#PredictsProject
www.predicts.org.uk

Predicts

The global response of terrestrial protected area biodiversity to human impacts

Claudia Gray, Samantha Hill, Tim Newbold, Lawrence Hudson, Luca Börger, **Andy Purvis** & Jörn Scharlemann

Natural History Museum
UNEP WCMC
University of Sussex
Swansea University Prifysgol Abertawe
Imperial College London
NERC Science of the Environment

Questions

- How effective are terrestrial Protected Areas in retaining site-level biodiversity?
- Do Protected Areas work solely by reducing pressures, or do they also mitigate responses?
- What attributes of Protected Areas matter?

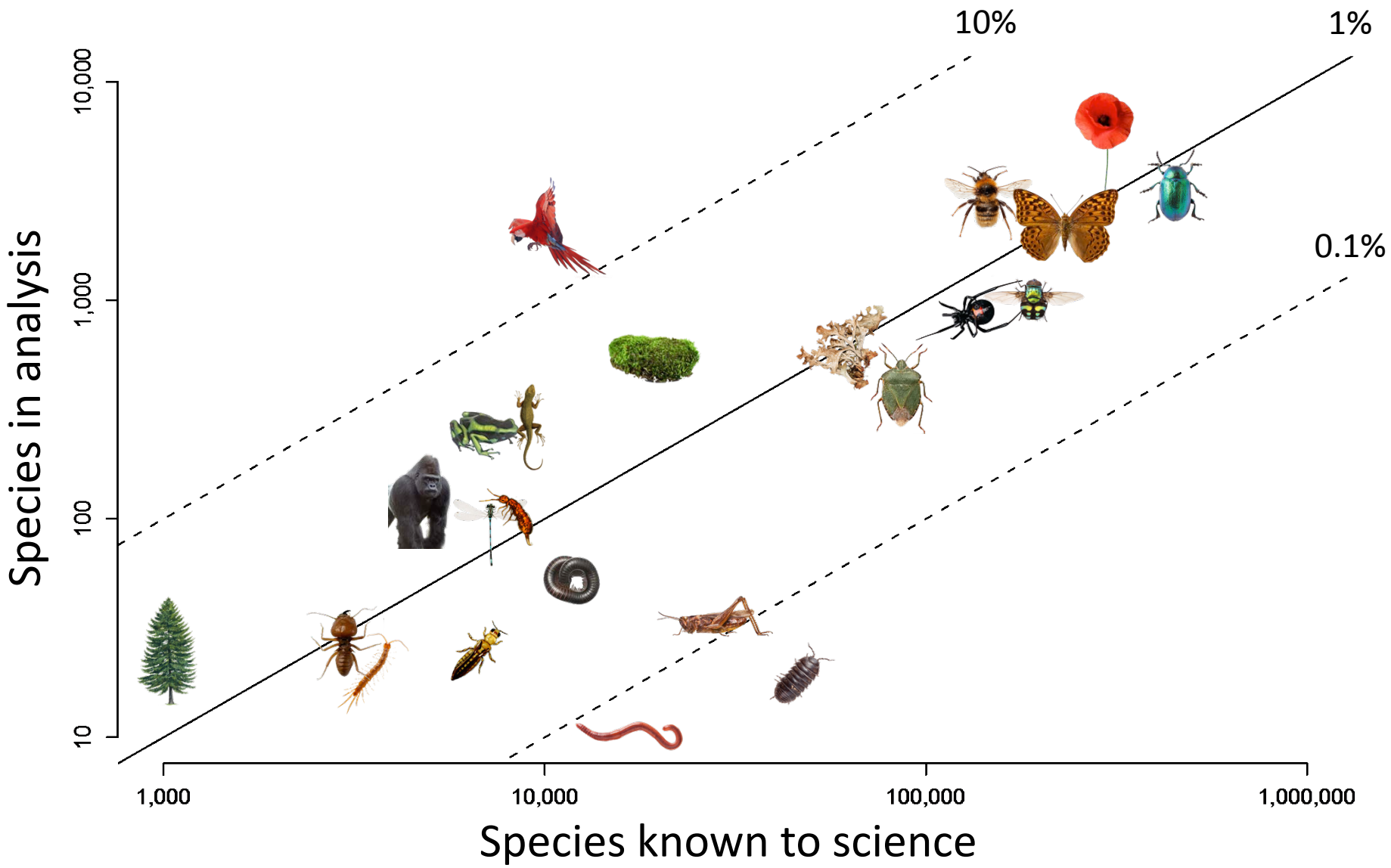
Spatial tside

8,685 sites
50 countries
100 ecoregions

126 published sources
192 data sets
1,107,009 samples

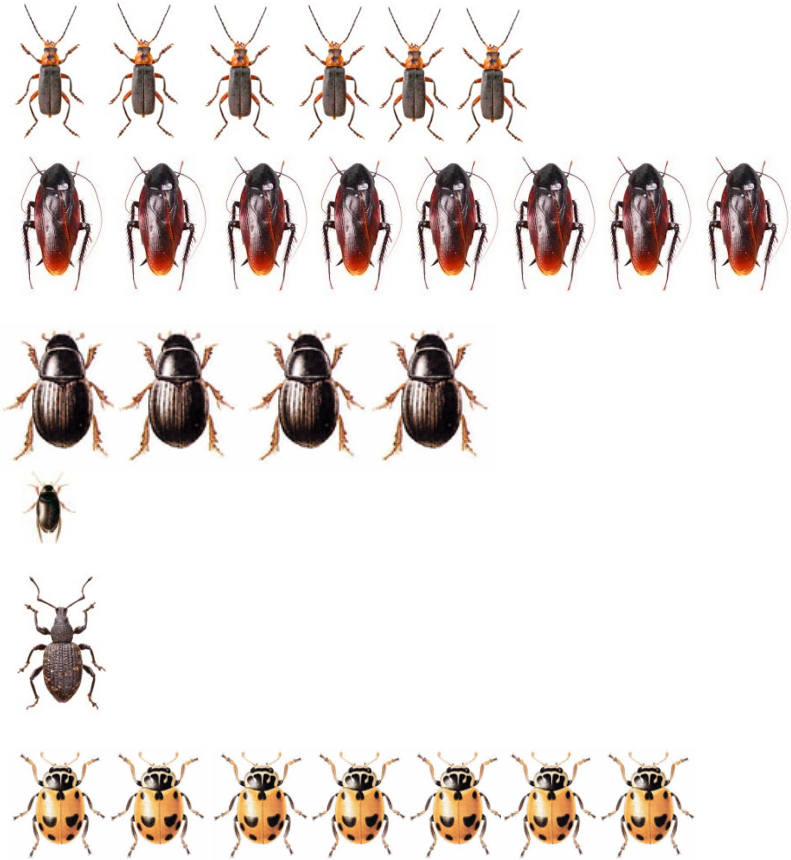
18 hotspots
467 protected areas
17,500 taxa

Taxonomic representativeness

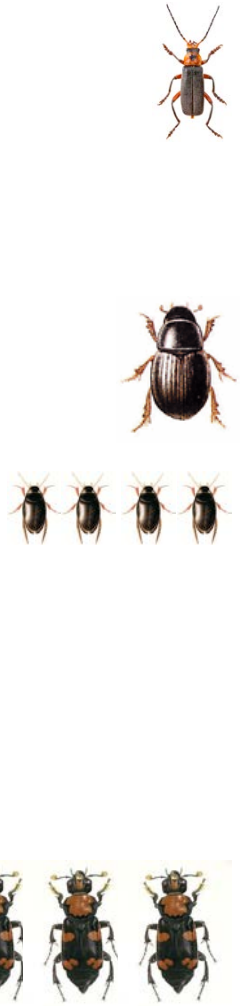


Richness, abundance & endemism

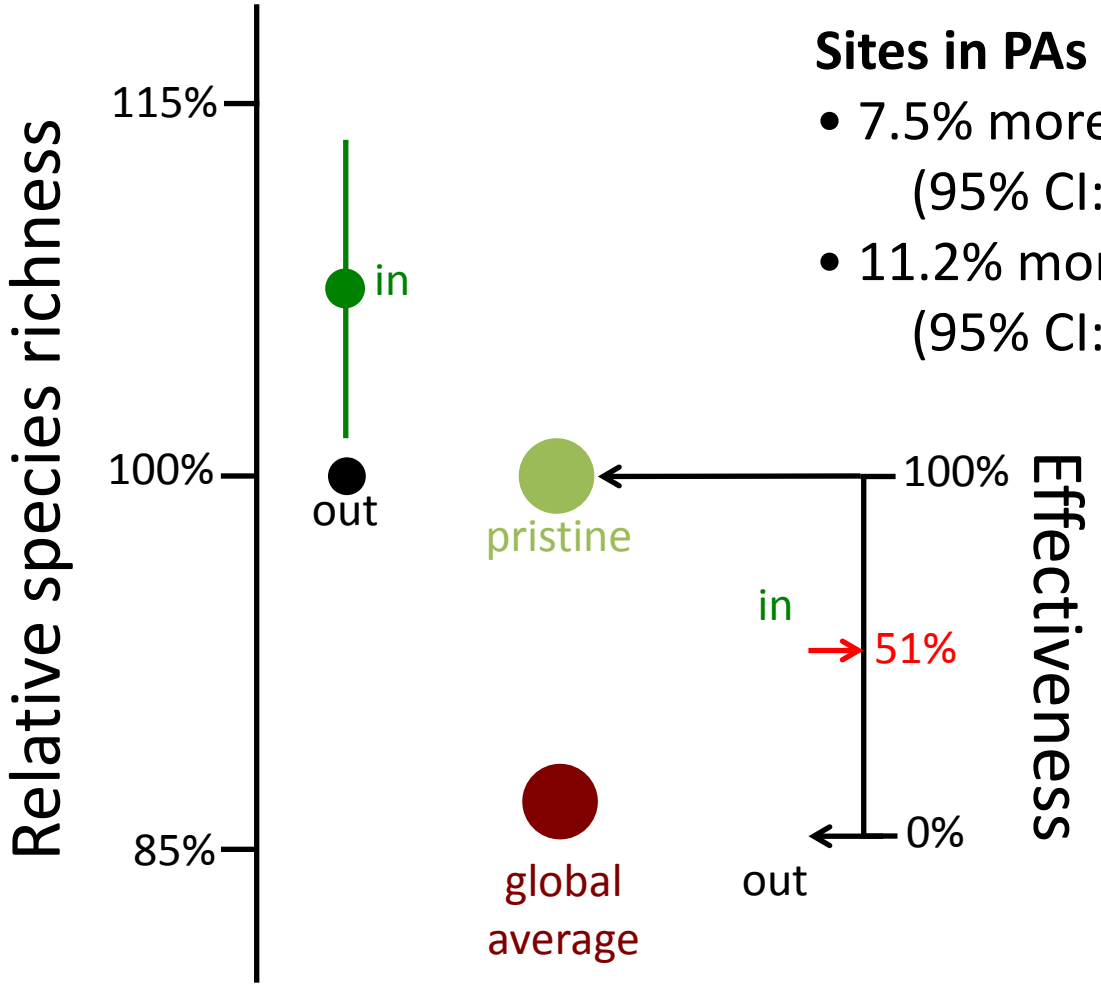
Site A



Site B



How effective are terrestrial PAs at retaining site-level biodiversity?



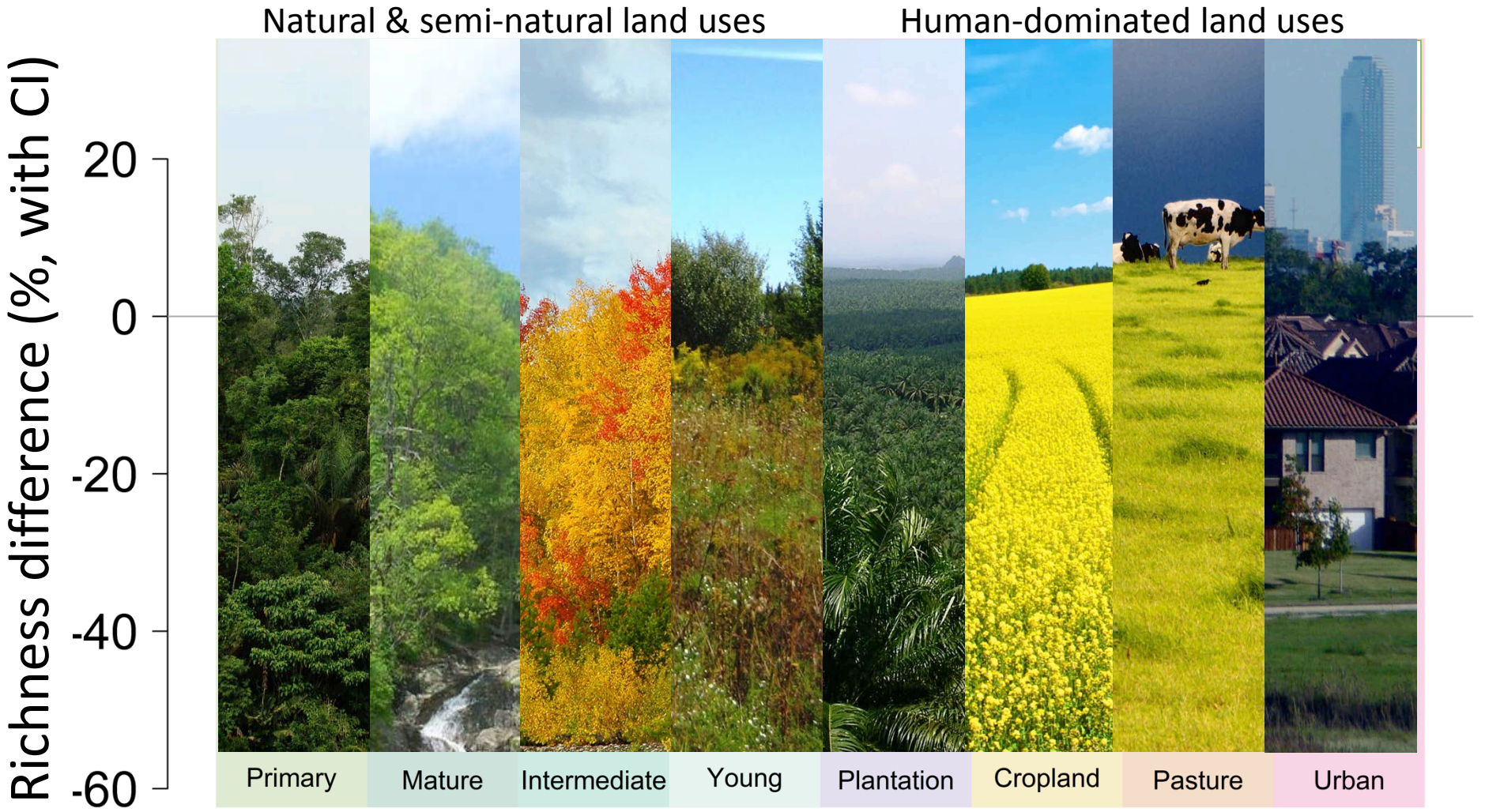
Sites in PAs have:

- 7.5% more species than sites outside (95% CI: 1.4% to 14.1%)
- 11.2% more individuals than sites outside (95% CI: -0.02% to 23.9%)

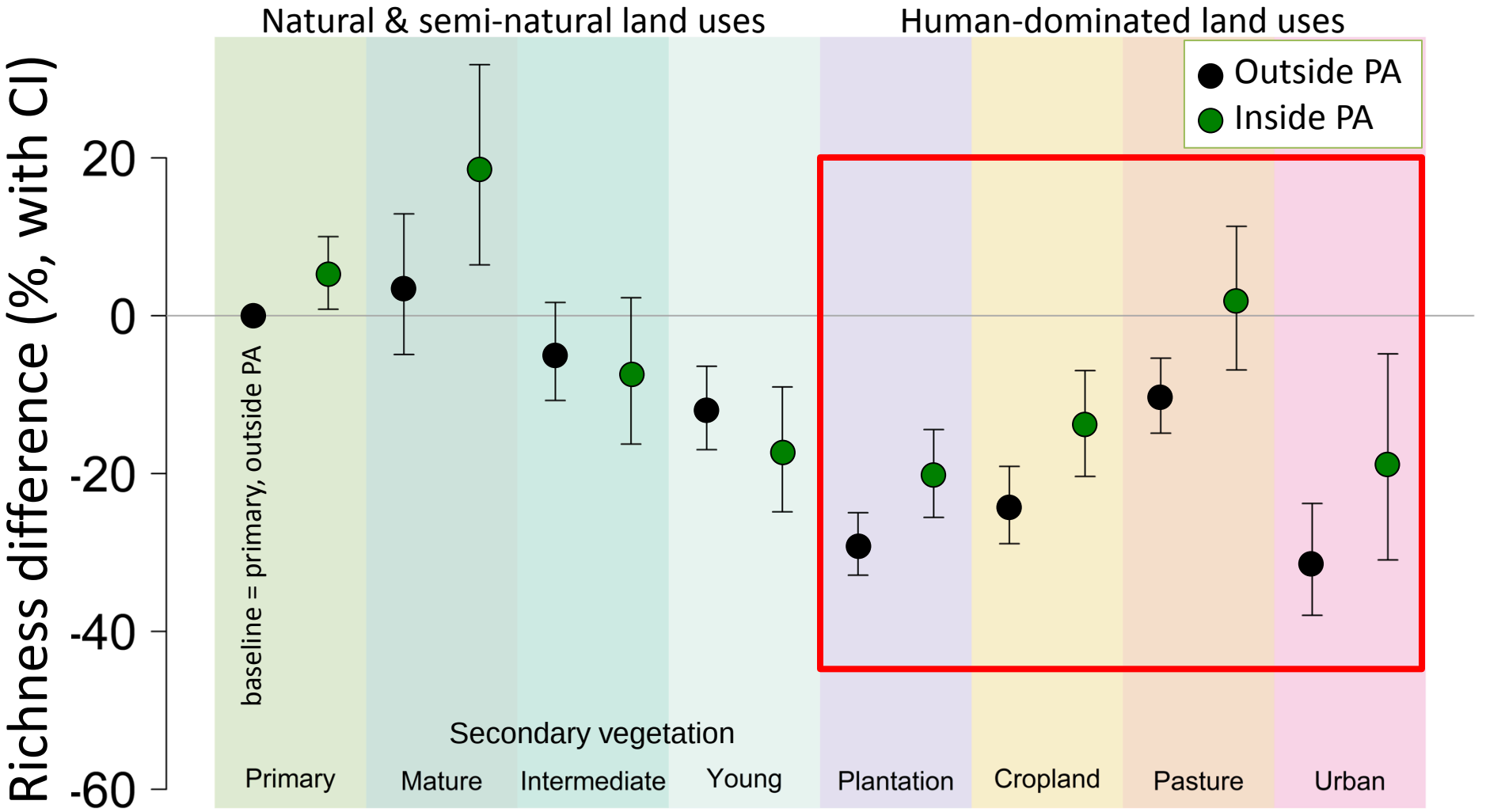
Estimate **PA effectiveness**:

- 51% for species richness
- 84% for total abundance

Land use and diversity outside PAs

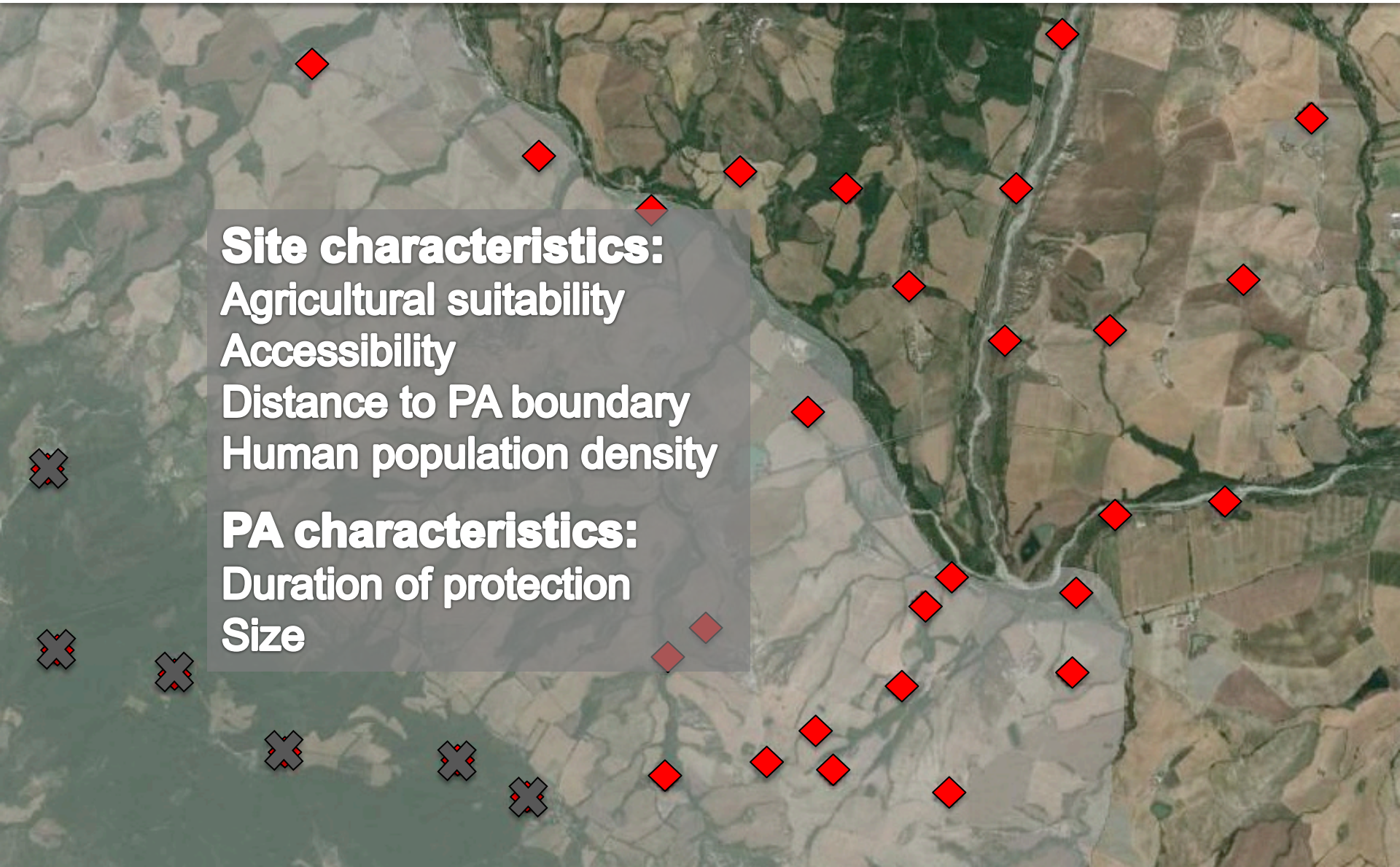


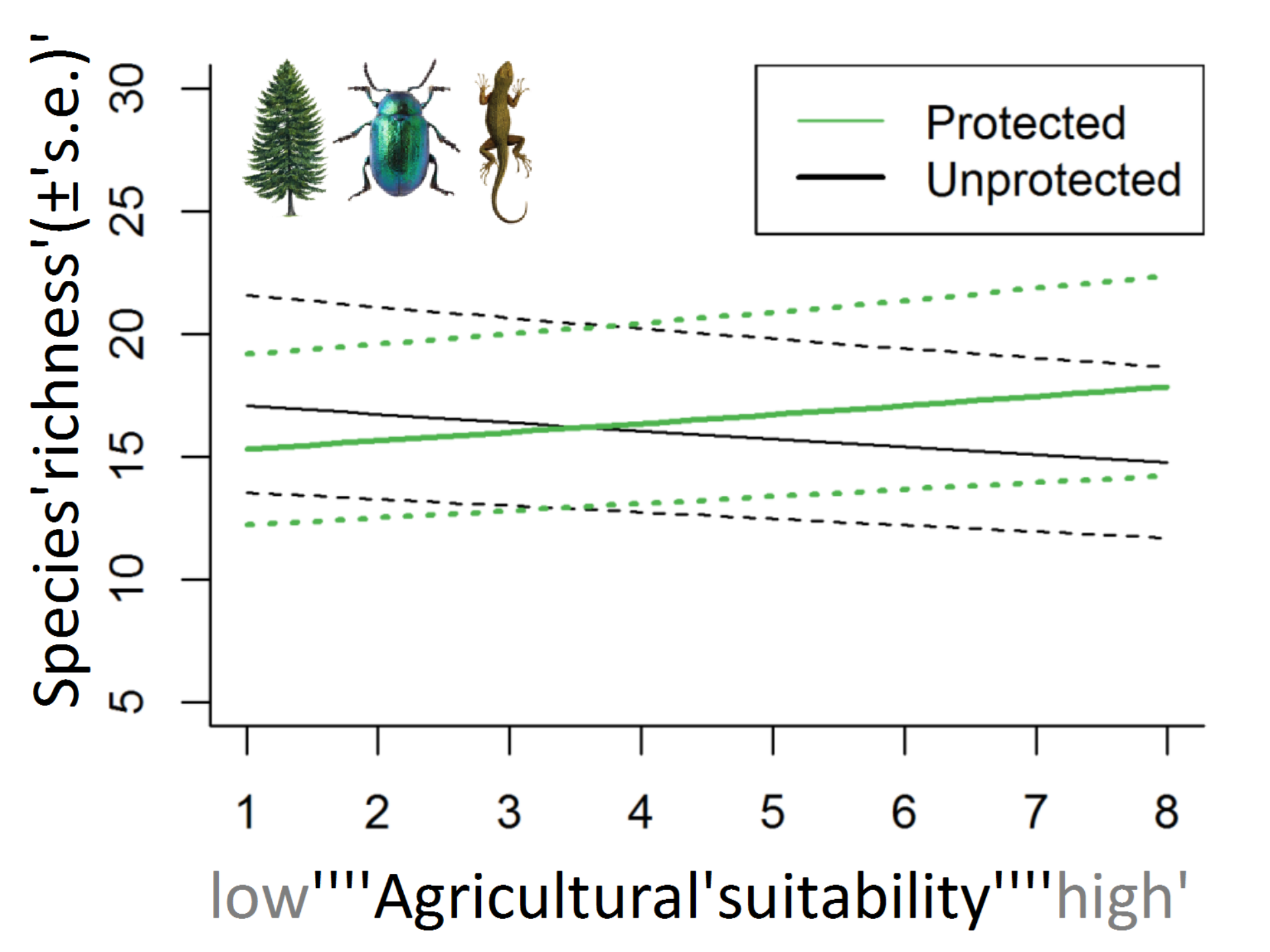
PAs mitigate land-use effects



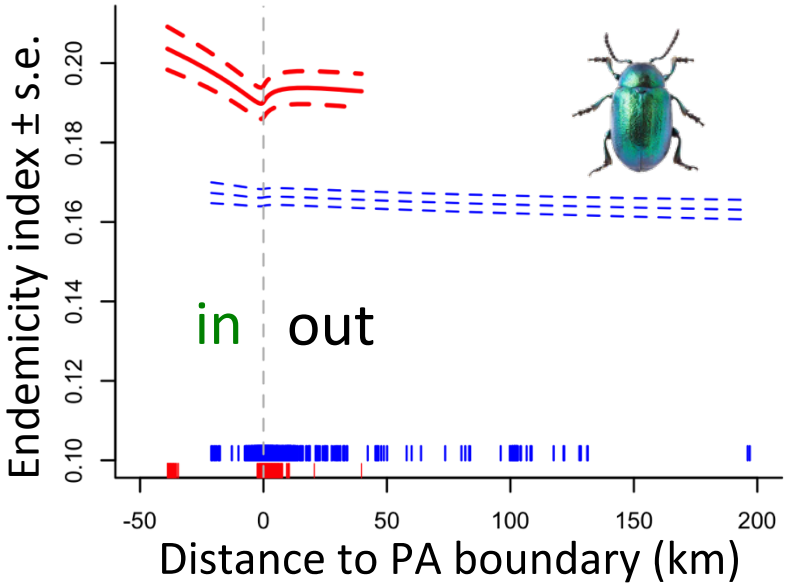
… especially in tropics, and especially for invertebrates

What features of sites & PAs matter?



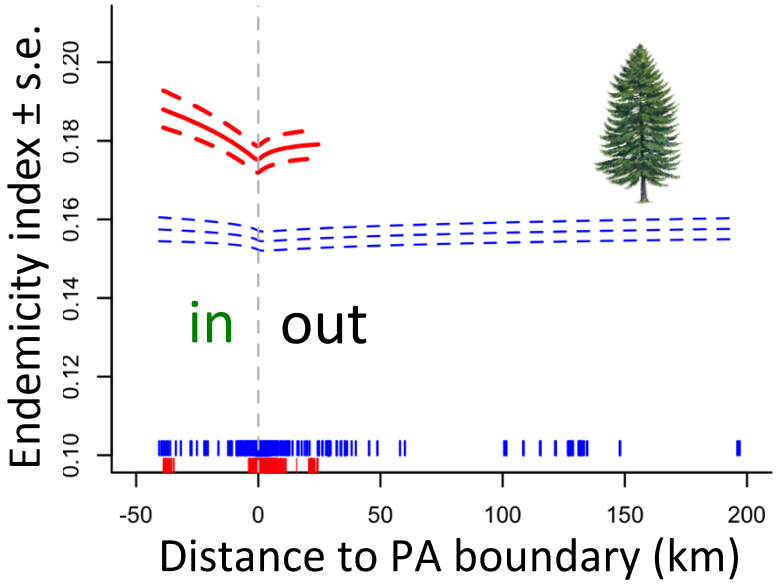

Species'richness'(±'s.e.)'
5
10
15
20
25
30
1
2
3
4
5
6
7
8
low''''Agricultural'suitability''''high'
Protected
Unprotected

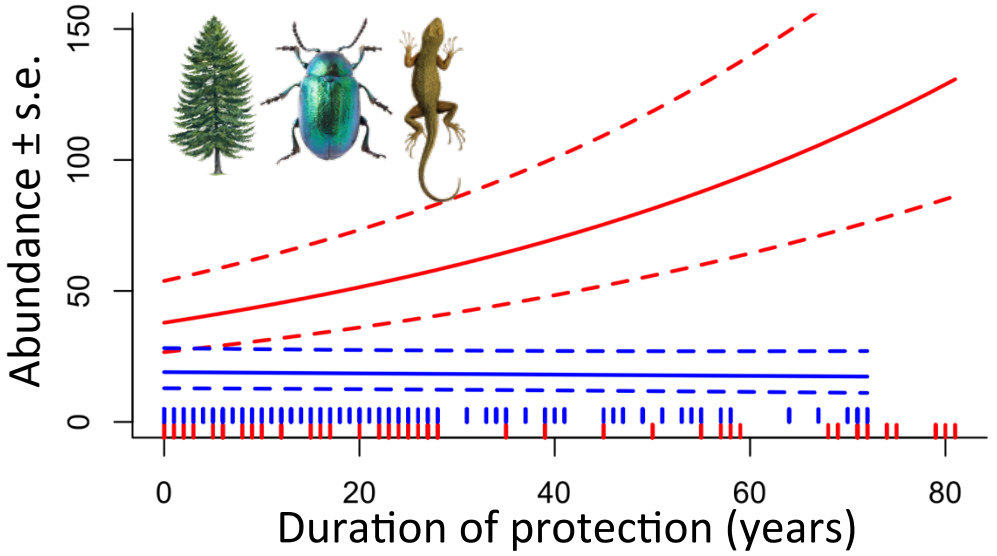
Tropical vs temperate



In the tropics:

- Invertebrate endemicity is higher further inside PAs (also richness)
- Botanical endemicity is higher further inside PAs (not richness)
- Abundance is higher in older PAs





#PredictsProject
www.predicts.org.uk

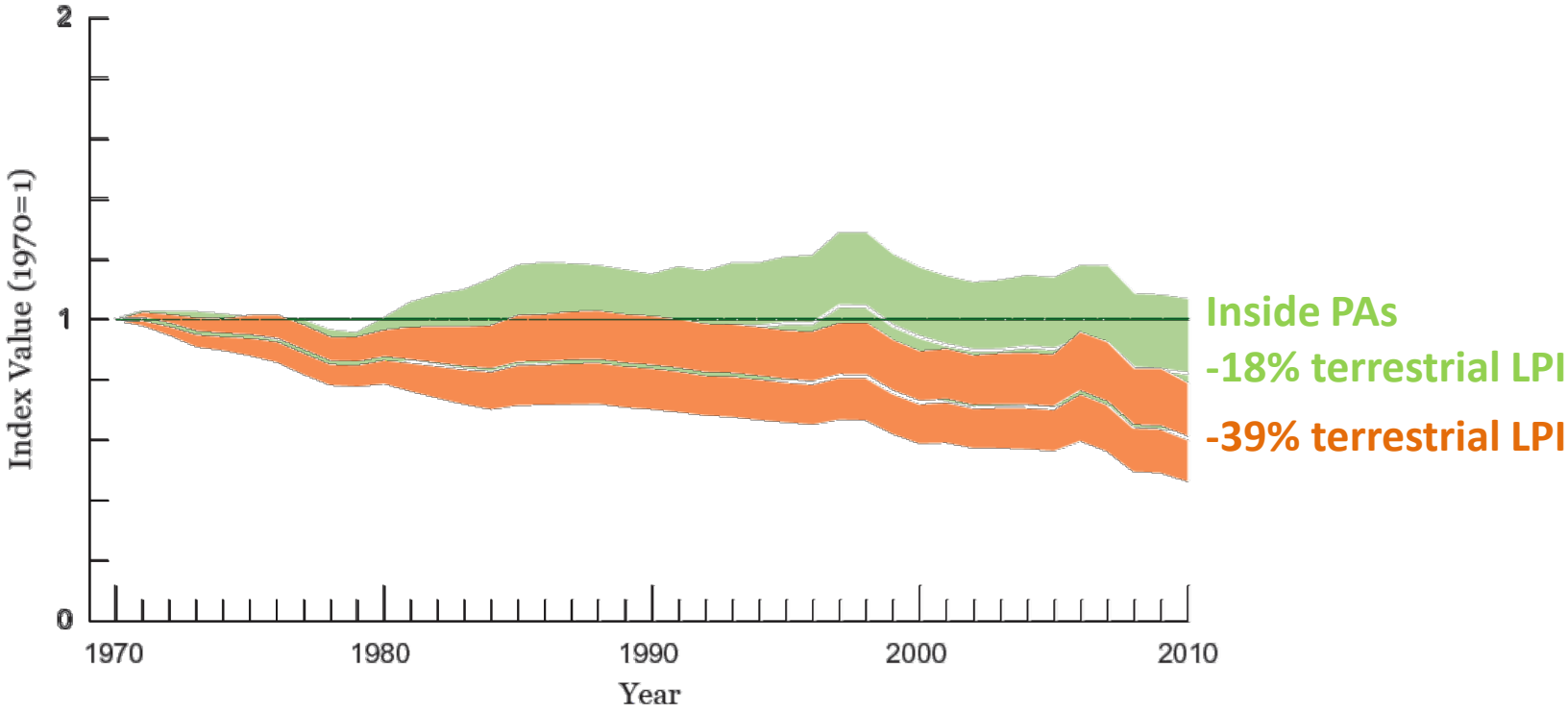
- How effective are terrestrial Protected Areas?
  - **51%** for species-richness, **84%** for abundance
- Mitigate responses or just reduce pressures?
  - Mitigate responses to land-use change, esp. in tropics
  - Response to human population is same inside and out
- Where do PAs make most difference?
  - Tropics
  - Land suitable for agriculture
  - Large, long-established PAs
- Effects of PAs are strongly contingent
  - Vary widely among regions, land uses and taxa
  - Need taxonomic & geographic breadth to get full picture

Any questions?

#PredictsProject
www.predicts.org.uk
andy.purvis@nhm.ac.uk

Many thanks to:
WDPA team
PREDICTS team
PREDICTS data contributors

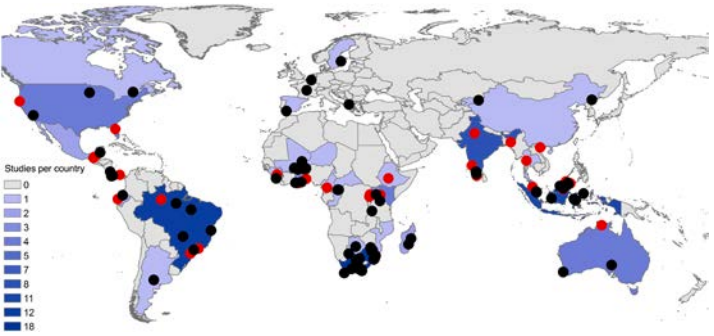
Species



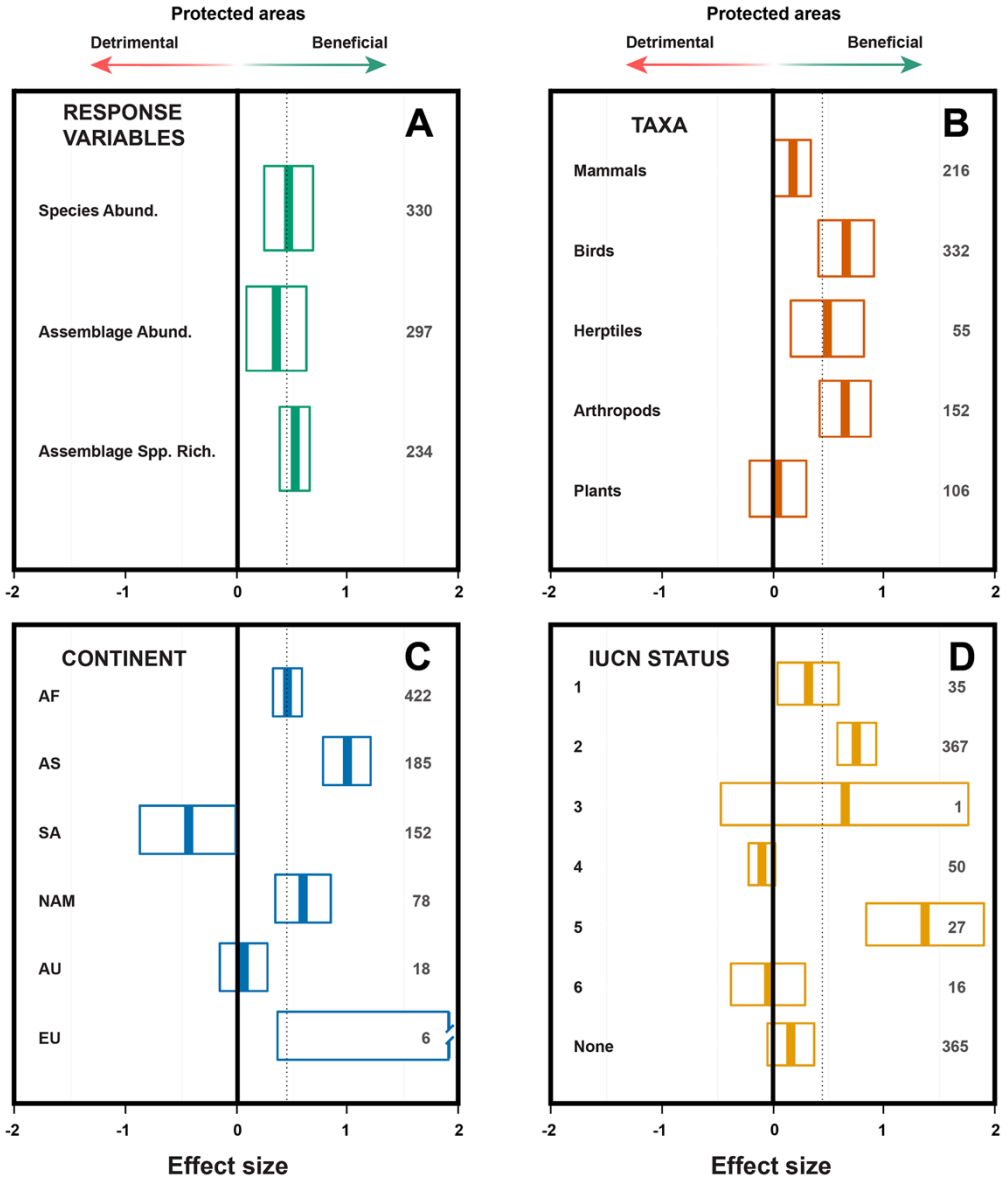
Inside/outside PAs: 1,956 / 4,182 populations;
773 / 1,562 mammal, bird, reptile, amphibian species

WWF 2014 *Living Planet Report*

Species

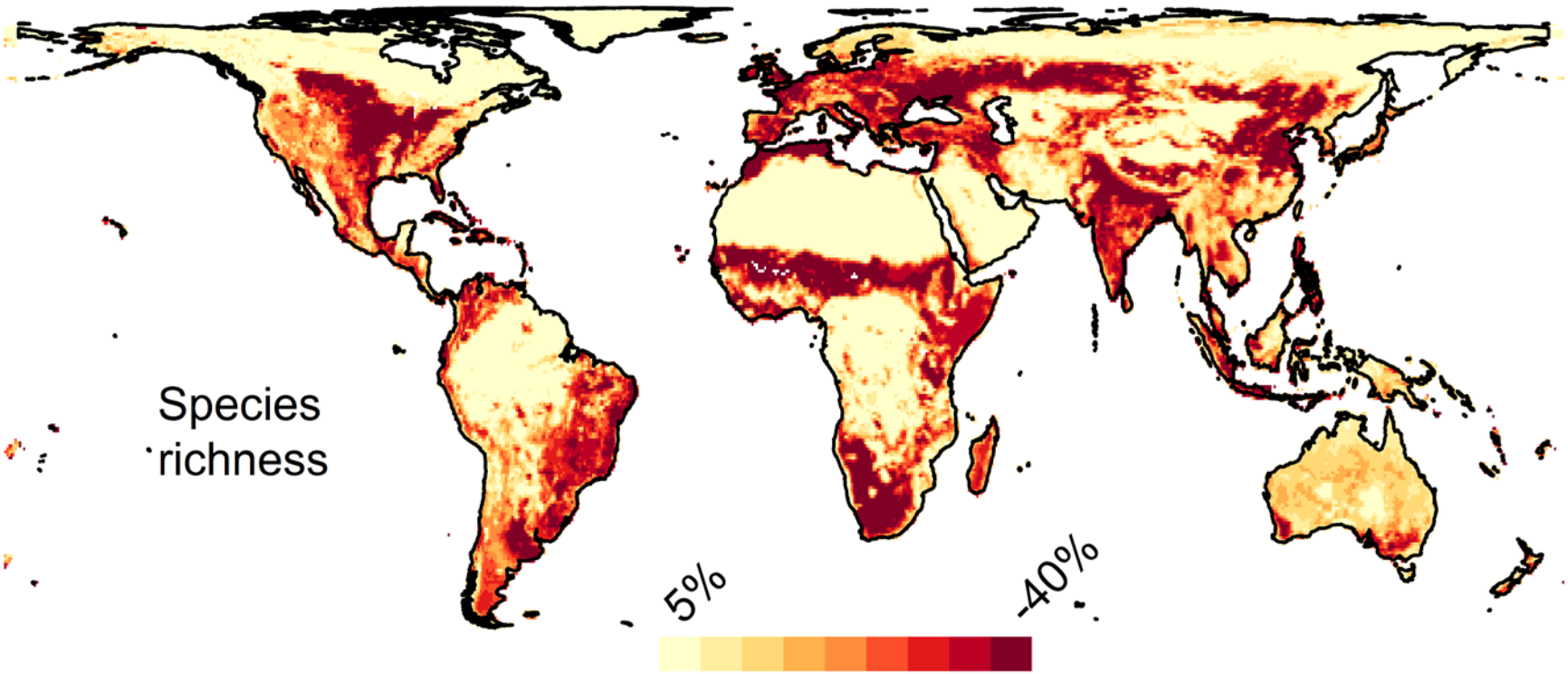


86 sources
57 protected areas



Coetzee et al. 2014 *PLoS ONE*

Loss of species diversity to date

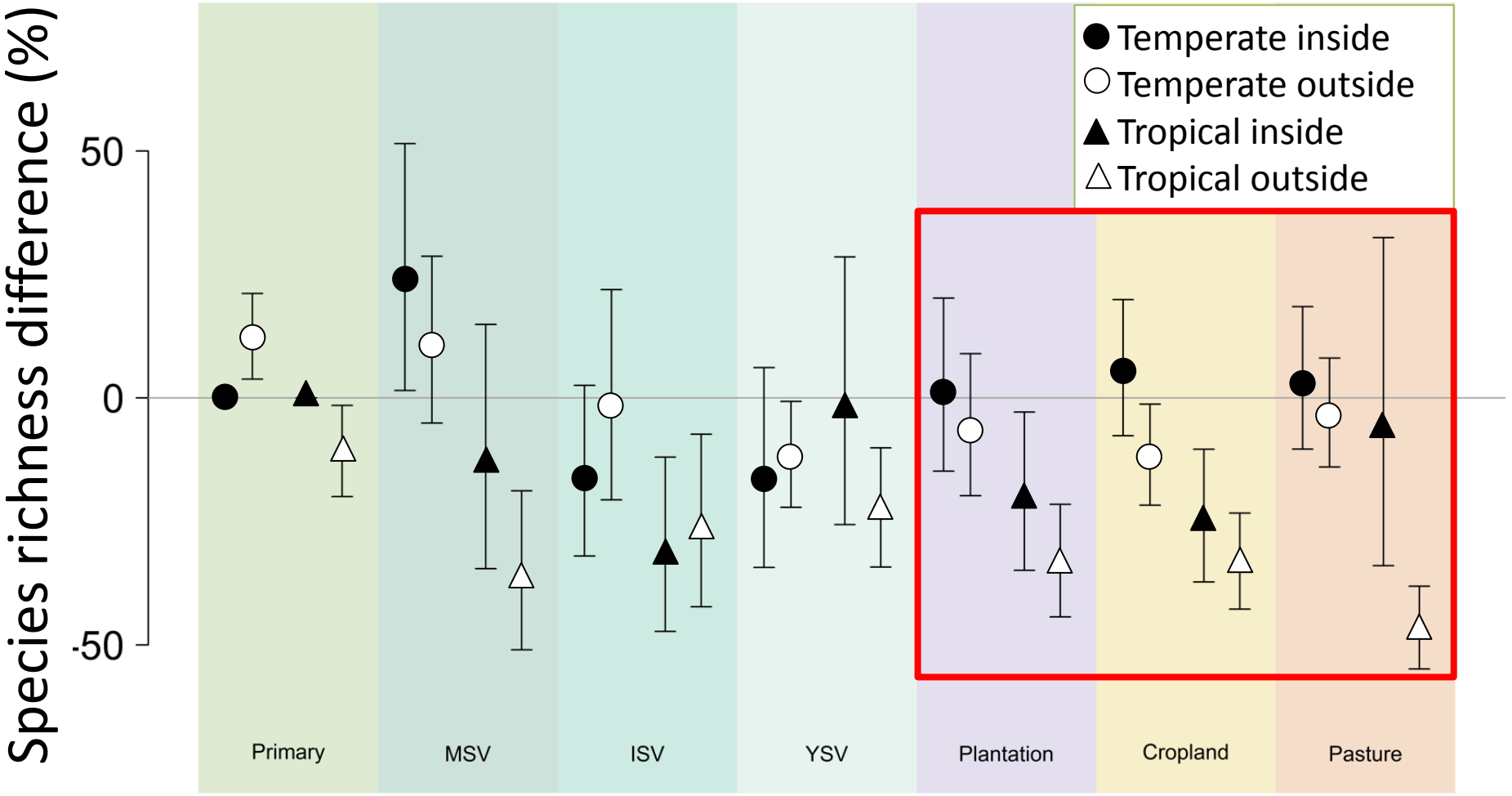


Newbold et al. (in revision)

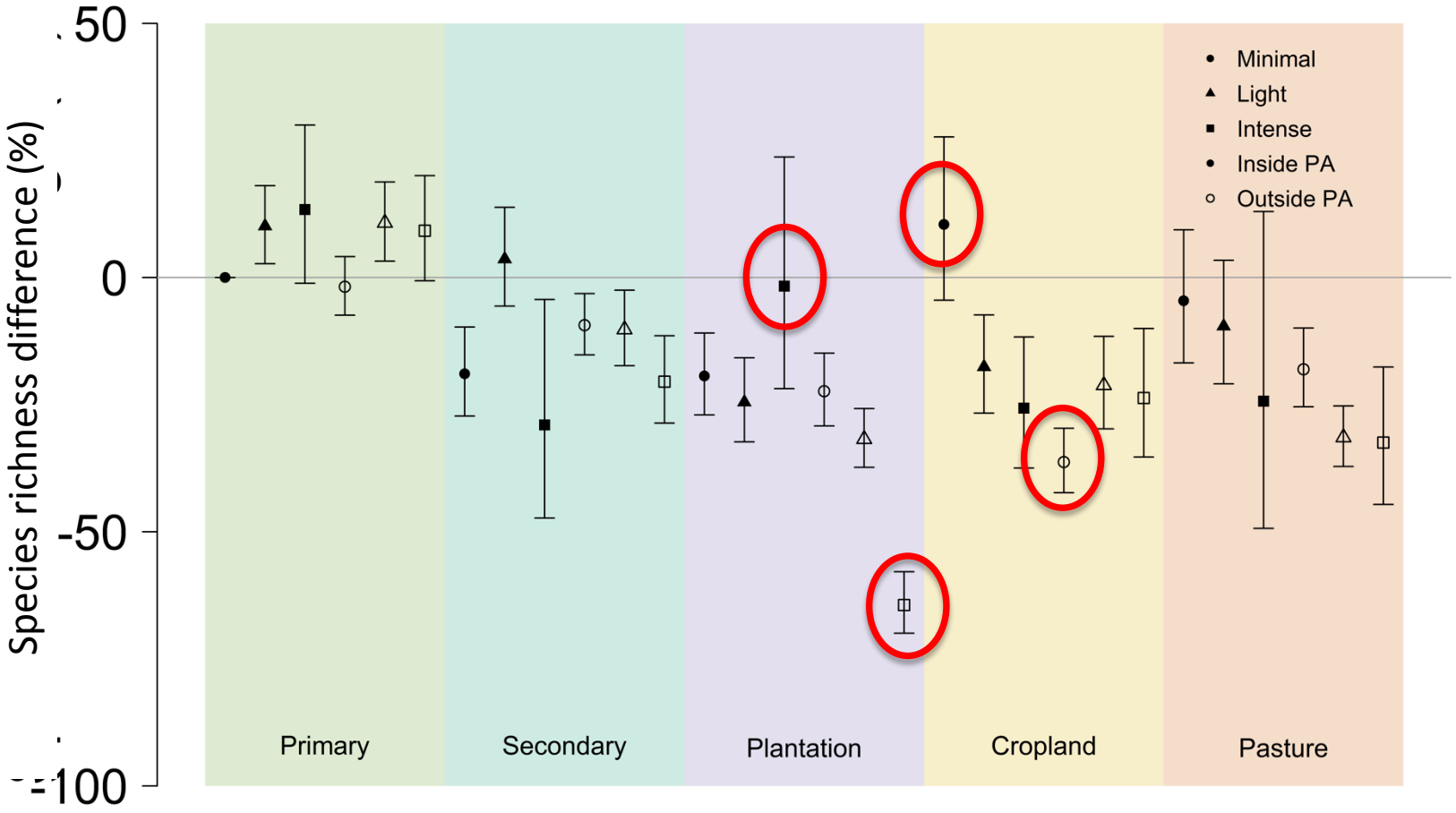
Coerce sites into matrix of land use classes and land use intensities

Land cover class	Minimal use	Light use	Intense use
Primary forest (forest composed of native vegetation, which is not known to have been destroyed during historical times)	Any threats identified are very minor (e.g., very light use) or very limited in the scope of their effect (e.g., hunting of a particular species of limted ecological importance).	One or more threats of moderate intensity (e.g., selective logging) or breadth of impact (e.g., bushmeat extraction), which are not severe enough to markedly change the nature of the ecosystem.	One or more threats that is severe enough to markedly change the nature of the ecosystem (e.g., clear-felling).
Primary non-forest	…	…	…
Mature Secondary Vegetation	…	…	…
Intermediate Secondary	…	…	…
Young Secondary Vegetation	…	…	…
Secondary Vegetation (indeterminate age)	…	…	…
Plantation forest	…	…	…
Cropland	…	…	…
Pasture	…	…	…
Urban	…	…	…

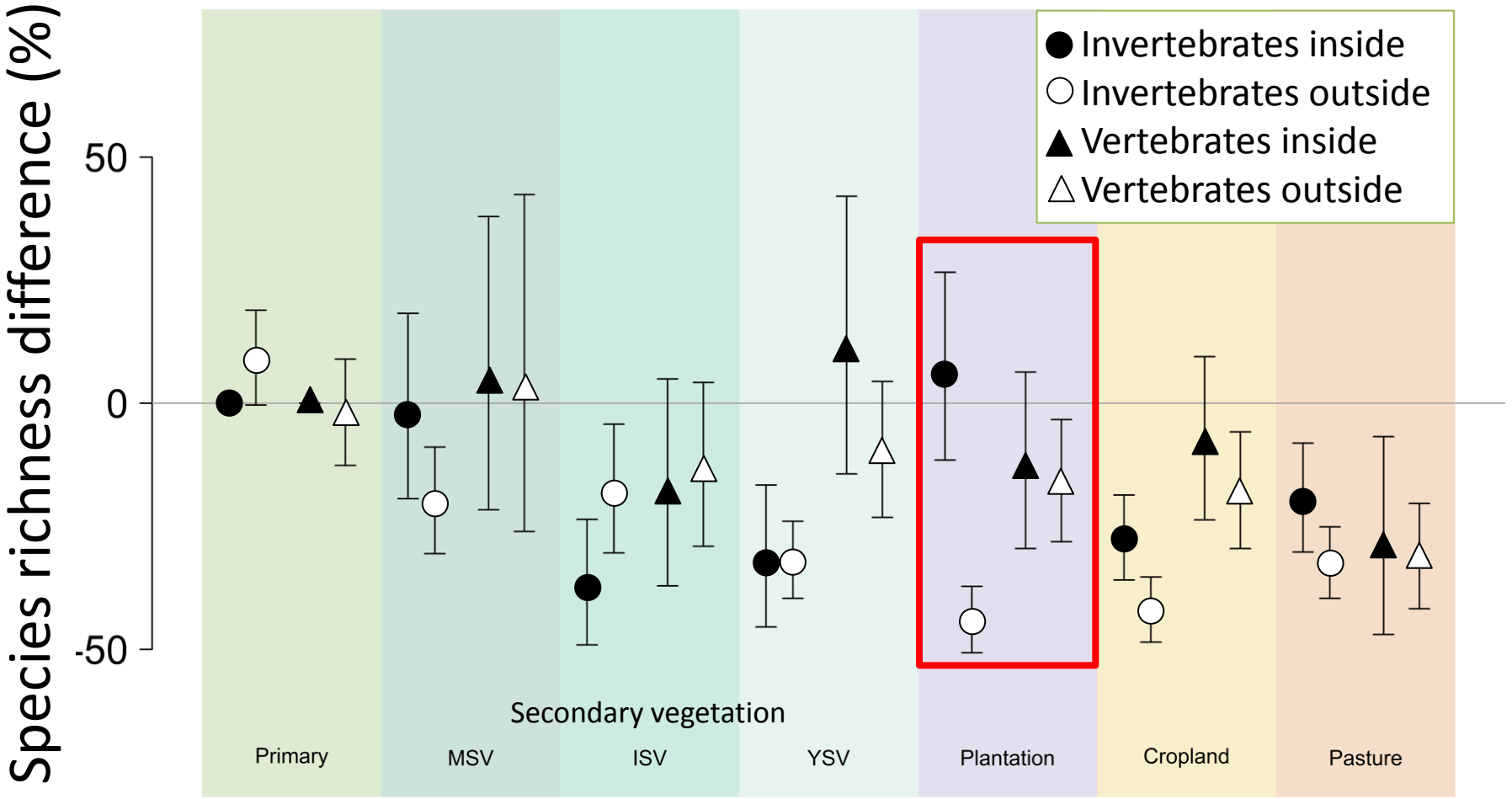
Land use has worse effects in tropics, but PAs there make more difference



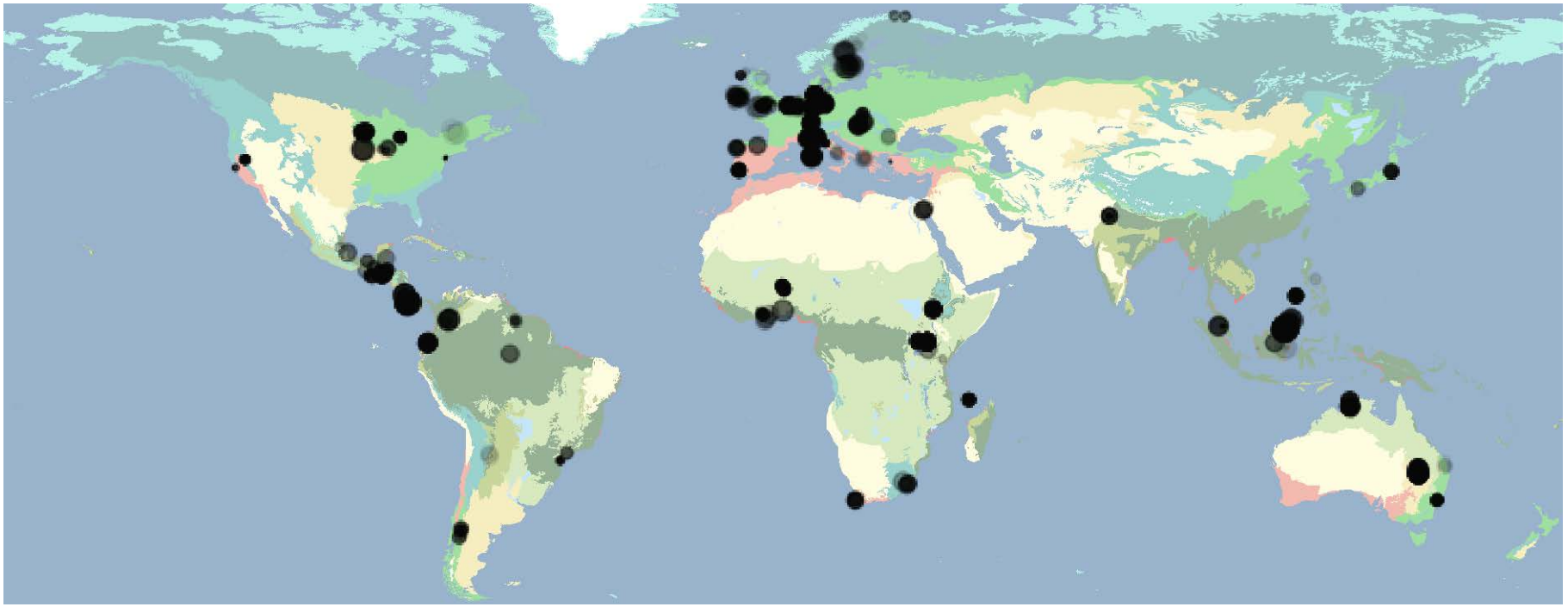
Given equal land-use intensity Protected Areas retain higher biodiversity, in most cases



Effect of PAs varies among taxa



The data set: matched land-use

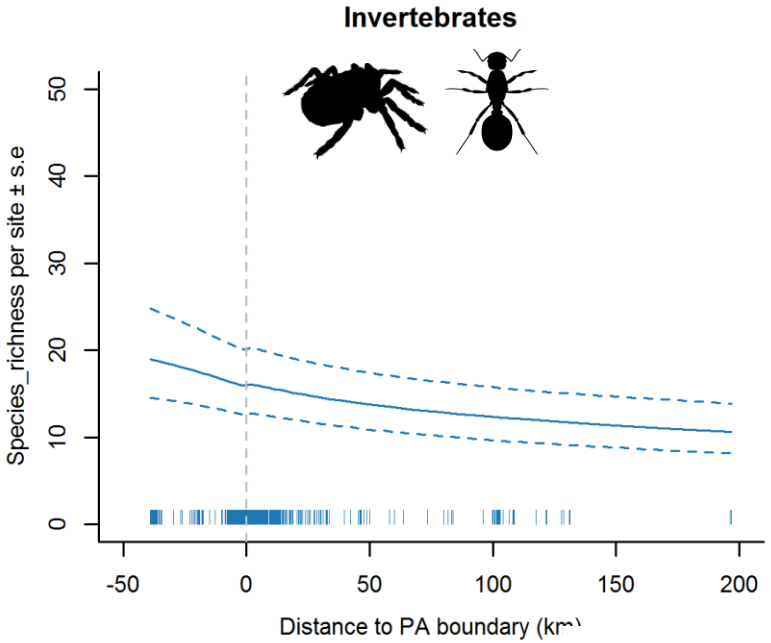


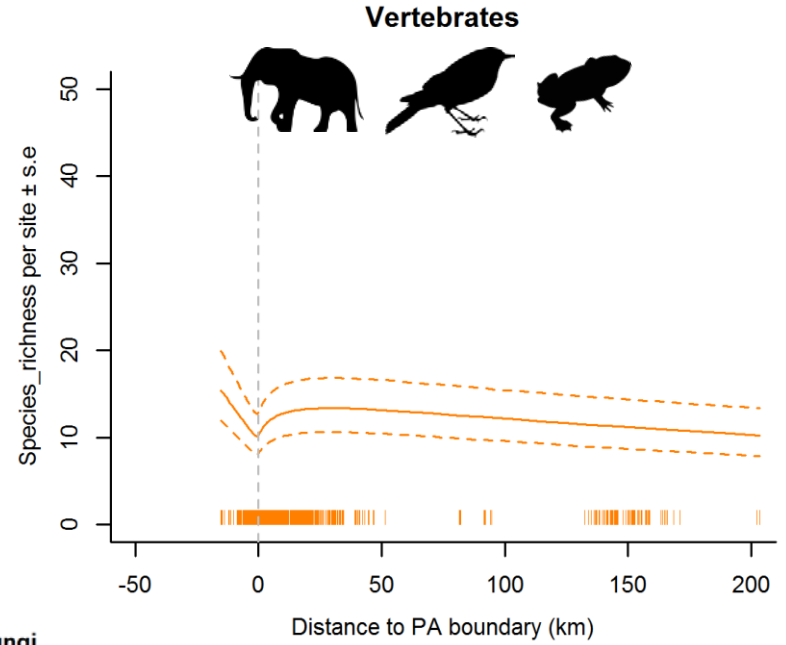
8,512 sites
48 countries
95 ecoregions

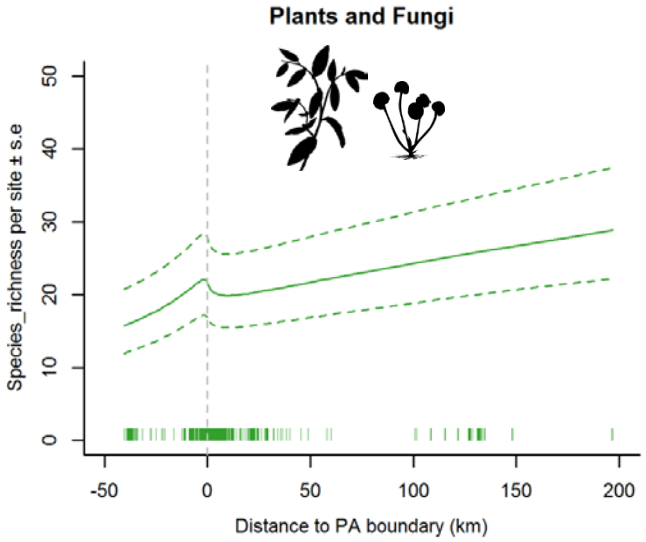
116 published sources
179 data sets
907,270 samples

17 hotspots
420 protected areas
15,656 taxa

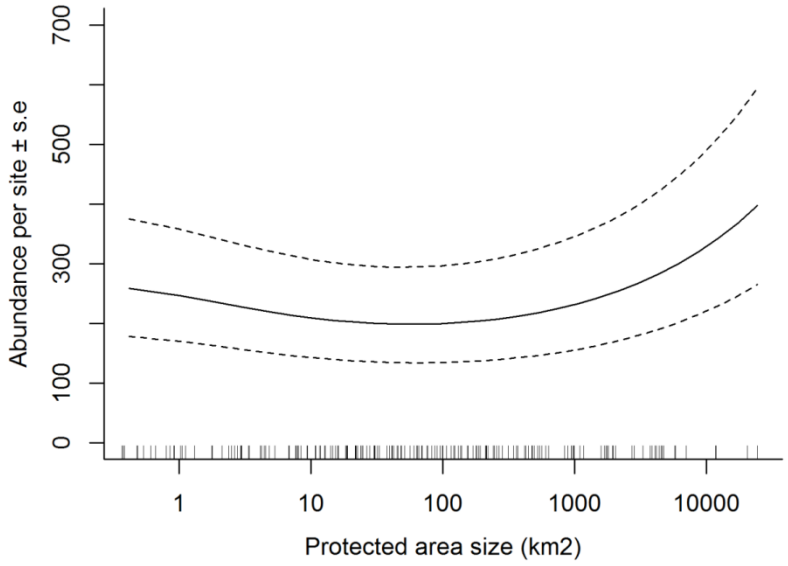
Higher species richness of invertebrates and vertebrates further inside PAs

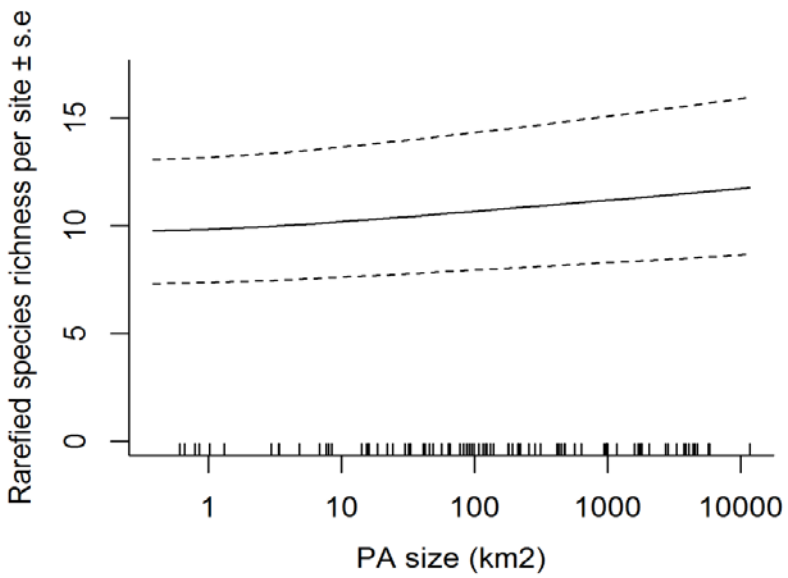






Does the size of the PA matter?





Yes, but no clear threshold size for recommendation