

BioCondition, Ecological Equivalence and Environmental Offsets

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Queensland Herbarium

Introduction

What is CONDITION for biodiversity?

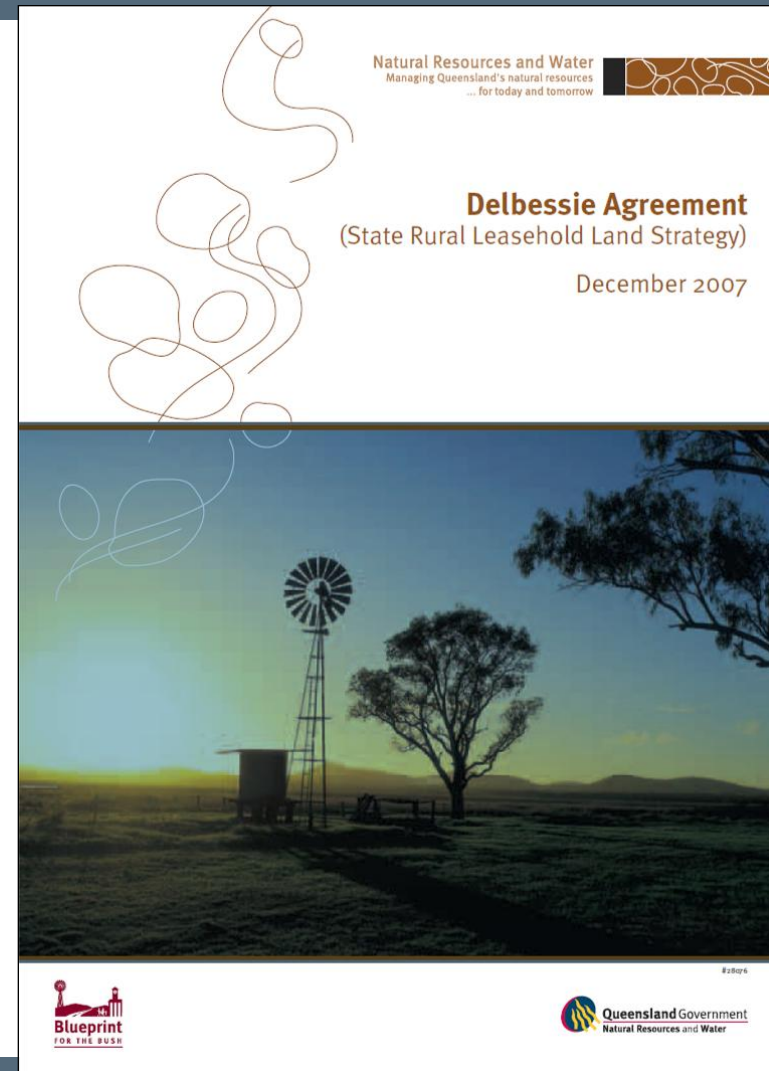
- ‘Condition’ is context dependant – means different things to different people
- For many years, ‘condition’ has been used in the context of grazing land management. More recently, definitions of condition for biodiversity have emerged in response to policy and management needs

Vegetation Condition for biodiversity	“..the degree to which the attributes of a patch of vegetation differs from the attributes of the same vegetation type in its reference (unmodified) state”	Eyre et al. (2011) - BioCondition
Land Condition	“The capacity of the land to respond to rain and produce useful forage”	Pickup et al. (2001) – GLM package

Policy in Queensland

Delbessie Agreement

- Duty of Care under *Land Act 1994*
- Requirement to assess condition of lease land
- Combination of pasture, soil & biodiversity condition attributes
- Must be comparable over years, long term monitoring
- Covers rural leasehold land and over 86 M ha (60% of QLD)
- Implemented December 2007



Policy in Queensland

Offsets Policies

- Policy for Vegetation Management Offsets
- Queensland Biodiversity Offset Policy
- Requirement to measure ecological equivalence – condition and special values

Department of Environment
and Resource Management

Ecological Equivalence Methodology Guideline

Policy for Vegetation Management Offsets

Queensland Biodiversity Offset Policy

Version 1

3 October 2011

Tomorrow's Queensland:
strong, green, smart, healthy and fair

Toward  **Queensland**
Government 

Policy in Queensland

The Reality Check of Policy Regulation and State-wide Implementation...

Condition assessment for biodiversity must:

1. Have proven relationships with biodiversity measures
2. Be robust
 - Minimal observer variation
 - Easy to define, measure, interpret
 - Reliable and consistent to re-measure
 - Legally defensible
 - NOT arduous, ambiguous or boring to undertake

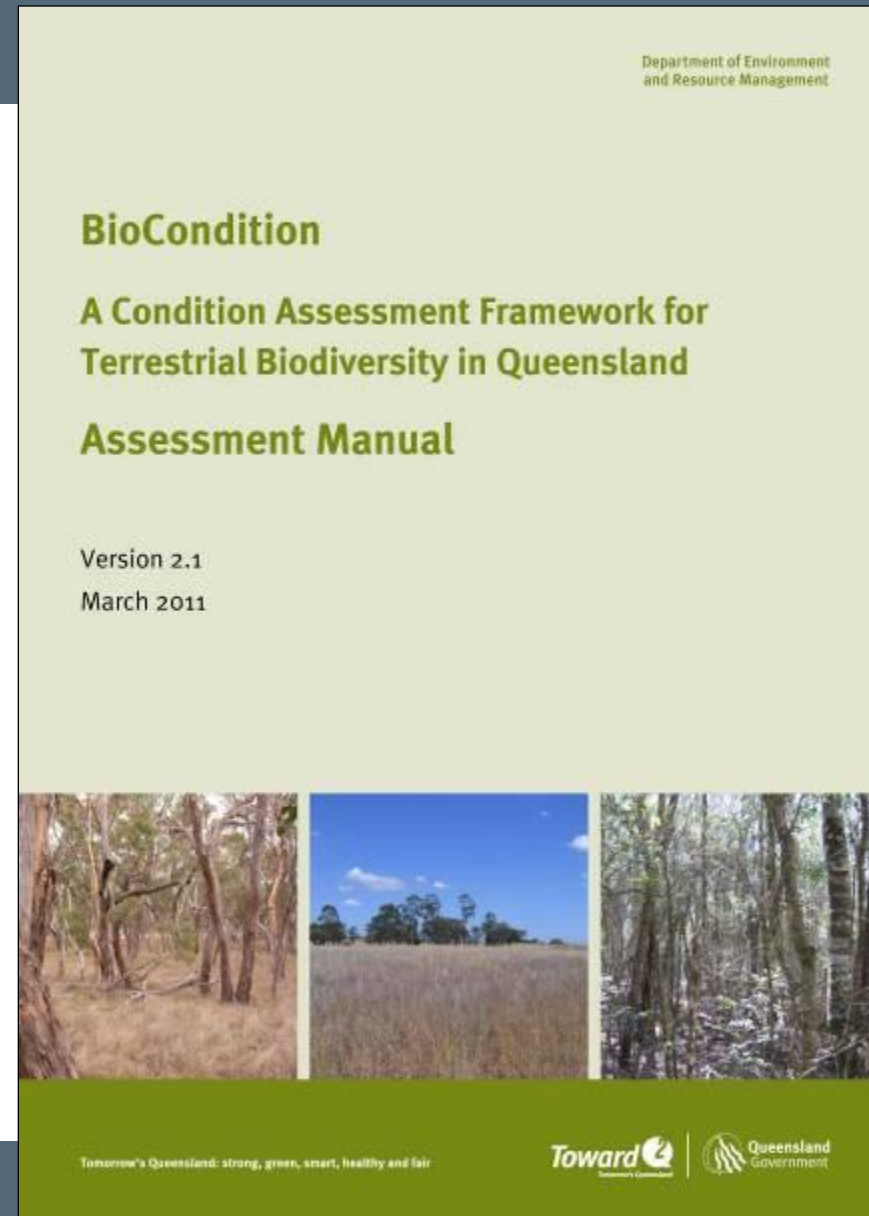


Usual dilemma.... Keep it simple but maintain scientific credibility

Background

Therefore, in response:

- **BioCondition** (v 1.6, 2006) was designed as a rapid condition assessment method
- The method was then tested and validated with funding from Meat & Livestock Australia and DERM
- Trial of robustness of method undertaken in 2010
- Outcomes from testing and trial led to the release of an amended version of **BioCondition** (v 2.1, 2011)



BioCondition

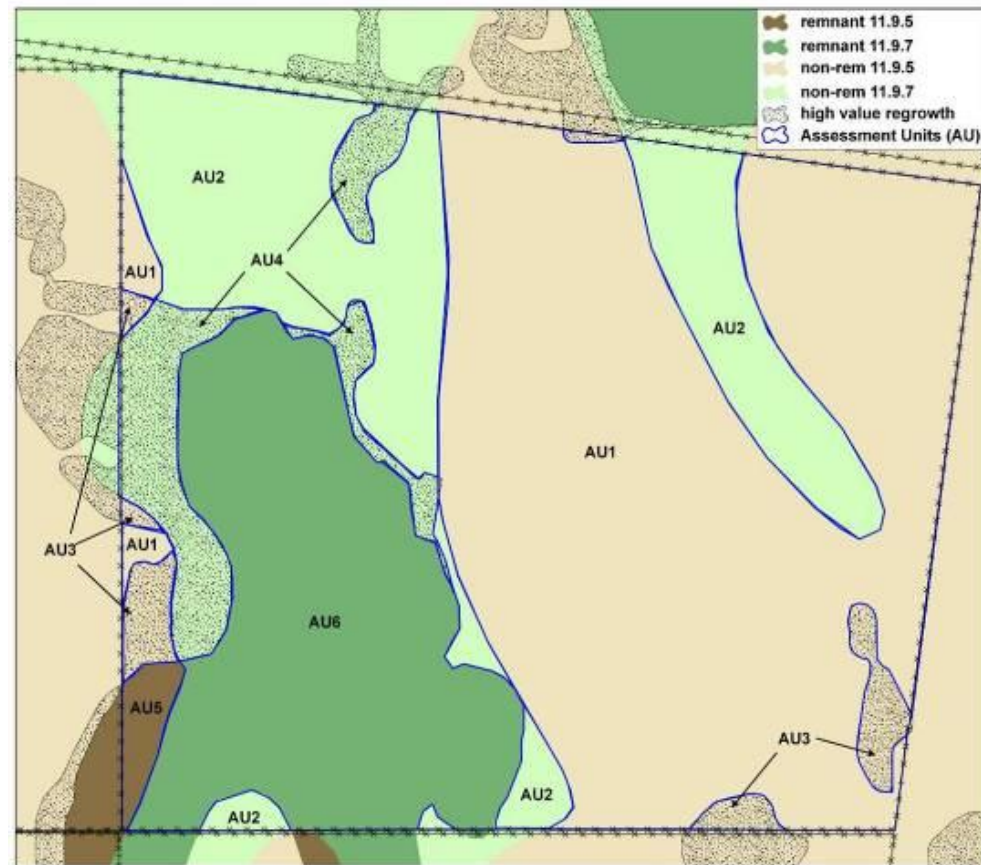


The primary components of BioCondition are;

1. The assessment unit
2. A suite of site- and landscape scale condition attributes
3. Benchmarks for each of the attributes for each regional ecosystem
4. A scoring system that provides a final “condition” metric or score along a continuum between ‘functional’ and ‘dysfunctional’ biodiversity condition

1. Assessment Unit

- The assessment unit is a homogenous unit defined by a unique regional ecosystem and broad condition state
- Pre-clear and remnant regional ecosystems mapped at 1:100 000 for Qld (or 1:50 000 in SEQ)
- Broad condition states (cleared/disturbed; regrowth and; remnant) also mapped under the *Vegetation Management Act 1999*
- All mapping layers available from Queensland Government Information Service



2. Condition Attributes

Research and testing of data to come up with a core set of attributes that are:

- easily and reliably measured in the field
- sensitive to change
- not correlated
- allow discrimination between sites
- educational or instructive
- represent faunal diversity and/or ecological processes



2. Condition Attributes

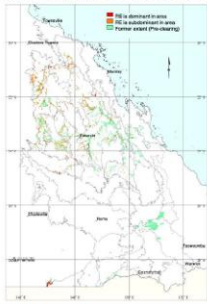

	Attribute	Weighting (%)
Site-based Condition Attributes	Recruitment of woody perennial species	5
	Native plant species richness for four lifeforms	20
	Tree canopy cover (%)	5
	Tree canopy height	5
	Shrub layer cover (%)	5
	Native perennial grass cover (%)	5
	Large trees	15
	Fallen woody material	5
	Weed cover	10
	Litter cover	5
	Landscape Attributes (fragmented subregions)	Size of patch
Context		5
Connectivity		5
OR Landscape Attributes (intact subregions)	Distance to permanent water	20
TOTAL		100

3. Benchmarks

- Allow quantitative and repeatable (over time and space) comparison of vegetation condition between and within regional ecosystems
- Are specific to each regional ecosystem in Queensland (problem: Qld has >1300 recognised regional ecosystems – lots to benchmark!)
- Are used by Tas, NSW, Vic condition assessment frameworks
- Are quantitative values for each assessable attribute, based on the average or median measures of a number of ‘reference’ sites collected during optimal seasonal conditions

BioCondition benchmark for regional ecosystem condition assessment
Brigalow Belt **Regional ecosystem:** 11.3.1

Acacia harpophylla and/or Casuarina cristata open-forest on alluvial plains

BioCondition attribute	Benchmark
Recruitment of dominant canopy species (%):	100
Native plant species richness:	
Tree:	3
Shrub:	5
Grass:	4
Forbs and other:	8
Trees:	
Tree canopy	
Tree canopy median height (m):	14
Tree canopy cover (%):	29
Tree sub-canopy	
Tree sub-canopy median height (m):	4
Tree sub-canopy cover (%):	9
Large trees	
Large eucalypt tree dbh threshold (cm):	na
Number of large eucalypt trees per hectare:	na
Large non-eucalypt tree dbh threshold (cm):	28
Number of large non-eucalypt trees per hectare:	170
Typical tree species: <i>Acacia harpophylla</i> (brigalow), <i>Casuarina cristata</i> (belah)	
Shrubs:	
Native shrub cover (%):	8
Typical shrub species: <i>Geijera parviflora</i> (wilga), <i>Terminalia oblongata</i> (yellowwood)	
Ground cover (%):	
Native perennial grass cover (%):	8
Organic litter cover (%):	34
Typical ground cover species: <i>Paspalum caespitosum</i> (brigalow grass), <i>Enteropogon acicularis</i> (curly windmill grass), <i>Paspalum distans</i> (shotgrass), <i>Chloris divaricata</i>	
Coarse woody debris Total length (m) of debris	1752
Non-native plant cover	0
Typical non-native species: <i>Opuntia tomentosa</i> * (velvety tree pear), <i>Opuntia stricta</i> * (smooth pest pear), <i>Pennisetum ciliare</i> * (buffel grass)	

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (*).

22/03/2012

3. Benchmarks

Vegetation in its reference state refers to the natural variability in the attributes of an ecosystem that is in a **relatively** unmodified state

In Qld we use a relative, Best-on-Offer (BOO) approach to identify reference sites for benchmark derivation, because truly unmodified patches of vegetation rarely exist.

Reference (BOO) mulga



Non-reference (non-BOO) mulga



3. Benchmarks

Best-on-Offer Reference sites (BOOs) criteria:

- Remnant vegetation in relatively functional condition
- Dominant threatening processes are minimised
- Water-remote, or with historically low grazing pressure
- Located in intact landscapes with benign fire-regimes
- Minimal removal of woody vegetation or mechanical disturbance
- >1km from contrasting land use
- Zero to low non-native plant cover
- No recent major management change
- Fenced areas (but be mindful of management history and persistence of exotic species)



3. Benchmarks

Benchmarks also derived from;

- Existing suitable data (i.e. from BOO sites)
- Technical descriptions (CORVEG)
- Expert opinion

To date benchmark documents available approximately 300 REs

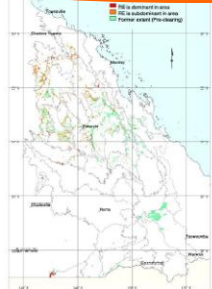

- Majority in the rangelands (Delbessie)
- Current interest in coastal forests and BRB (offsets)
- Download from the EHP website - <http://www.ehp.qld.gov.au/>
- Ongoing ad hoc program

3. Benchmarks

BioCondition benchmark for regional ecosystem condition assessment

Brigalow Belt Regional ecosystem: **11.3.1**

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Don Butler

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Bioregion

Short description

Pre-clear/remnant extent

Regional Ecosystem

Typical appearance

Benchmark values

BioCondition Attributes

4. BioCondition Score

The scoring system;

- provides a final “condition” metric or score that allows comparison between patches of vegetation.
- Final score obtained by adding each attribute score and dividing by the maximum possible score for the RE i.e. 100 for wooded RE’s; 50 for grassland; 65 for shrubland; or 85 for mangrove ecosystems.
- This standardises the score between 0 and 1, allowing equivalence between different ecosystems such as grasslands, for which the benchmark value of some attributes is zero.



BioCondition score = 0.88

intact canopy cover

large trees

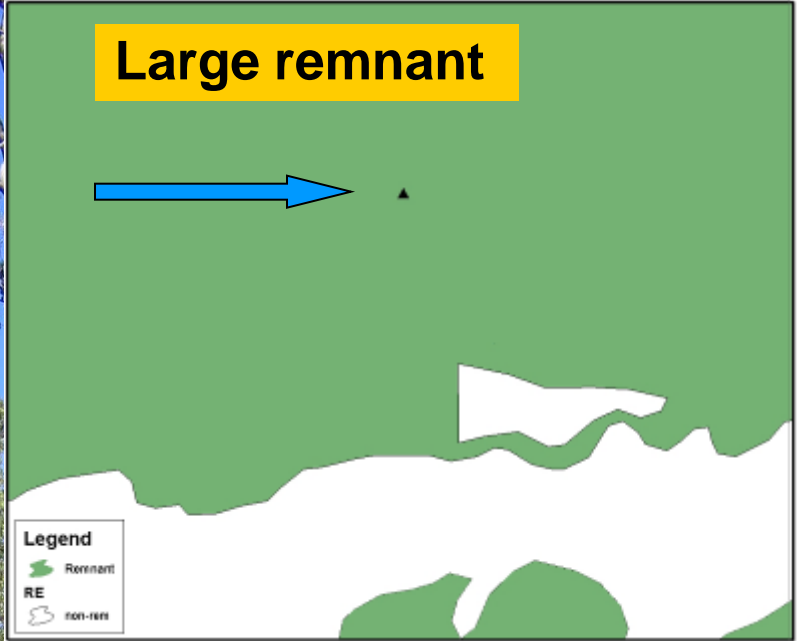
no weeds

recruitment of young trees

high plant species richness

logs & organic litter

shrub and ground cover



BioCondition score = 0.59

reduced canopy cover

no large old trees

low plant species diversity

no logs, reduced litter cover

small patch, limited connectivity



some weeds

bare ground, few shrubs

Ecological Equivalence Method (EEM)

EEM comprises two broad criteria:

- ecological condition (BioCondition)
- special features (GIS layer).

EEM used as a comparison of impact area and proposed offset.

Proposed offset need to:

- fulfil specific offset policy requirements,

AND

- achieve or exceed ecological equivalence score of impact area for both criteria.

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Ecological Equivalence Method (EEM)

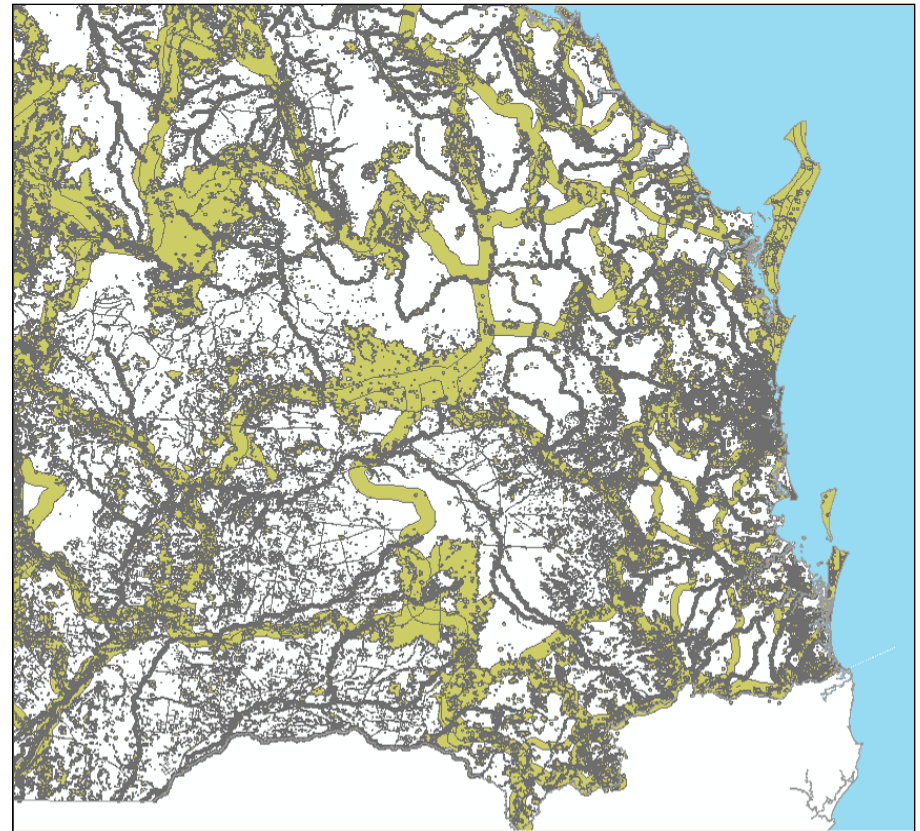
EEM indicators derived from BioCondition and BPA mapping features

BioCondition		BPA features ¹
Criteria		
Criterion 1 – ecological condition		Criterion 2 – special features
#	Indicators	Indicators
1	Recruitment of woody perennial species	Centres of endemism
2	Native plant species richness	Wildlife refugia
3	Tree canopy height	Disjunct populations
4	Tree canopy cover	Taxa at limits of geographic range
5	Shrub canopy cover	High species richness
6	Native perennial grass cover	Relictual populations
7	Organic litter	Regional ecosystems with distinct variation in species associated with geomorphologic and other environmental variables
8	Large trees	Artificial water body of ecological significance
9	Coarse woody debris	High density hollow bearing trees
10	Weed cover	Breeding or roosting areas used by significant numbers of individuals
11	Size of patch (fragmented landscapes)	Ecological corridor
12	Connectivity (fragmented landscapes)	Priority species within the bioregion
13	Context (fragmented landscapes)	Significance of patch within a one kilometre buffer
14	Distance from water (intact landscapes)	Protected area estate buffer

¹Queensland Biodiversity and Vegetation Offsets Special Features map layer

Ecological Equivalence Method (EEM)

- Most projects now require offset strategies as part of the EIS/EMP process
- EEM needs to be incorporated as standard baseline assessment
- However, designs/alignments change
- EEM offers a “rapid assessment process” (ie. accepting the maximum permissible score for each attribute)



Conclusion

- LESS IS MORE – reducing complexity of measures does not affect r'ship with 'biodiversity', but reduces variation in measures by different observers.

- Training is essential

Undertaking a BioCondition V 2.1 assessment is now;

- quicker
- less complicated, and hopefully
- less boring



Observer Variability

- 77 observers with variable ecological field experience (zero to 25 years) assembled
- Each undertook the site-based field component of the BioCondition assessment following initial training in measuring techniques
- All assessments done at the one site

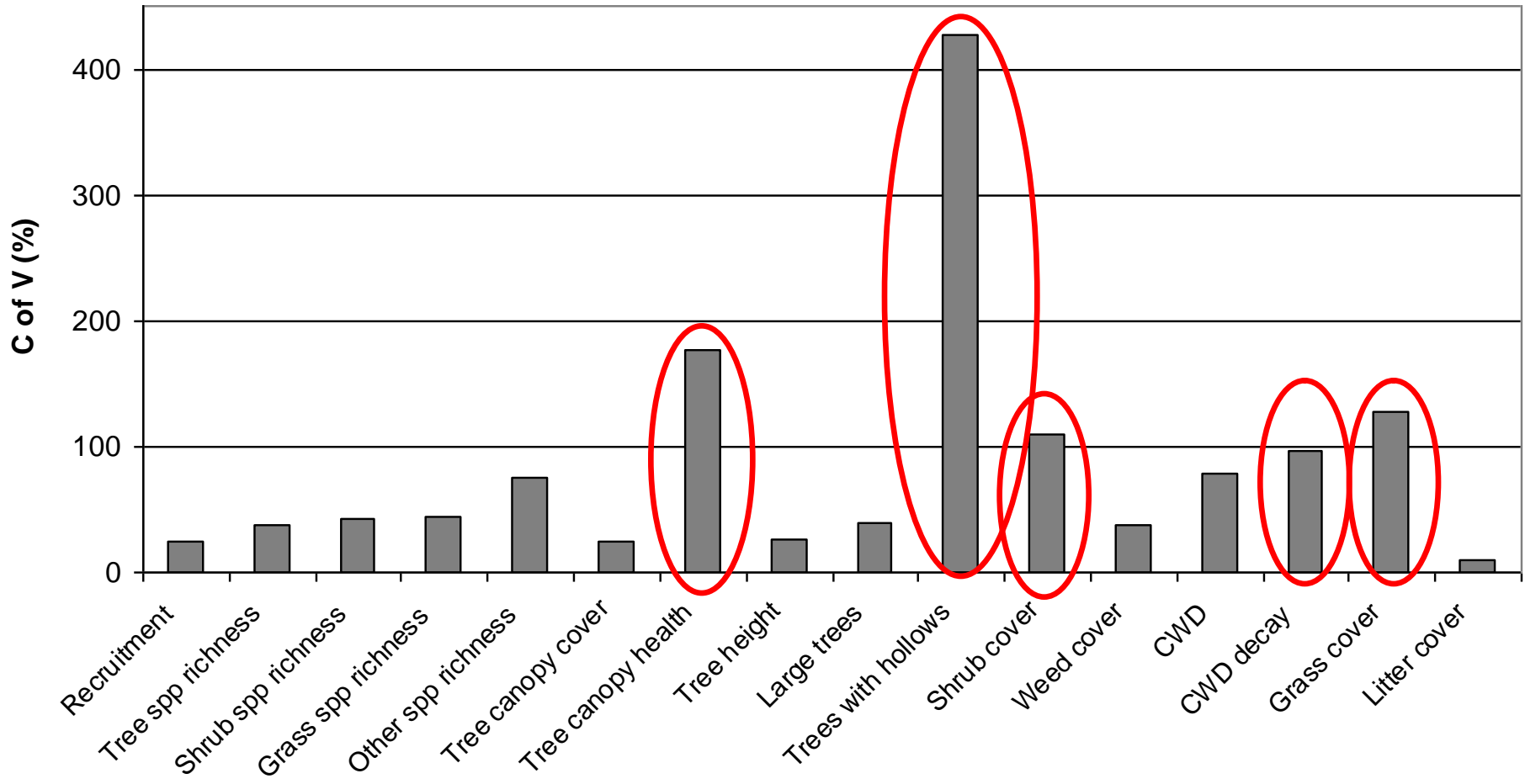


See Kelly, A.L., Franks, A.J. and Eyre, T.J. (2011) Assessing the assessors *Ecological Management and Restoration*

Observer Variability

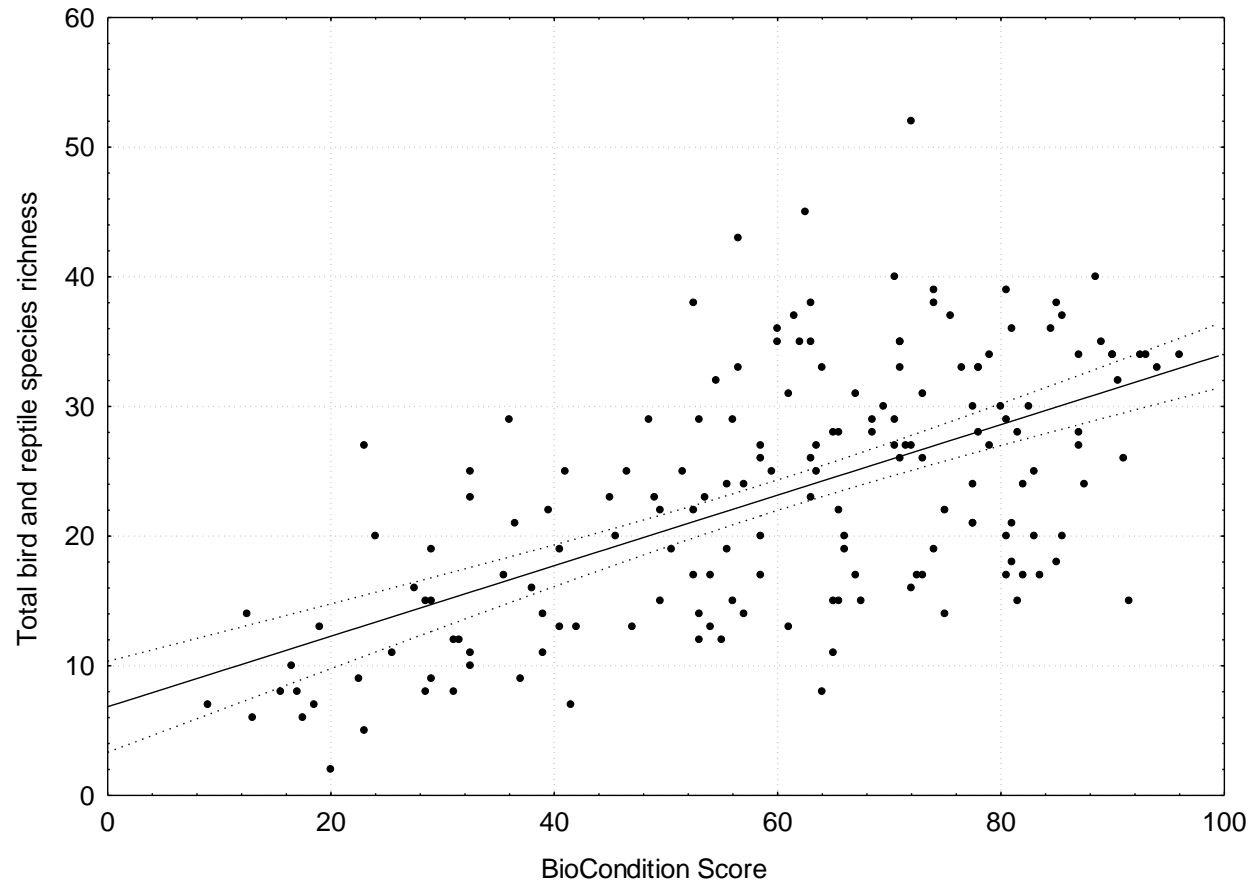
Indicators measured with too much variation:

- Tree canopy health & trees with hollows
- Shrub cover, CWD decay and grass cover - marginal



Observer Variability

Therefore, hollows, canopy health and CWD decay also dropped, training to improve assessment of shrub cover (and other indicators).....



..which actually improves (slightly) the relationship between the BioCondition score and bird and reptile species richness

Before: $r^2 = 0.25$

After: $r^2 = 0.41$