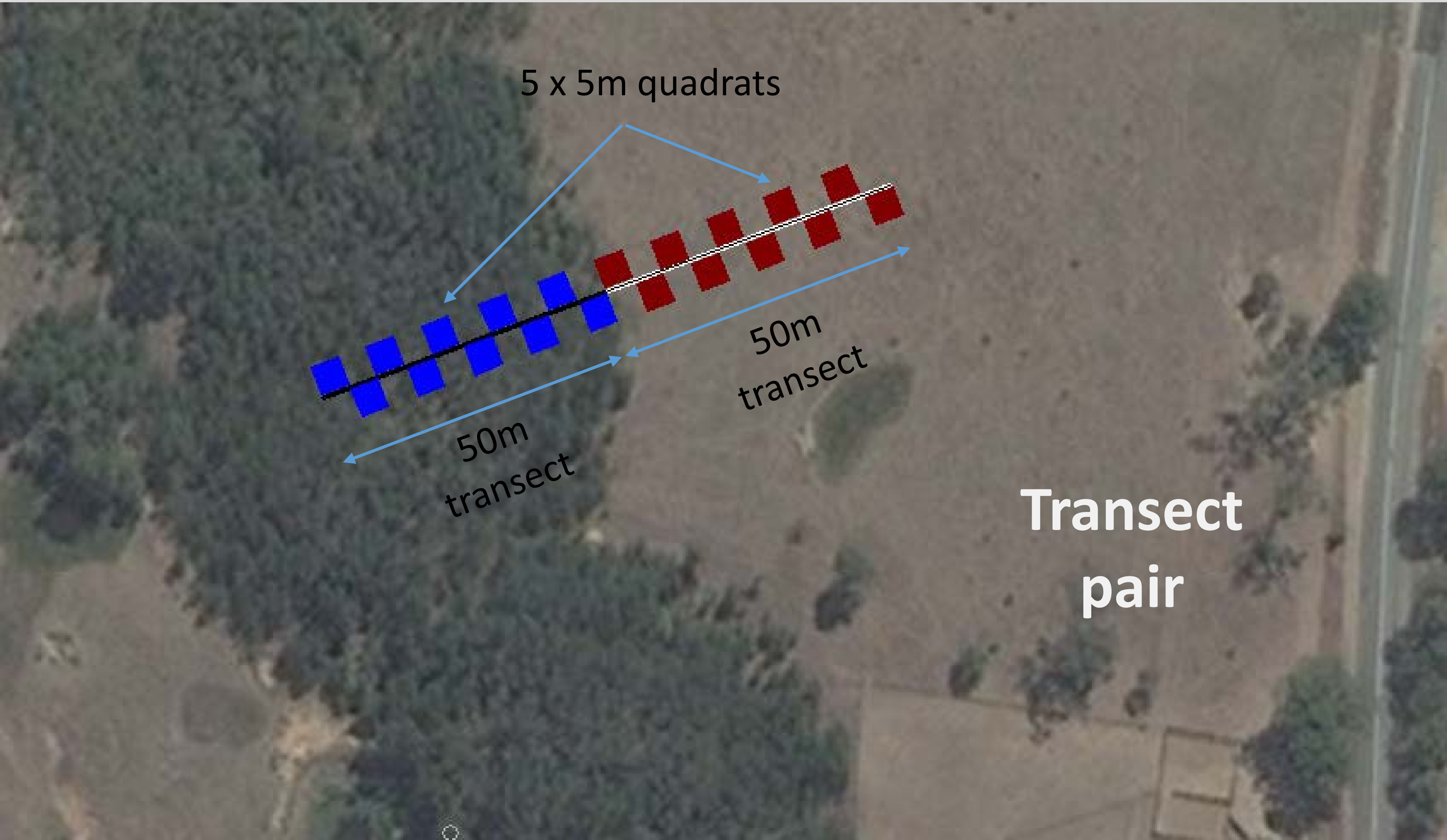
Case Study # 2 – Transect layout



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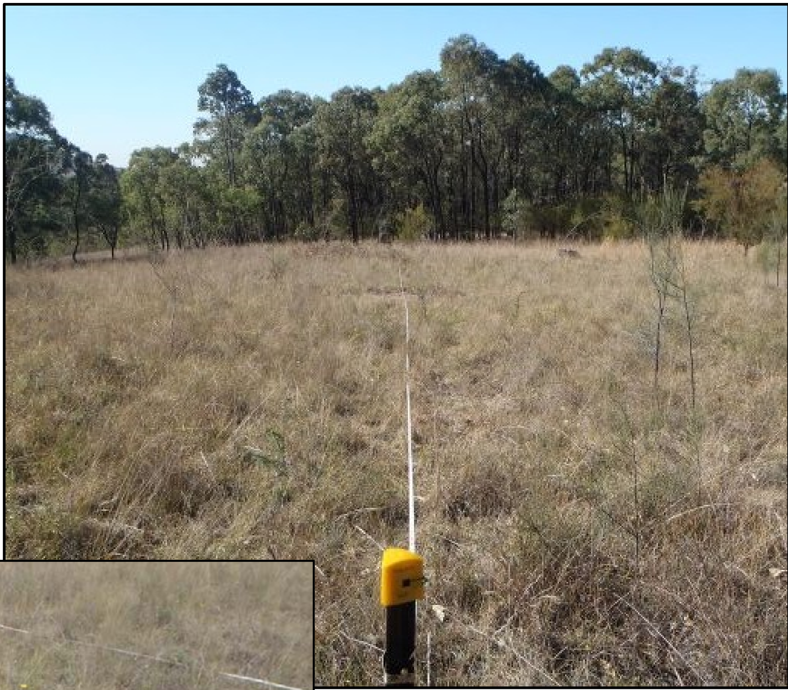
Case Study # 2 – Transects & quadrats

Transect pair



Quadrat

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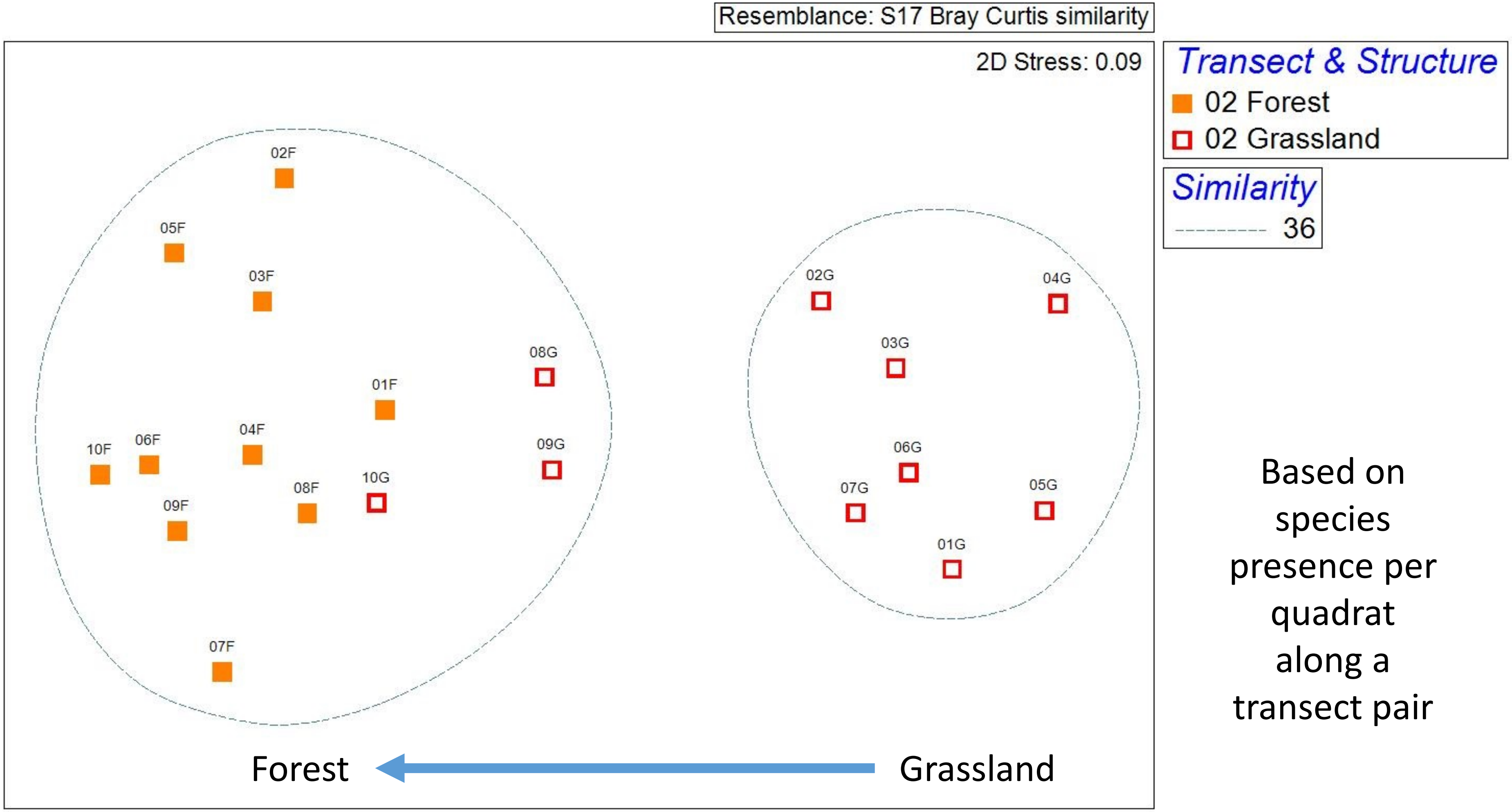
Case Study # 2 – Species diversity



Based on species presence per quadrat along a transect pair

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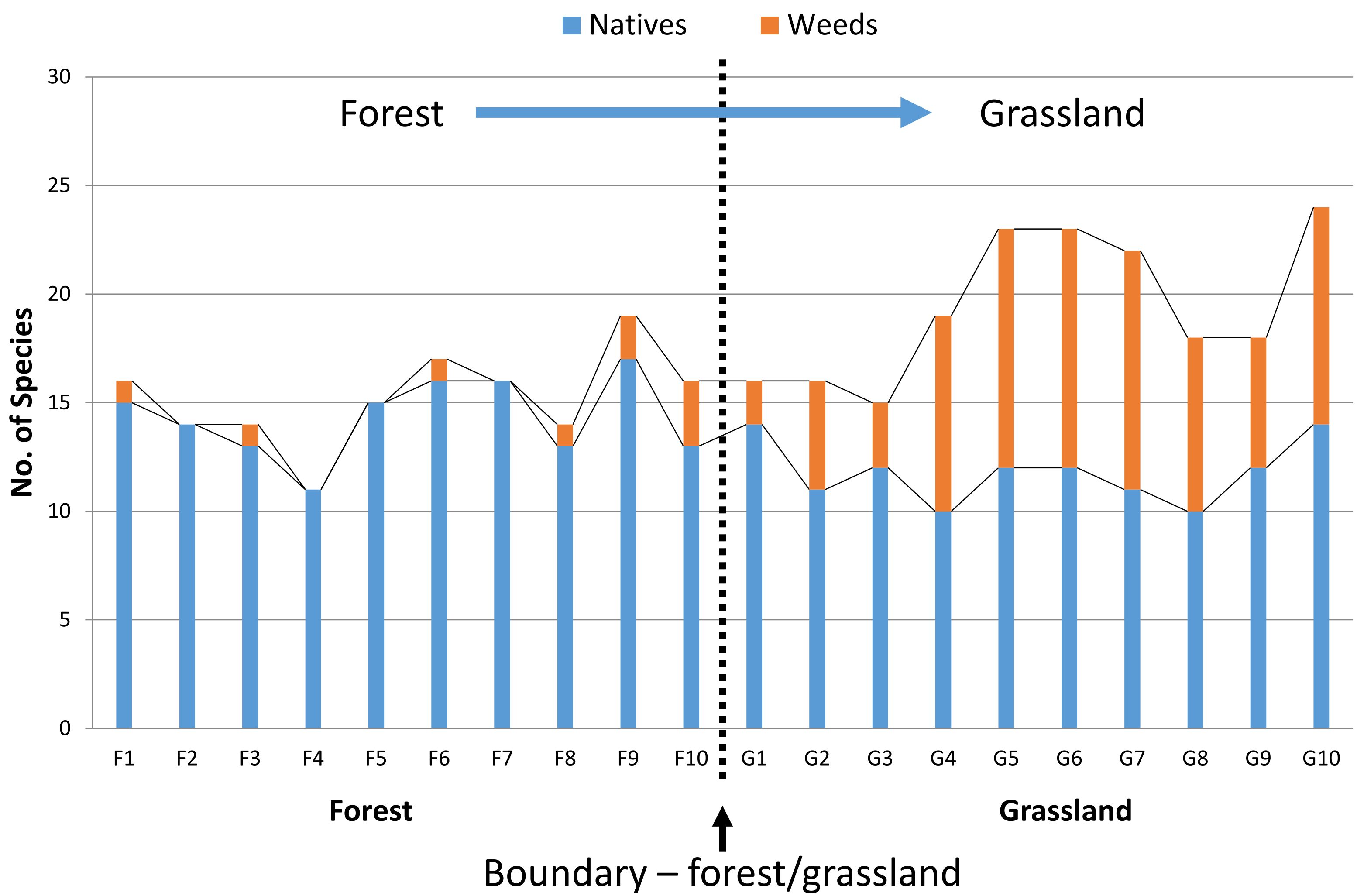
Case Study # 2 – Weed distribution



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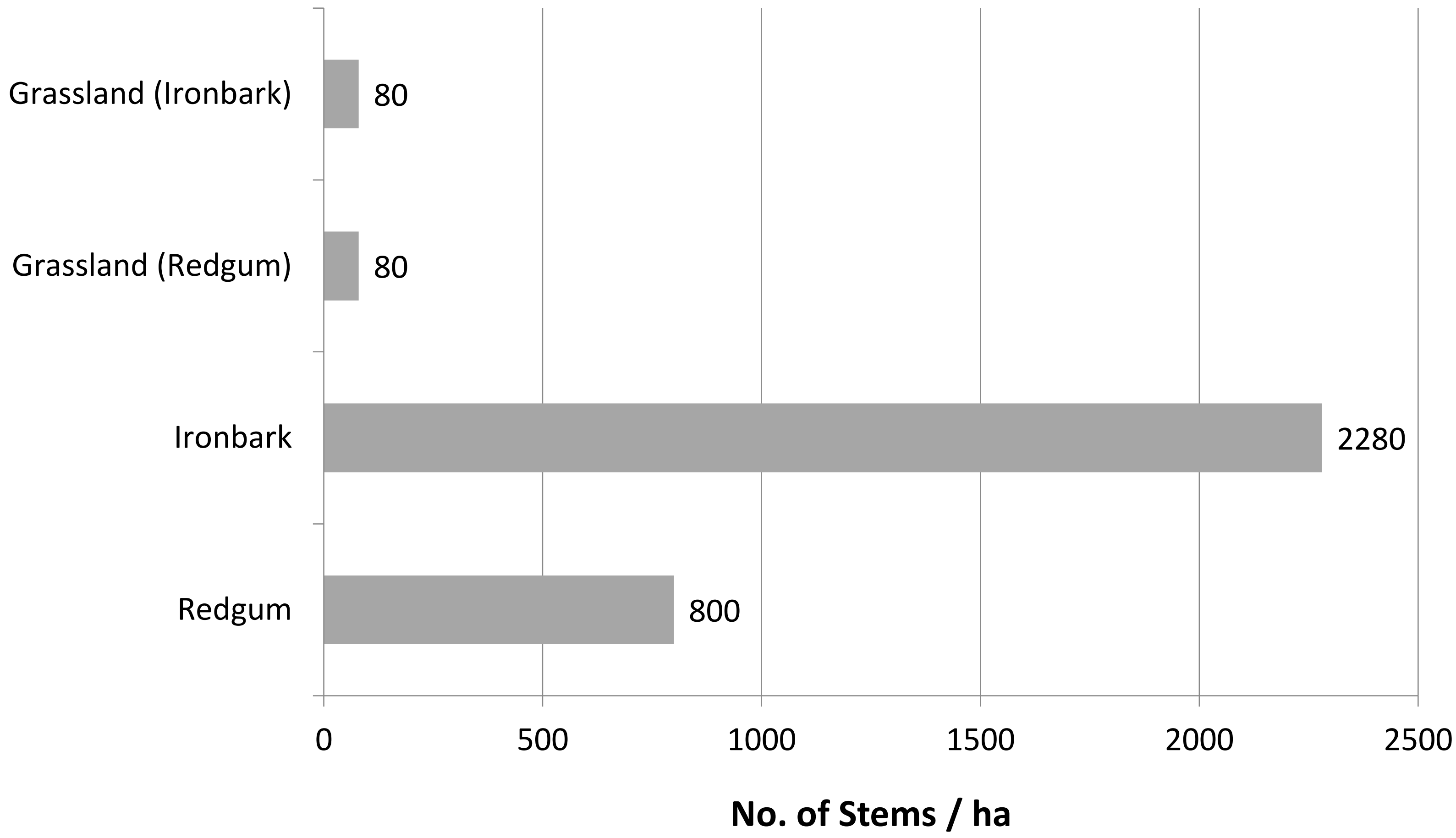
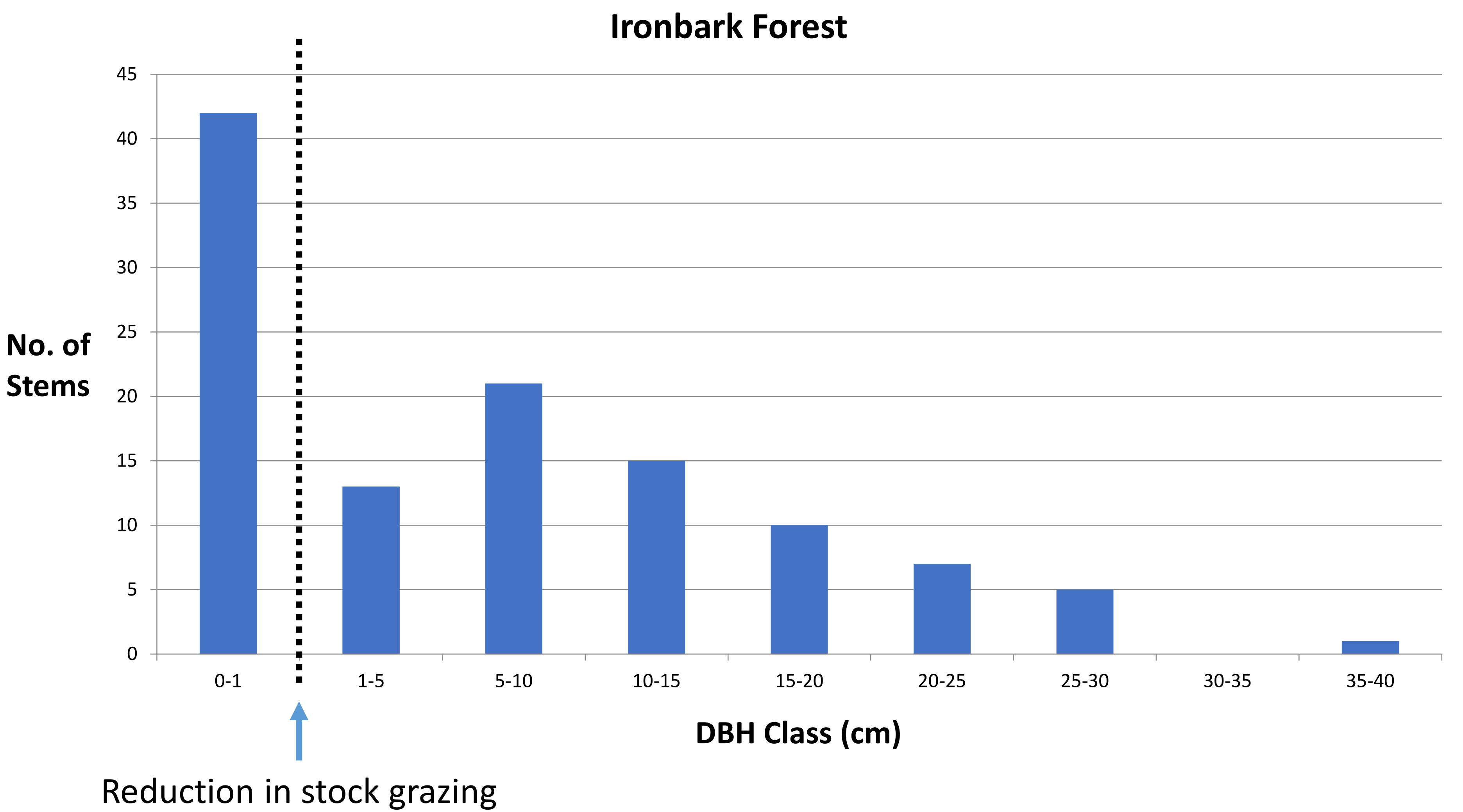
Case Study # 2 – Canopy density



Case Study # 2 – Canopy age classes



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Case Study # 2 – Summary data

	Category:	'Benchmark'		'Regenerating'	
	Management Unit:	Ironbark	Redgum	Grassland (Ironbark)	Grassland (Redgum)
Species diversity	(total)	52	51	69	48
	native (%)	45 (86.5)	44 (86.3)	47 (68.1)	31 (64.6)
	weeds (%)	7 (13.5)	7 (13.7)	22 (31.9)	17 (35.4)
Canopy	basal area (cm^2)	11381.89	1480.54	4.60	459.64
	mean DBH (cm)	11.93	11.62	1.59	24.19
Density	Canopy (stems/ha)	2280	800	80	80
	Woody shrubs (stems/ha)	2980	6160	2180	680
	Acacia stems (stems/ha)	1220	3840	1800	560
Weed cover	(mean % cover)	0.5%	0.5%	14.85%	80.85%
Leaf litter cover	(mean % cover)	21.5%	60%	2.1%	5%
Bare ground cover	(mean % cover)	0.5%	12.8%	3.75%	0.4%

Improvements?

Benefits of a different approach

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Comparison of methods

Attribute	Braun-Blanquet	Biobanking	Alternative
Species diversity (No. spp)	√	√	√
Weed diversity (No. spp)	√	√	√
Cover indiv. Species	% estimate		relative count
Cover indiv. Weeds	% estimate		relative count
Canopy spp. density		% estimate	count
Shrub spp. density		% estimate	count
Ground spp density		relative count	relative count
Canopy regeneration		relative count	count
Canopy spp. age class			count
Wattle spp. density			count
Boundary dynamics			√
[Tree hollows (no. trees)		√	
Fallen logs (length)]		√	

Fauna attributes

Why change flora monitoring methods?

- We need to structure monitoring programs so that returning ecosystems can be managed to be representative of ‘benchmark’ levels
- Methods need to collect *quantitative* data that can track changes over time, and adapt management where required
    - o visually estimating cover values (ie: the Braun-Blanquet method) is not sufficient

Monitoring leading to management

- Consideration of canopy regrowth thinning
- Consideration of *Acacia* regrowth thinning
- Weed control (woody or highly invasive spp)
- Supplementary planting if natural regeneration is limited (distant from source trees & shrubs)
- Consideration of ecological burning
- Consideration of ‘crash’ grazing

What are we aiming for?

Native vegetation benchmarks

Vegetation benchmarks

- Do we know what benchmarks to aim for?
  - Pre-European settlement – grassy woodlands managed by Aboriginal burning; often widely spaced trees; all native species
  - Post-European settlement – derived native grasslands interspersed with remnant trees; no burning but stock grazing; often improved pastures
  - After removal of stock (ie: offset acquisition) – dense regeneration of trees; limited or no grazing; no burning

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Woodland ‘offset thickening’

Pre-European settlement (<1788)

Post-European settlement (1800s-1900s)

Post-offset establishment (>2000s)

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Original woodland tree – broader than tall

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Original Box woodland – widely spaced trees

Original Ironbark woodland – widely spaced trees

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Box Woodland to Forest

Fuzzy Box (*Eucalyptus conica*)

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Ironbark Woodland to Forest

Benchmarks for woodland canopy density

- So what canopy density is acceptable to monitor offsets against?
  - 10-35 trees per hectare (pre-European)?
  - 500 or 2500 trees per hectare (post-offset establishment)?

- Or somewhere in between?

New ‘benchmark’ data?

- Existing Plant Community Types (PCT) benchmark values are based on *classification* data across varying disturbance (transitional) classes – not collected specifically for benchmarking
- Ideally, floristic and structural data should be collected from expert-driven selection of ‘old growth’ remnants to establish benchmark data – but which benchmark?

Summary

How different monitoring can address these issues

Floristic monitoring methods

- Quantitative (not qualitative) data is required to correctly monitor the development and restoration of offsets
- A need for more certainty and consistency in the type of data collected from offset monitoring (more stringent guidelines)
- Braun-Blanquet and Biobanking both have a role in vegetation management, but are of limited use in offset monitoring

Lock up and leave?

- Vegetation communities are complex
- Removing grazing pressure will ***not*** automatically restore woodland communities
  - With no management (grazing or fire), are we creating major bushfire hazards for the future?
  - Should offset management plans include and enforce regular fire events, crash grazing, or canopy thinning to re-create grassy woodlands?

Multiple persistent states

- Vegetation exists in multiple persistent states due to different disturbance histories
- Change is constant; ecosystems are dynamic
- We need decisions and guidance on which benchmarks to use (eg: pre-European, current day)
    - Perhaps a sliding scale to reflect last major disturbance event?

Restoring the Hunter Valley

- Through offsetting practices, we now have the opportunity to restore native vegetation communities that have been heavily disturbed after 200 years of agriculture
- Appropriate monitoring techniques are a key component to guide management towards this restoration


End