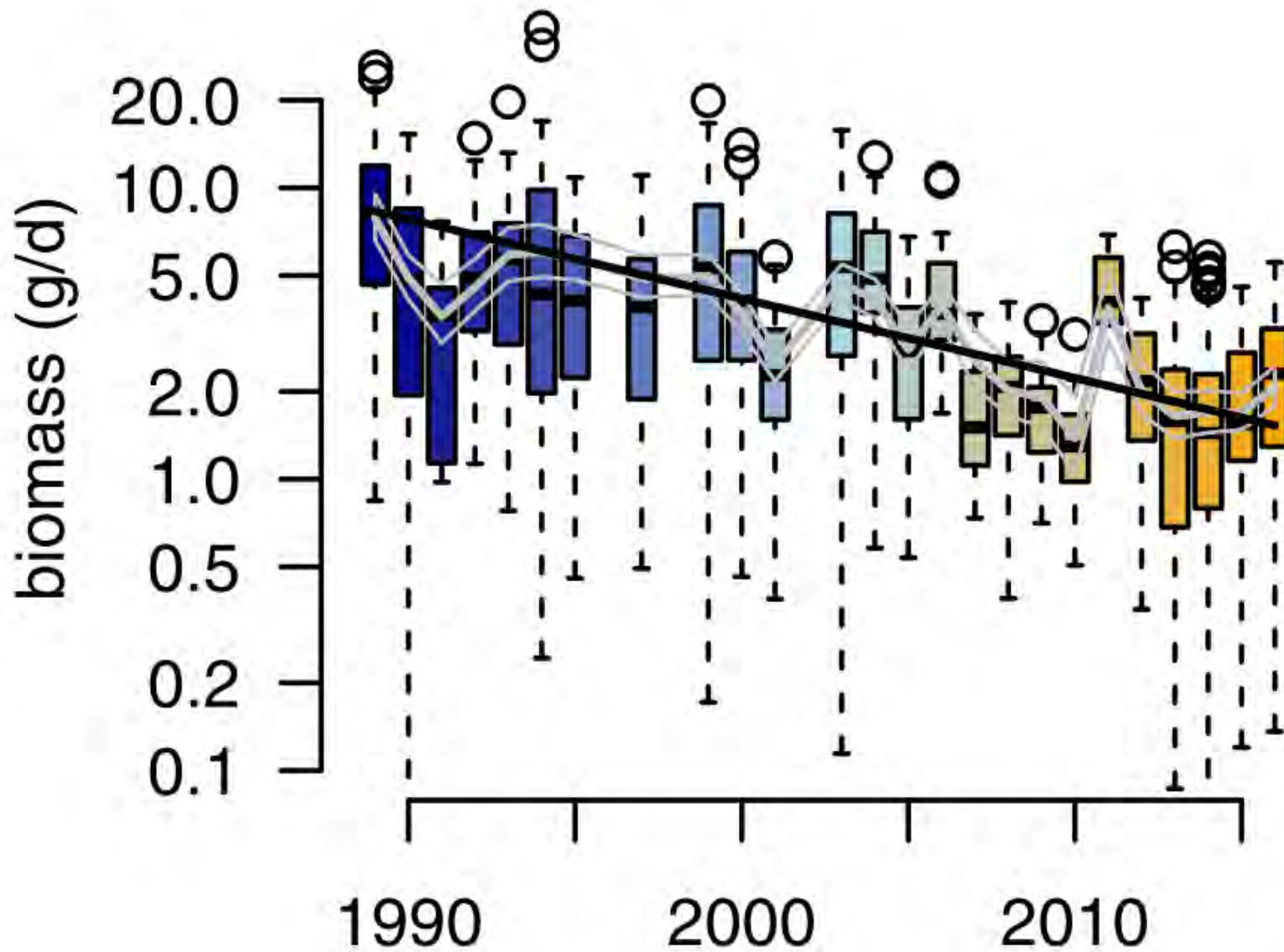


Anthropogenic land use and climate drive insect biodiversity change but not systematic loss

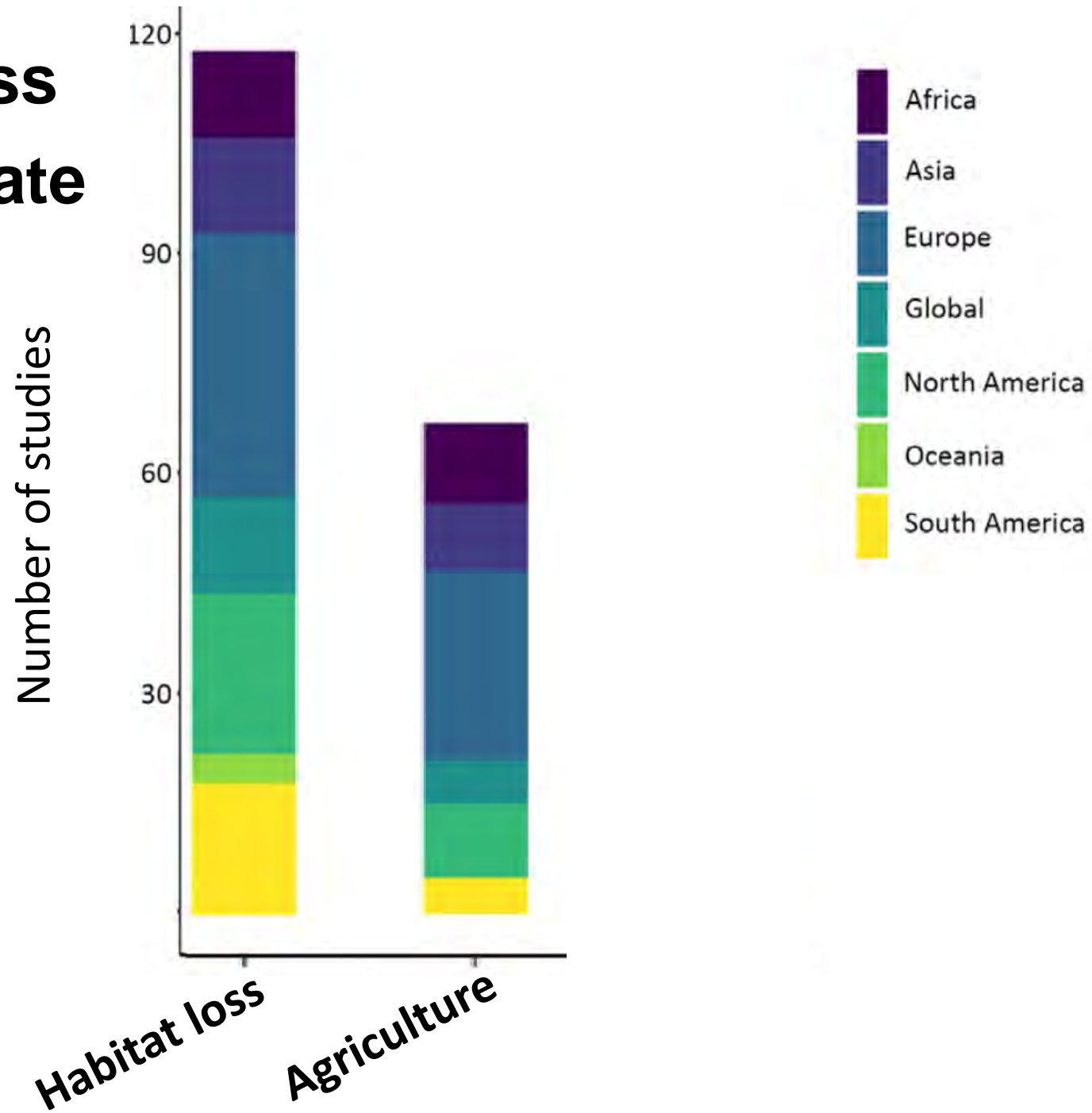
James Sinclair, Domink Buchner, Florian Leese, Steffen Pauls, Ellen Welti, and Peter Haase



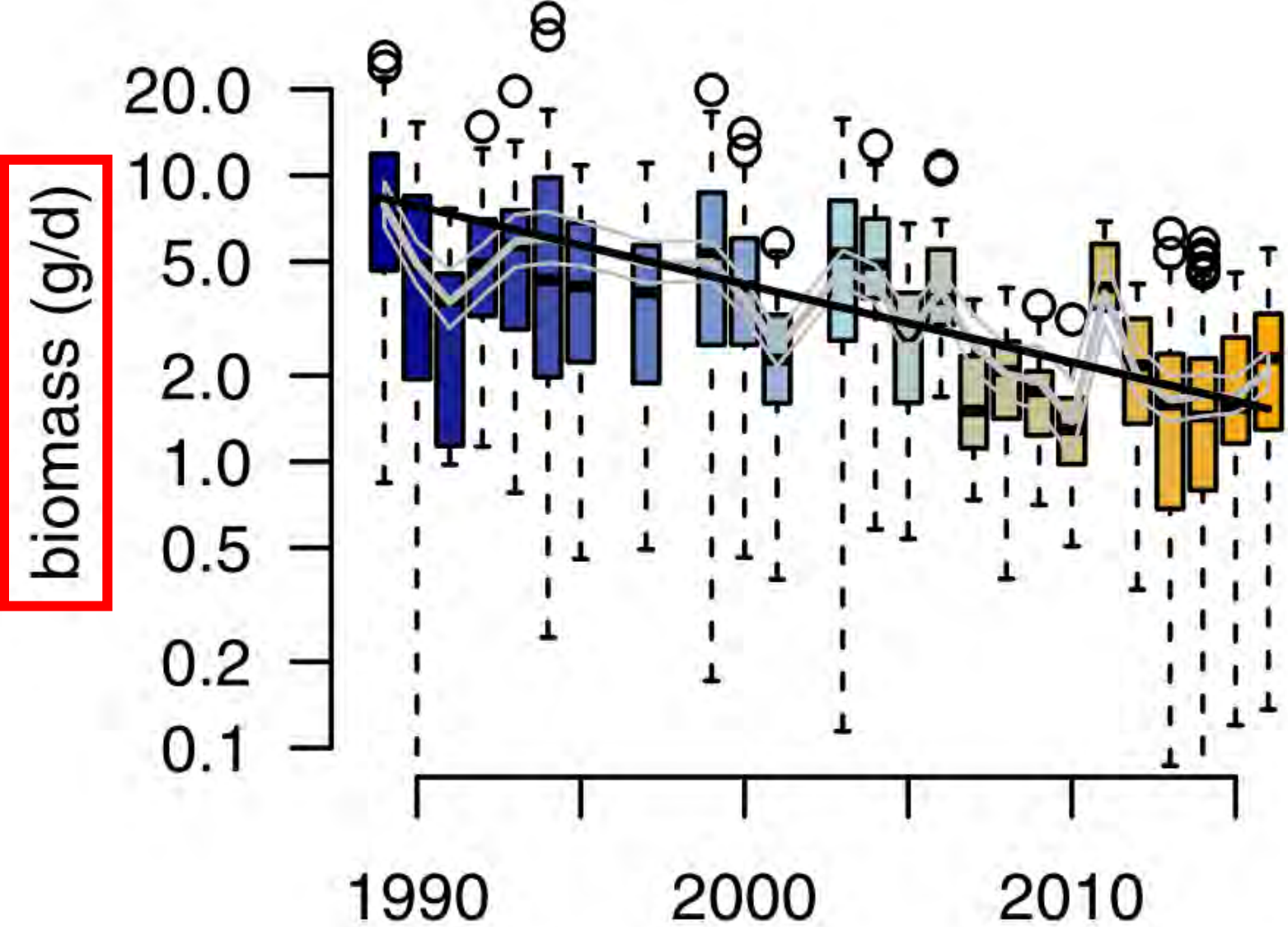
Reported declines in insects



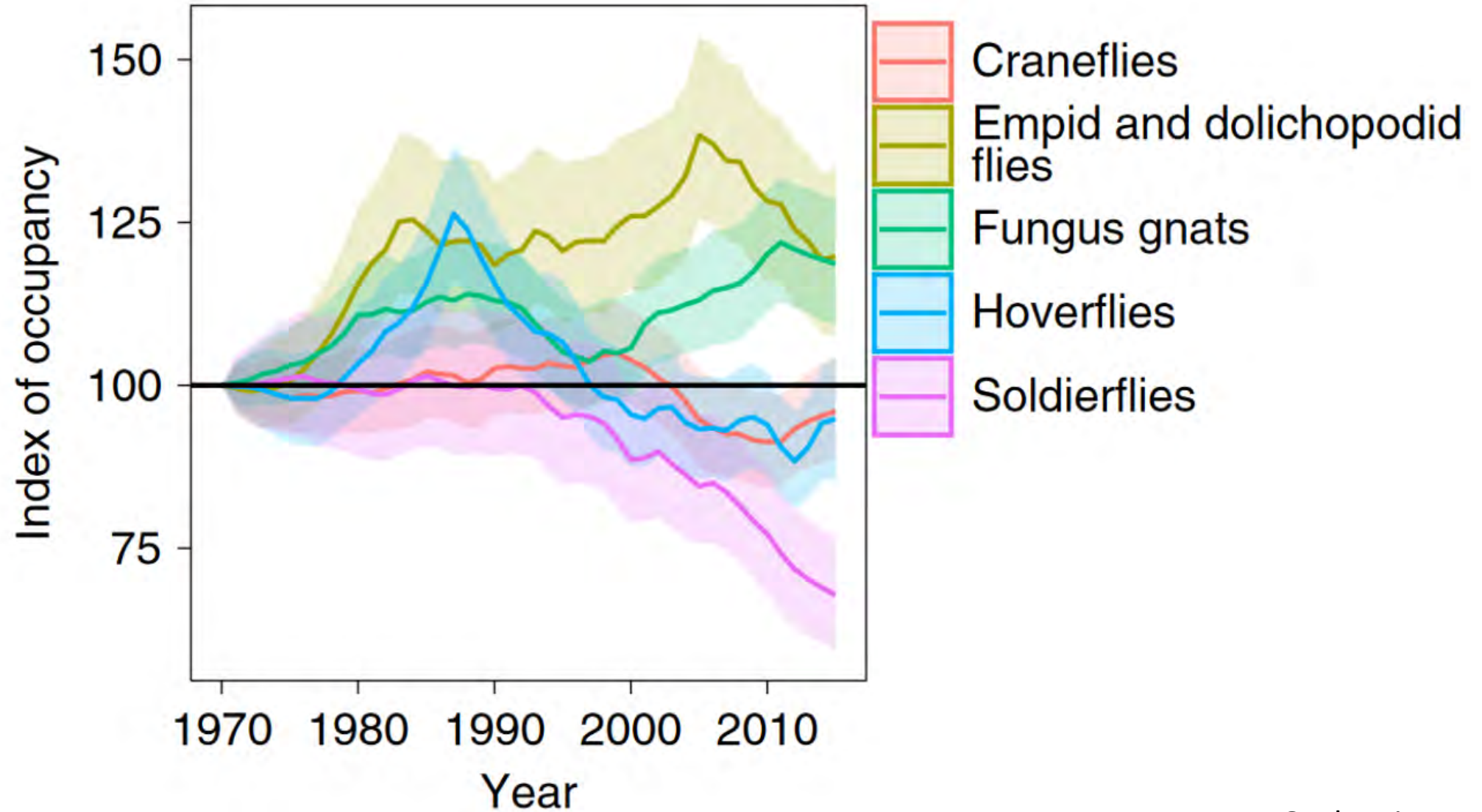
Habitat loss ...and climate

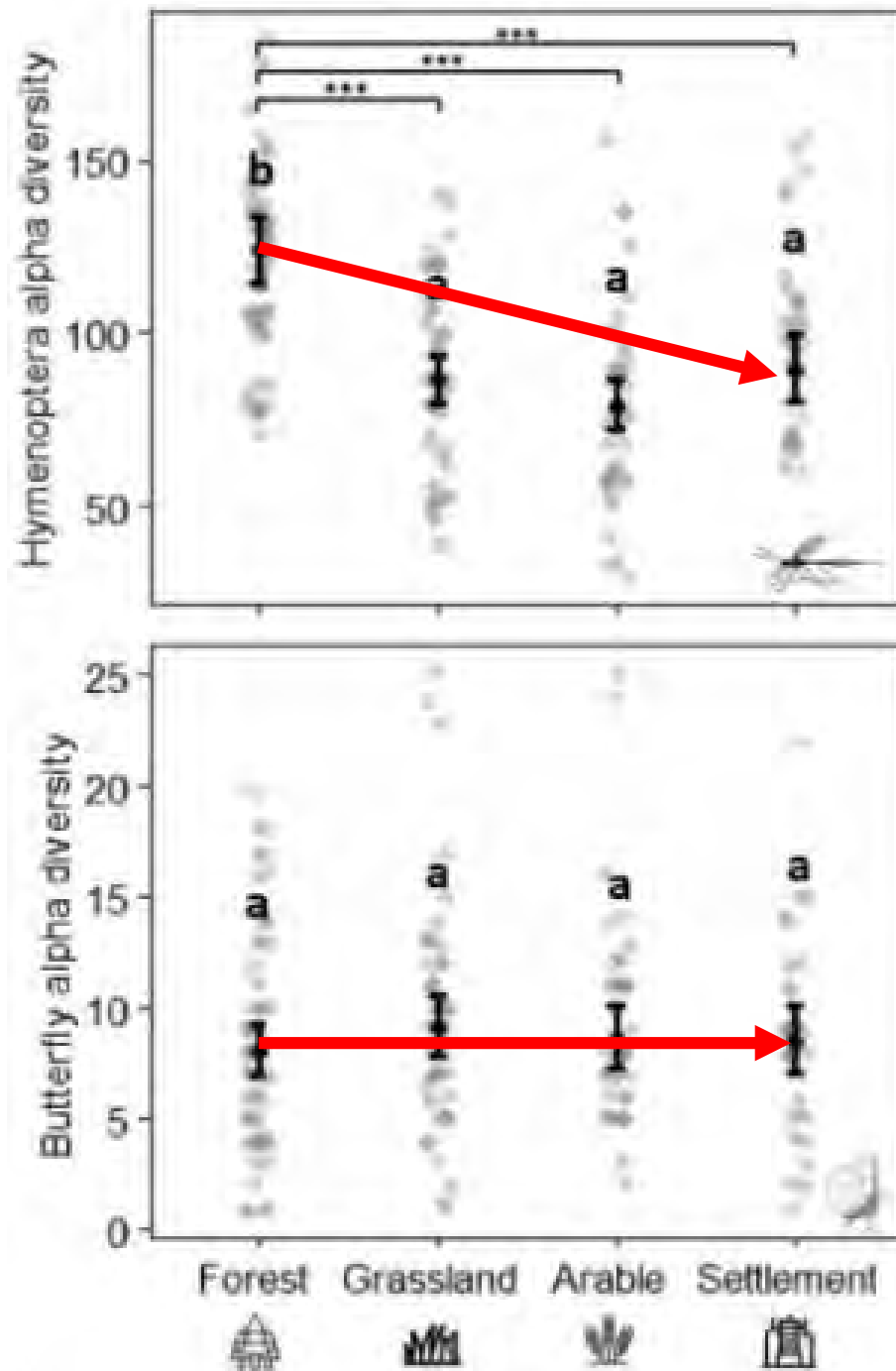


Studies can be restricted by metrics, taxa, or locality



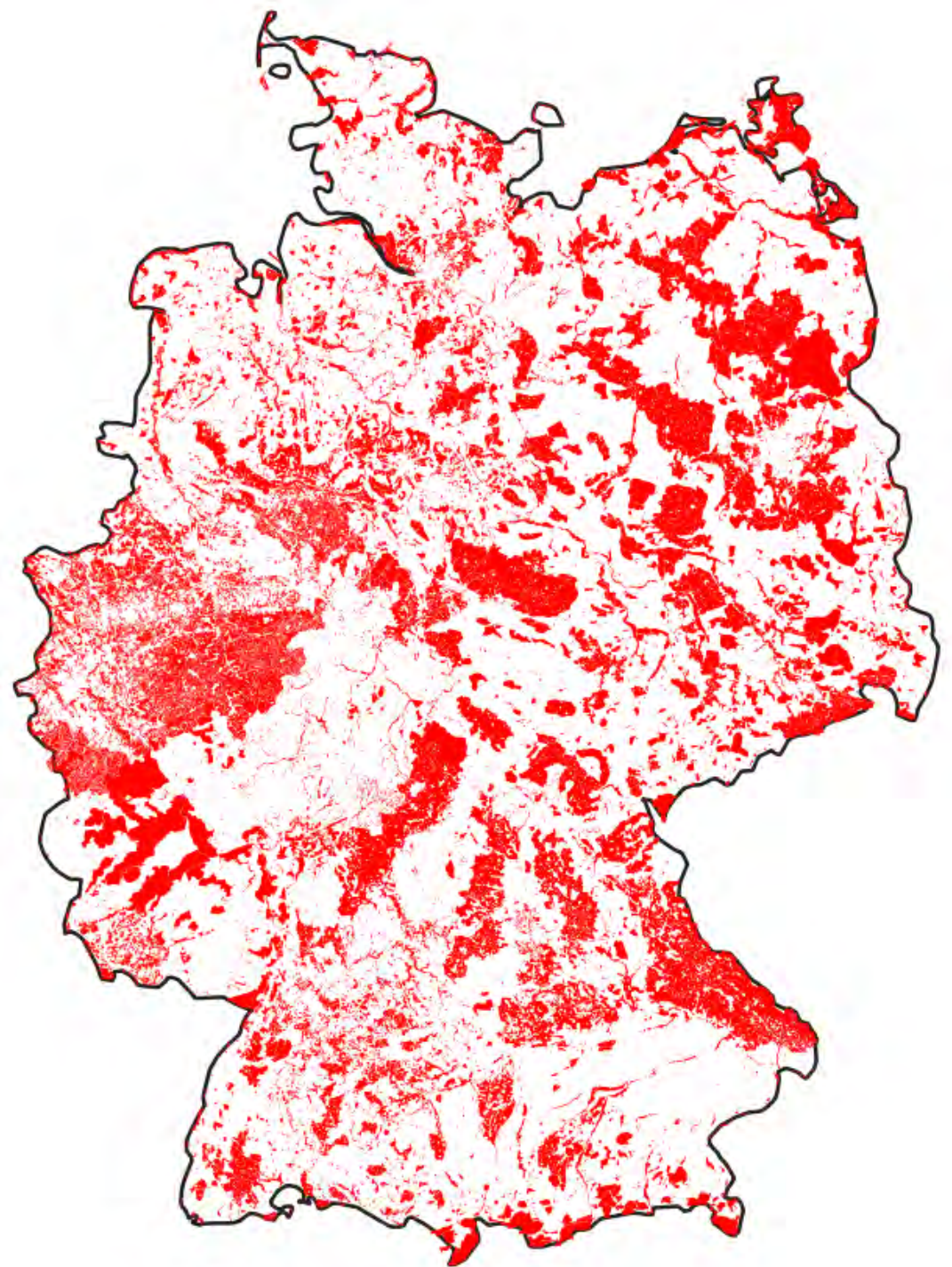
Changes can be more complex across the broader community





Protected areas (red)

- How are insects doing in protected versus unprotected areas?
- Are protected areas in hotspots of insect biodiversity?

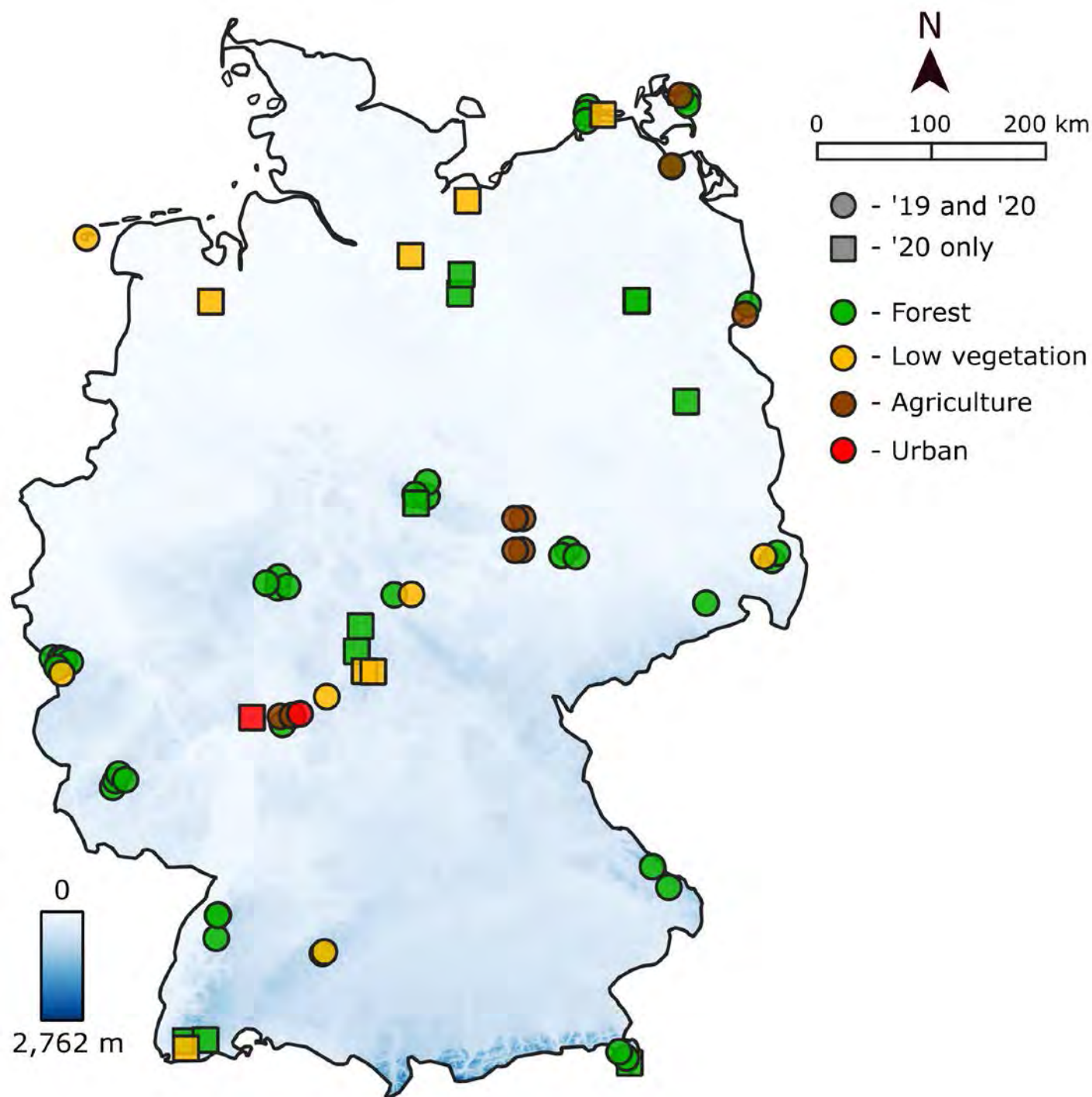


Q1: How are land use and climate affecting insect composition?

Q2: What is happening in protected versus unprotected areas?

German Malaise Trap Program

- 56 sites across Germany during 2019 and 75 in 2020
- Sites encompass a gradient of land use, climate, and elevation
- Sampled insects every two weeks (usually) from April to October which were identified to species via metabarcoding



Community composition

10,802 species

Flies
36%



Butterflies & moths
16%



Bees & wasps
22%



Beetles
17%



True bugs
6%



Key taxonomic groups



Red-listed species

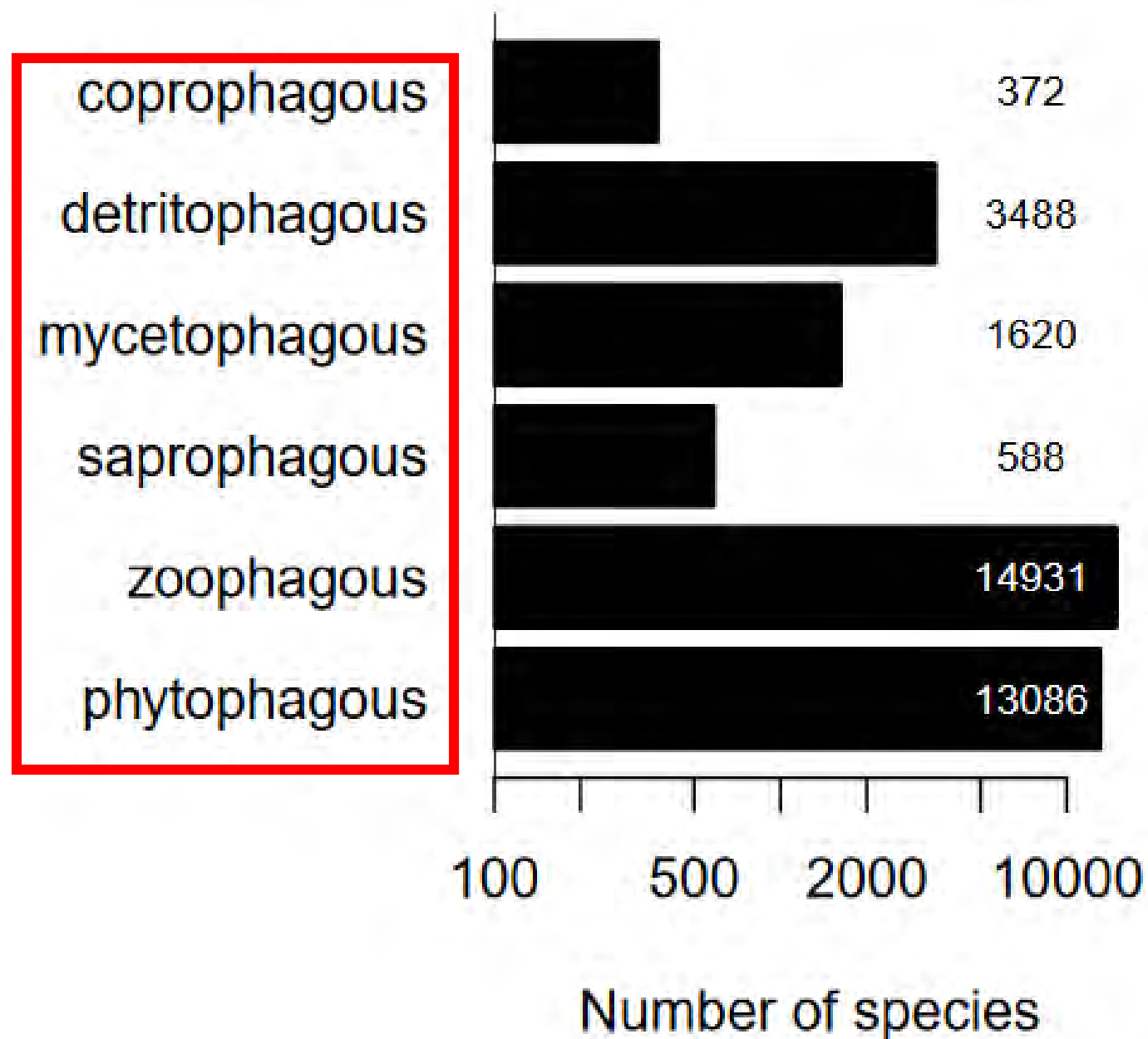


Pollinators



Invasive species

Feeding traits



Temporal turnover

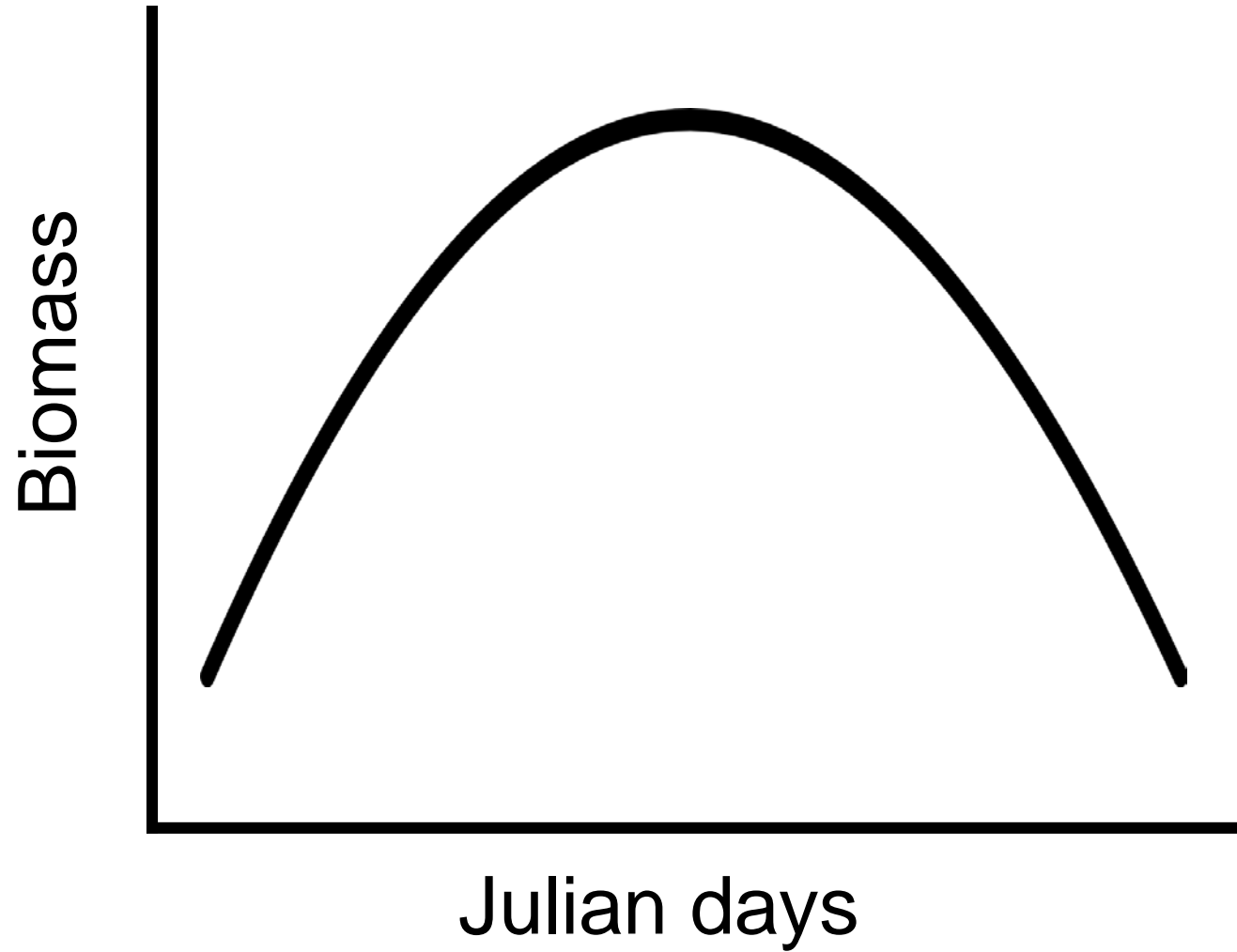
Low (0)



High (1)

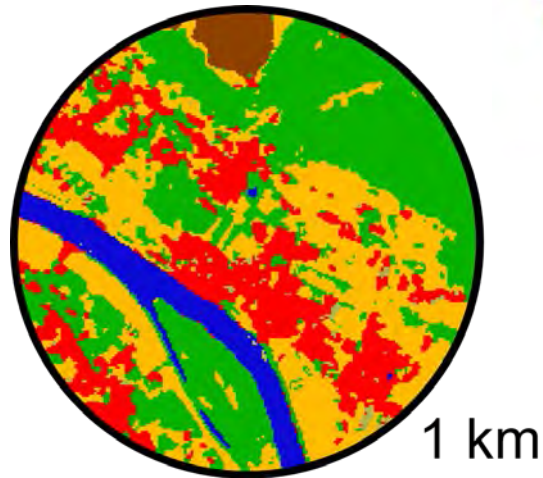
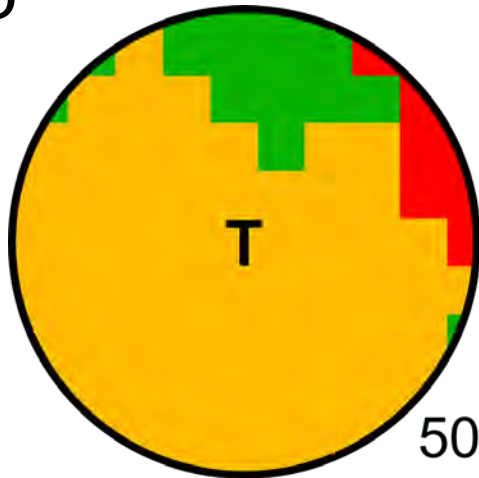


Timing of peak biomass and richness



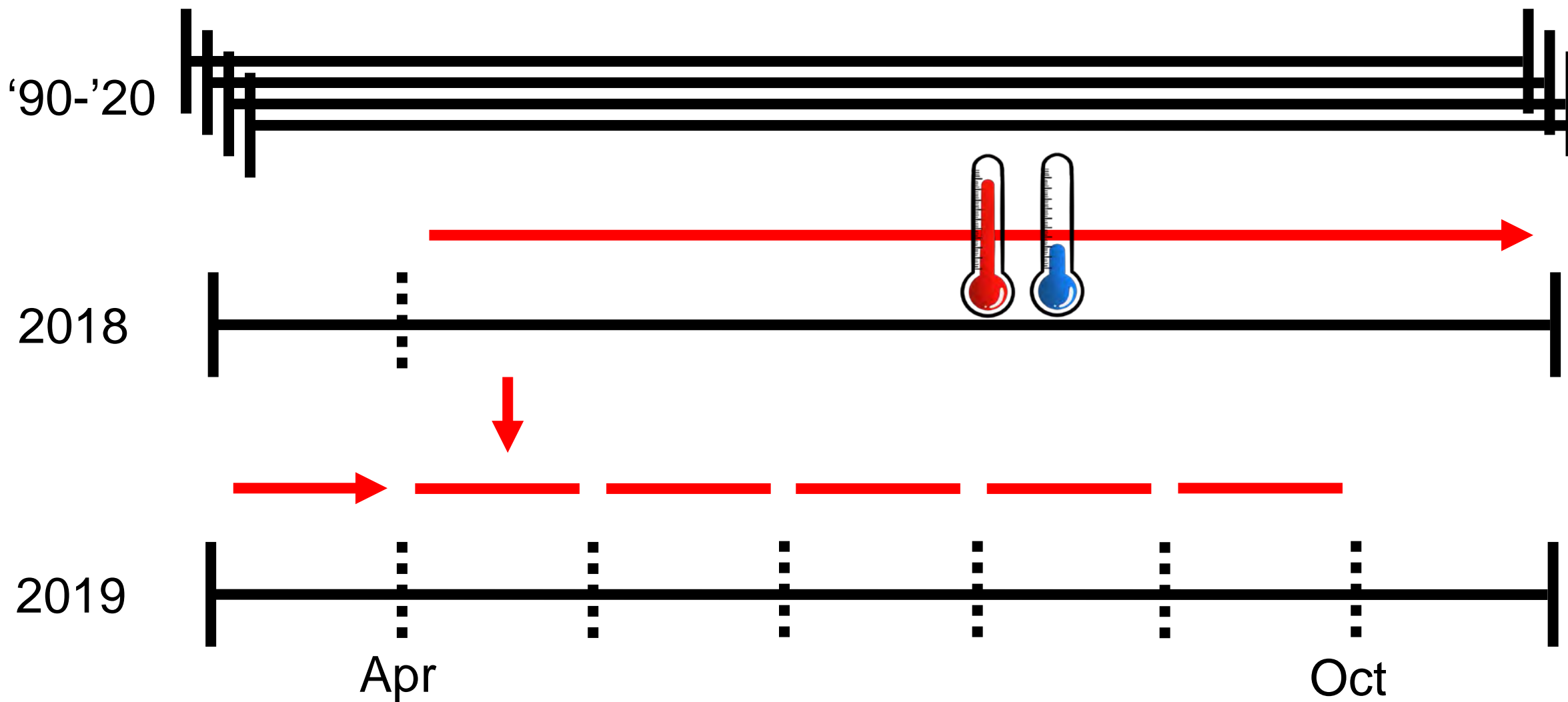
Land use

- Sentinel-2 satellite imagery with 10x10m resolution
- Forest, low vegetation (grasslands and meadows), urban, agricultural, and bare soil
- 50m and 1km buffer around each trap



Climate

Temperature, precipitation, and humidity



Protected areas

“Well-protected”

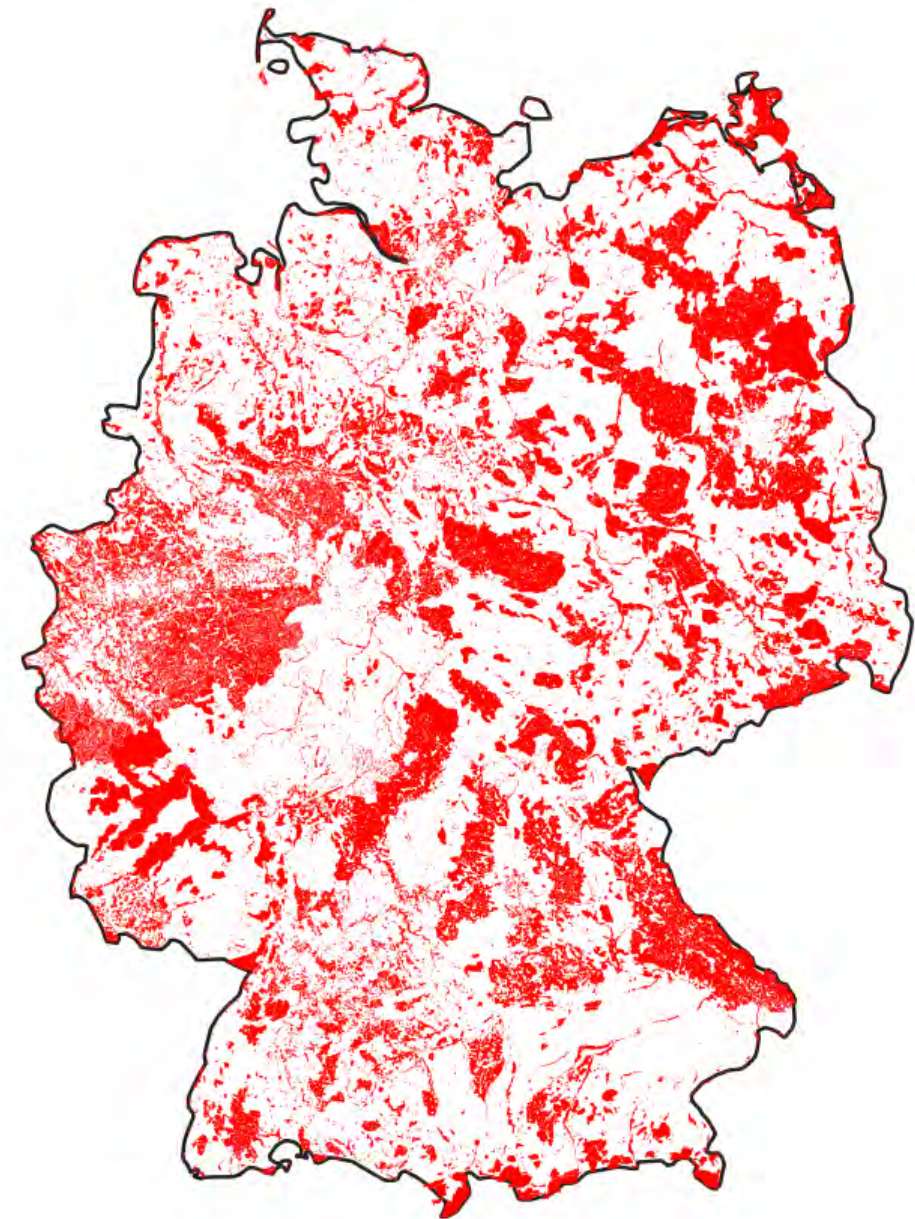
Nature reserves, national parks, biosphere reserves

→ **No development** (IUCN category II or IV)

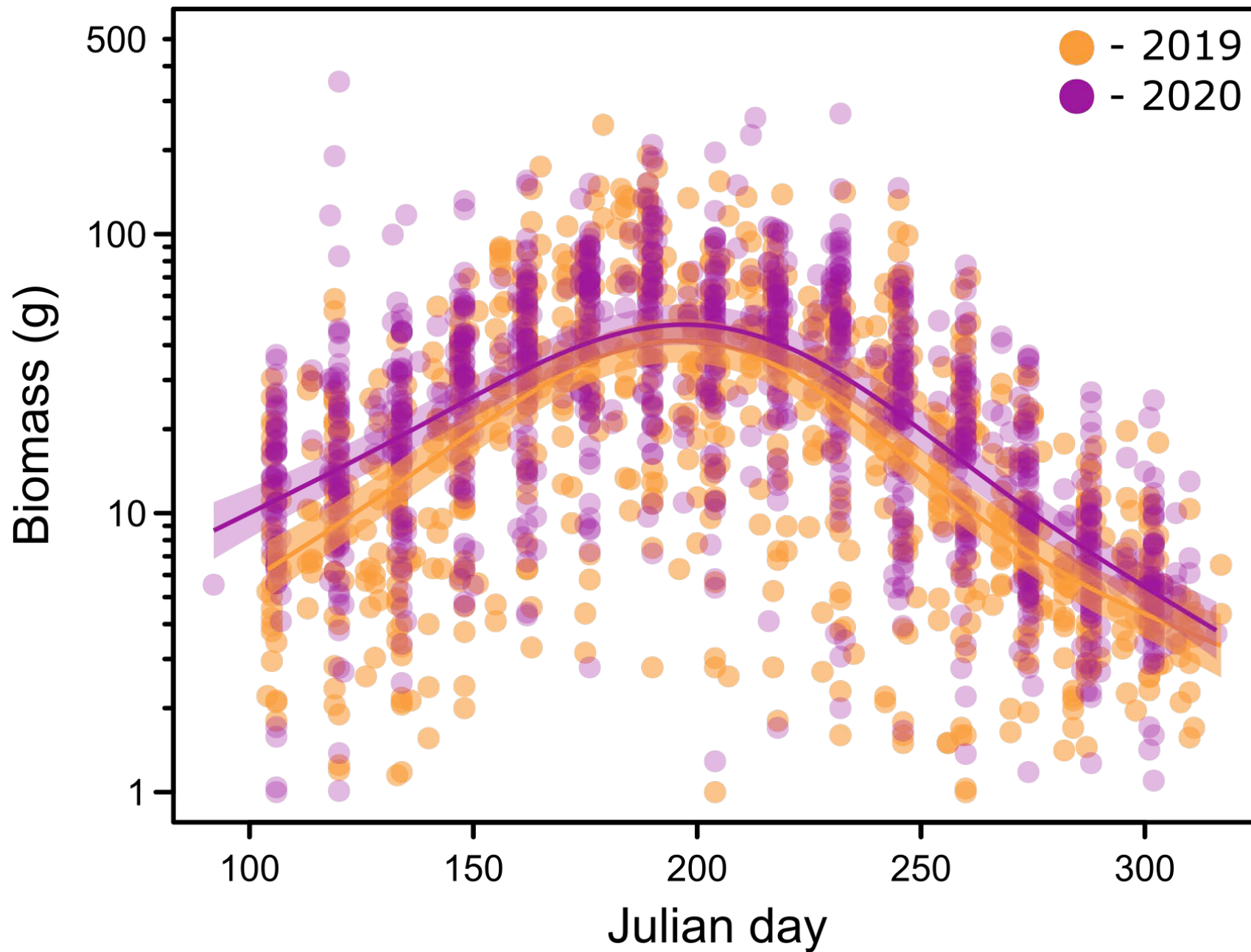
“Less-protected”

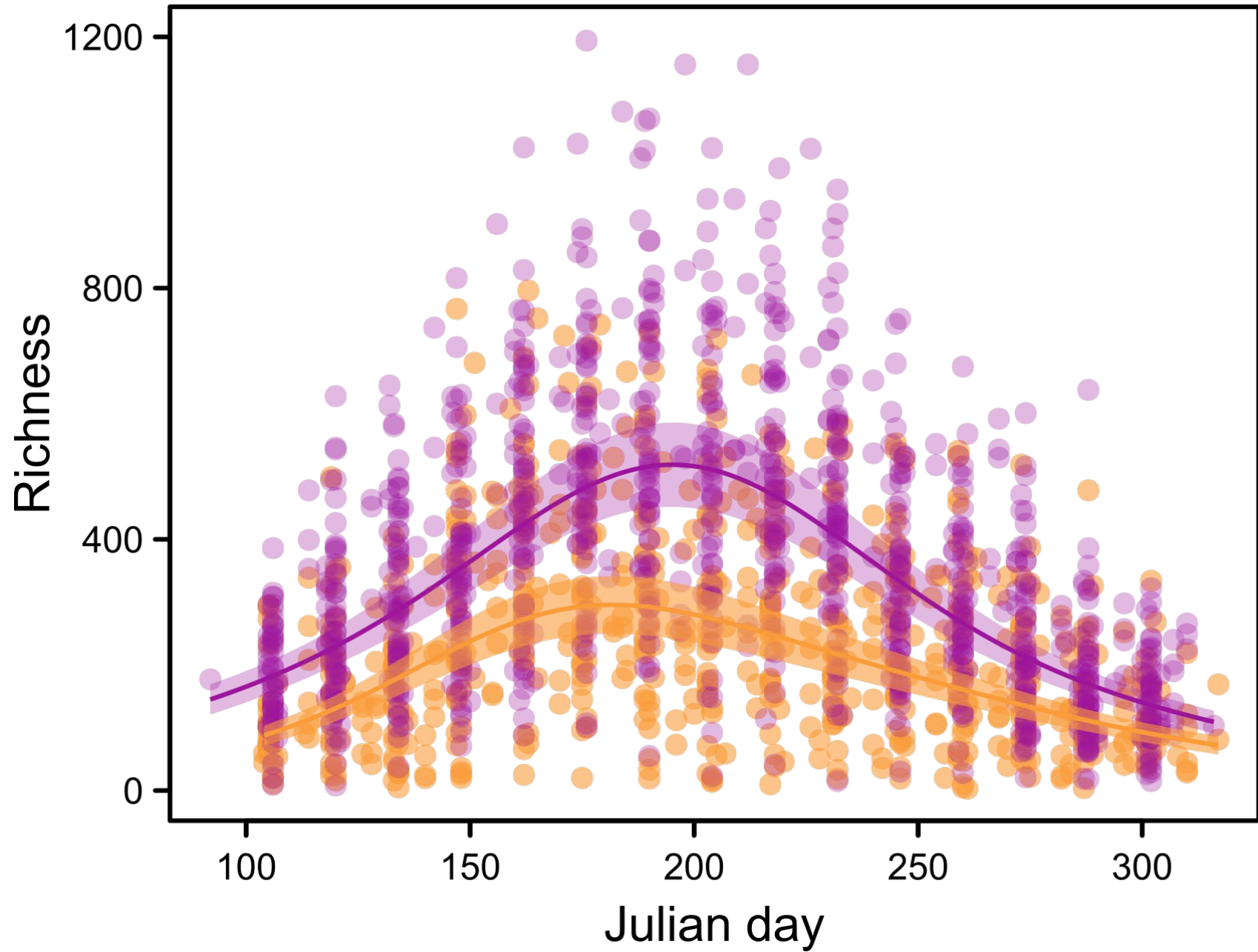
Landscape protection areas

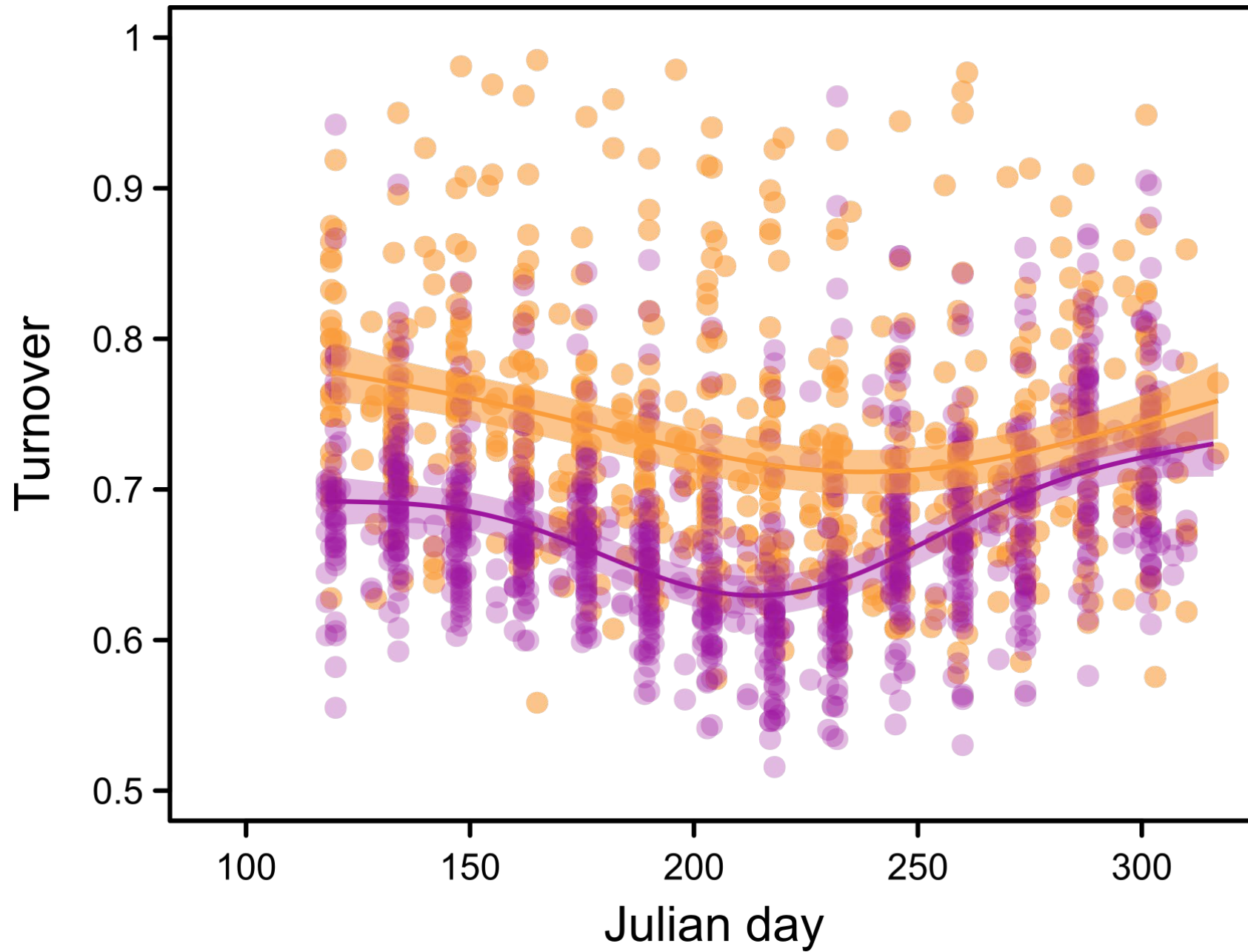
→ **Some development** (IUCN category V)

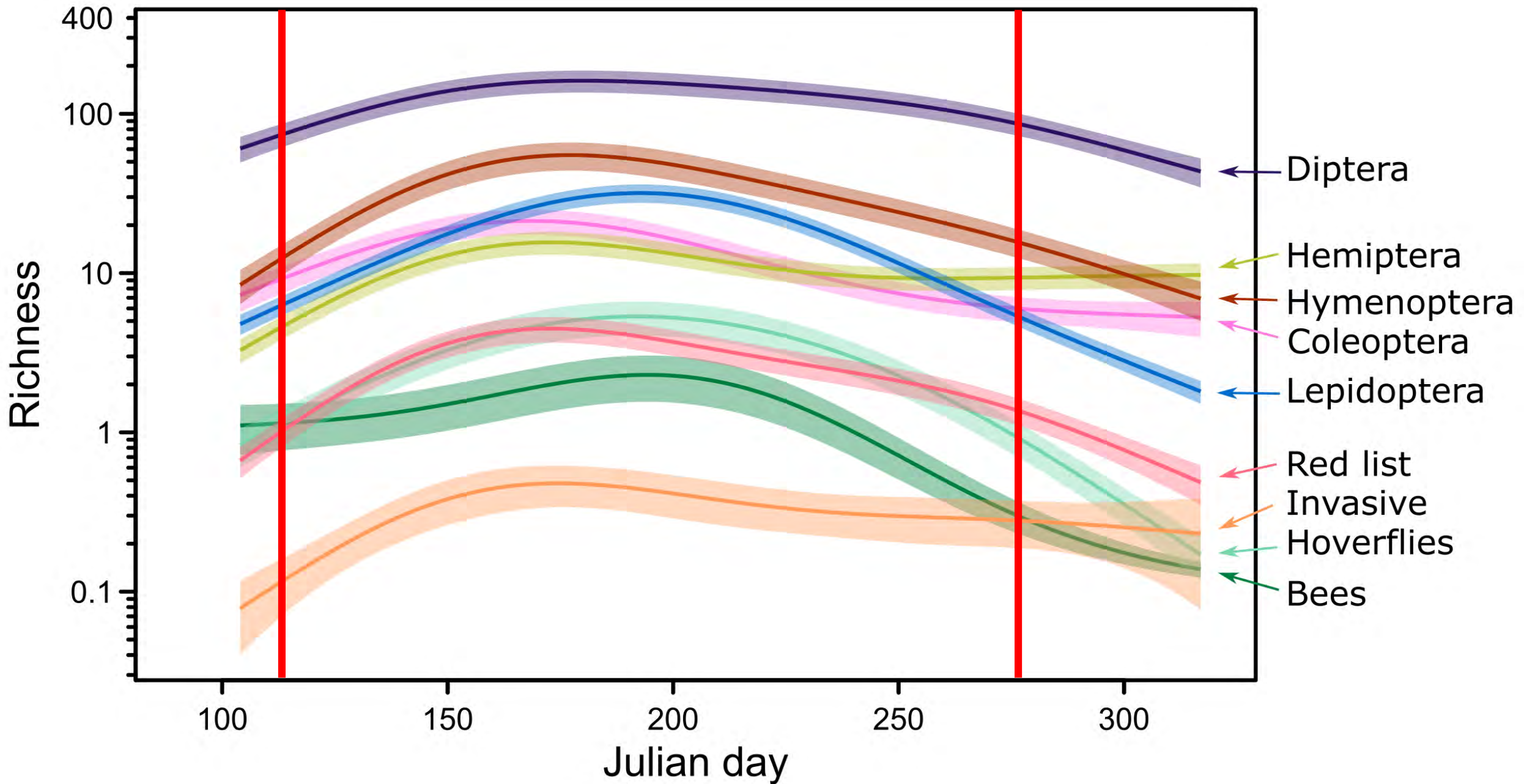


Results

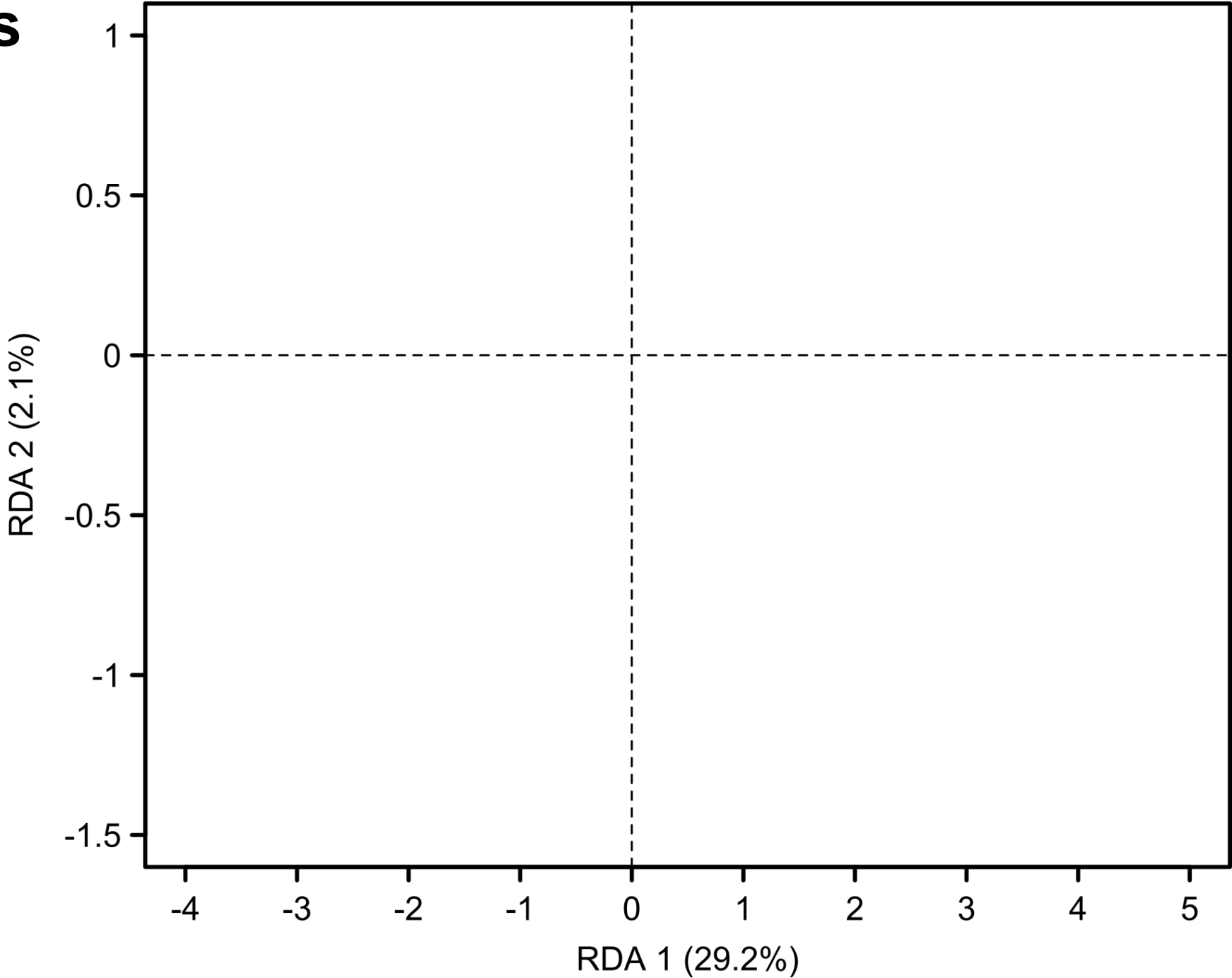






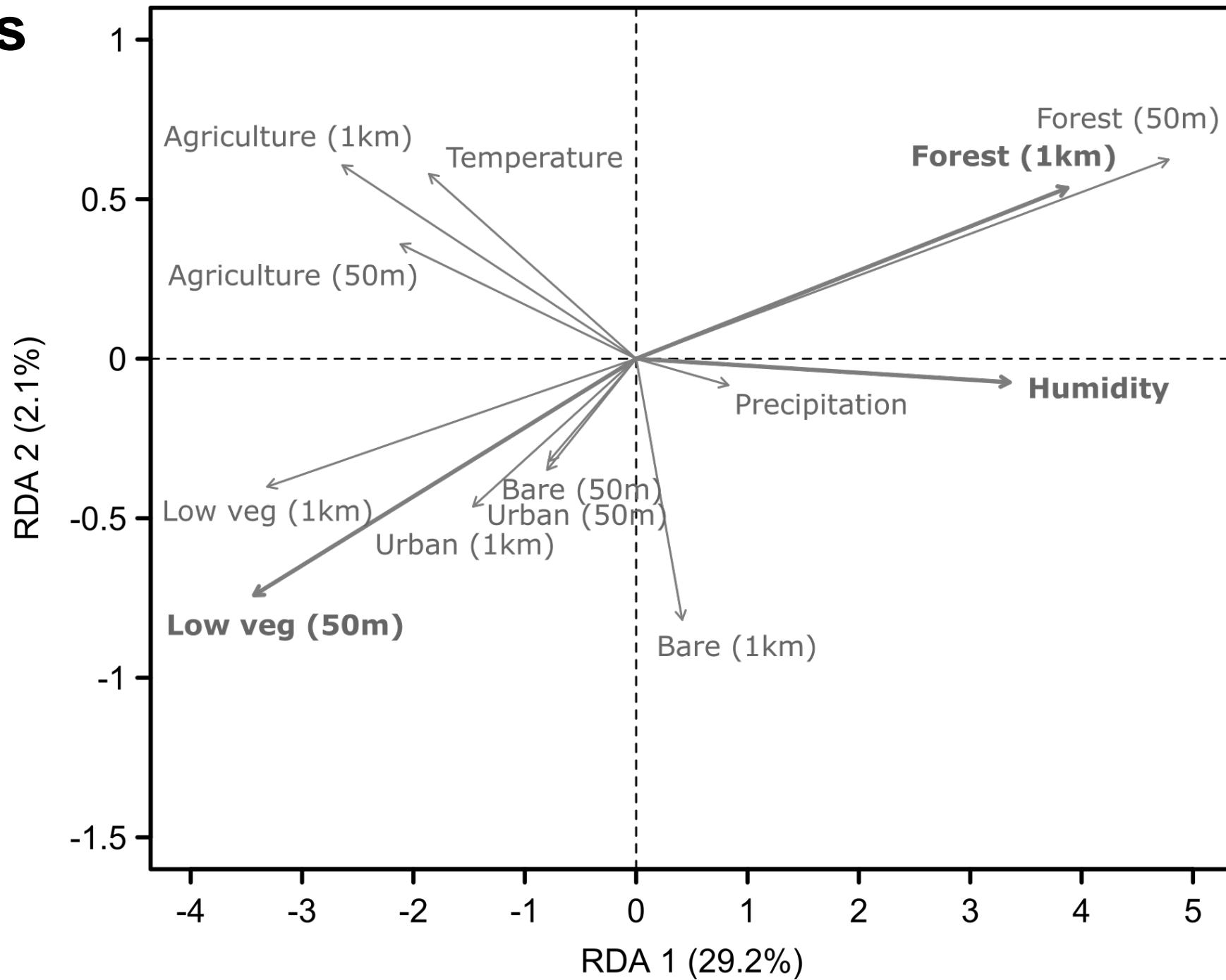


Biomass



Biomass

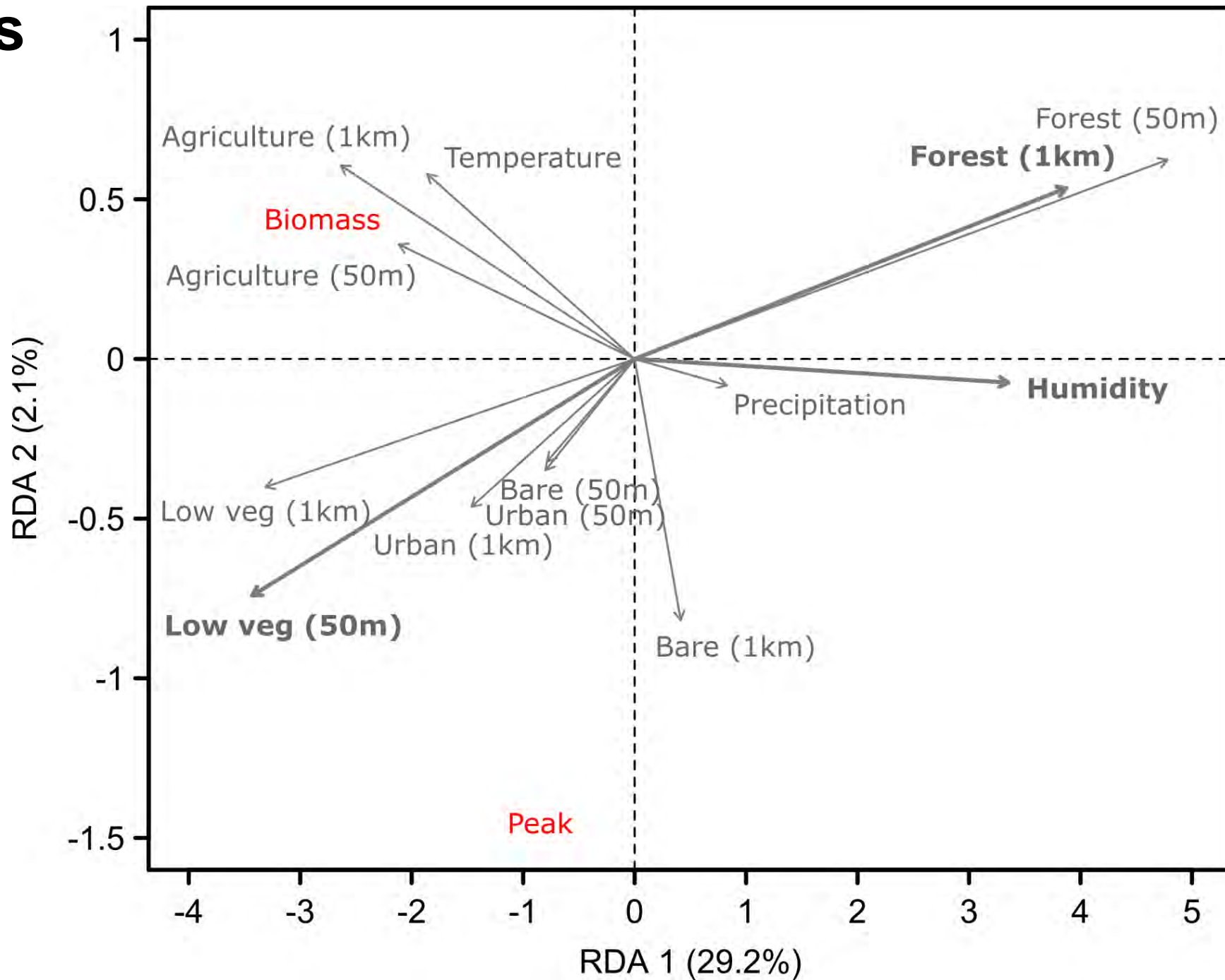
Low vegetation,
drier



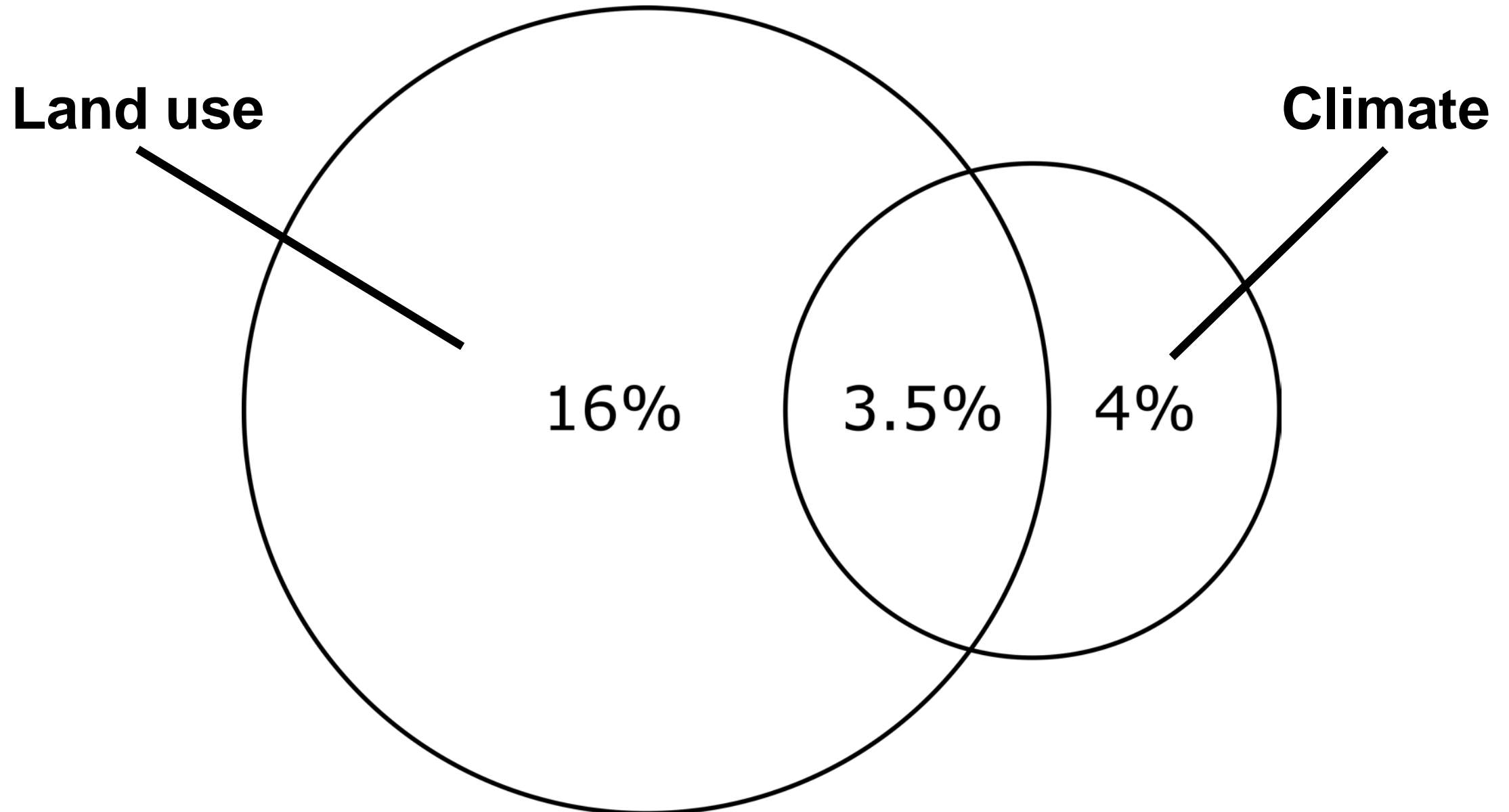
Forest,
humid

Biomass

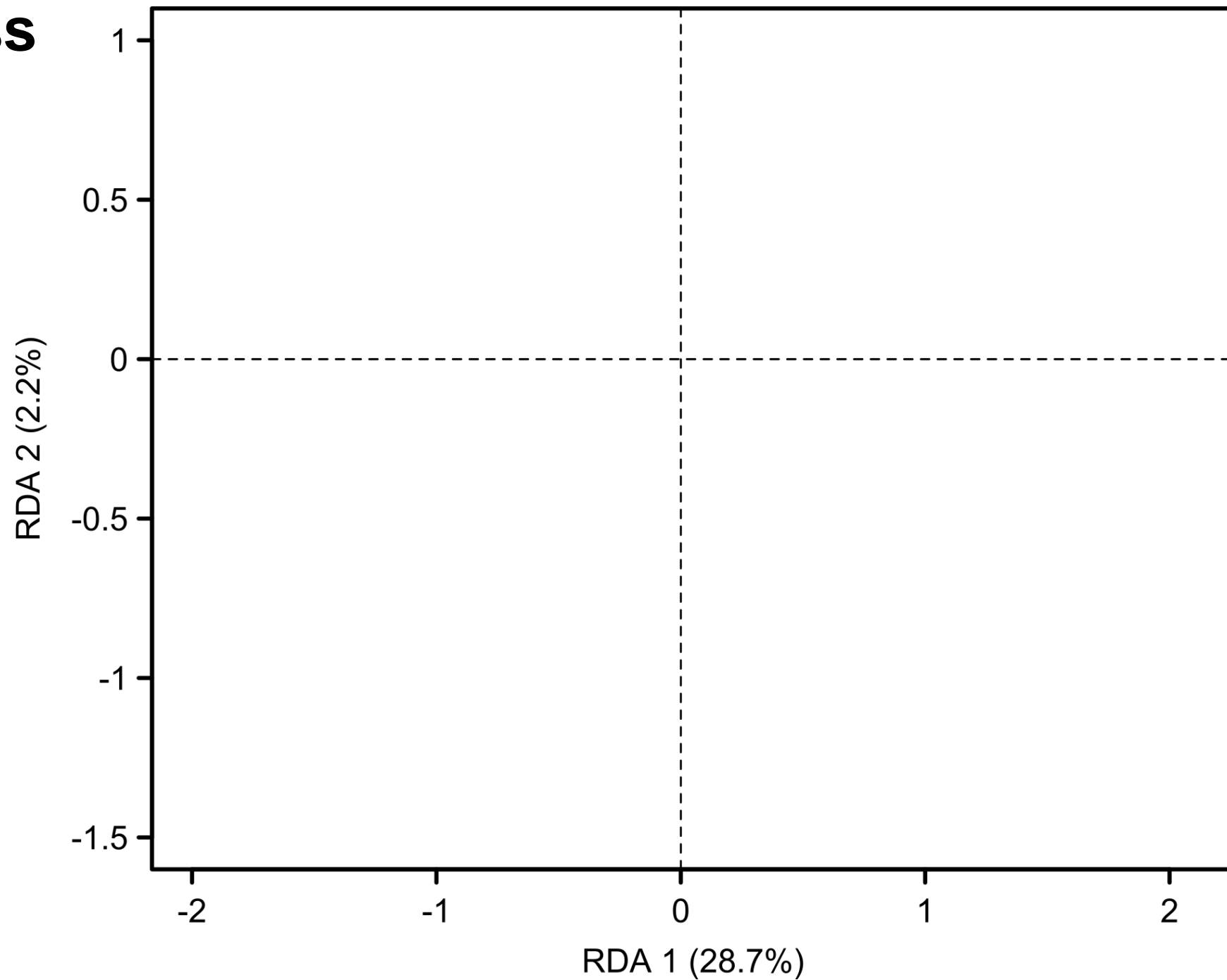
Low vegetation,
drier



Variation partitioning

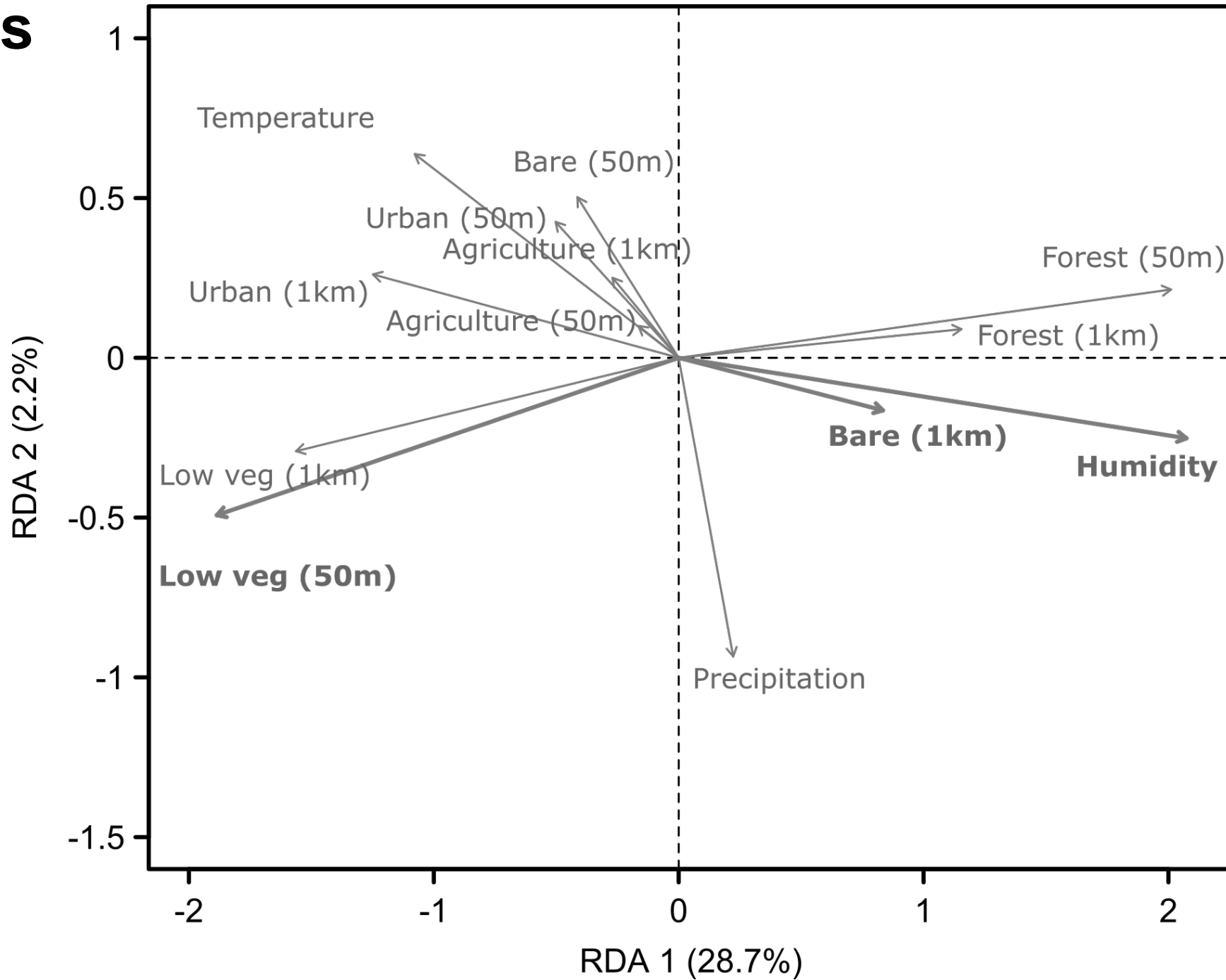


Richness



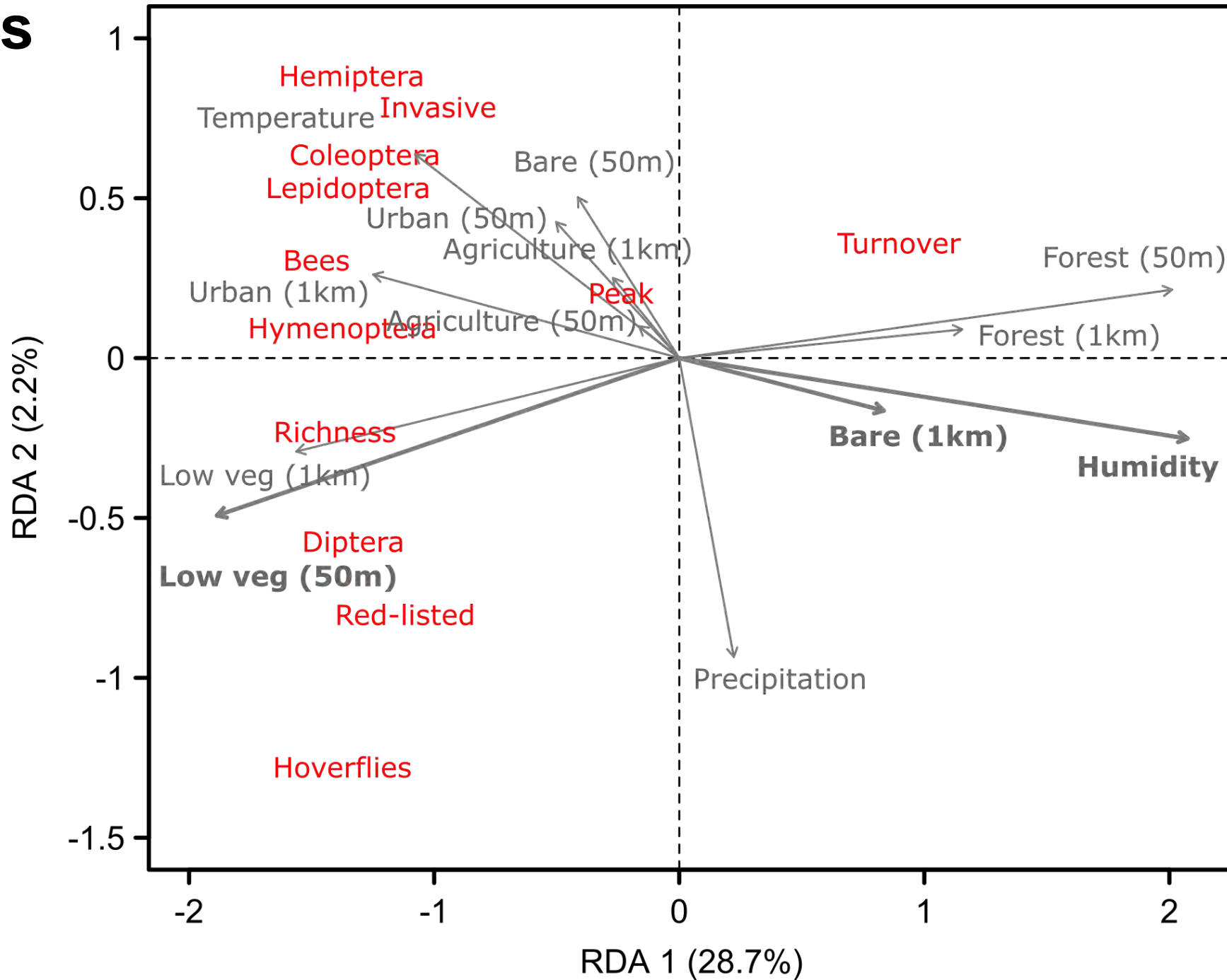
Richness

Low vegetation,
drier



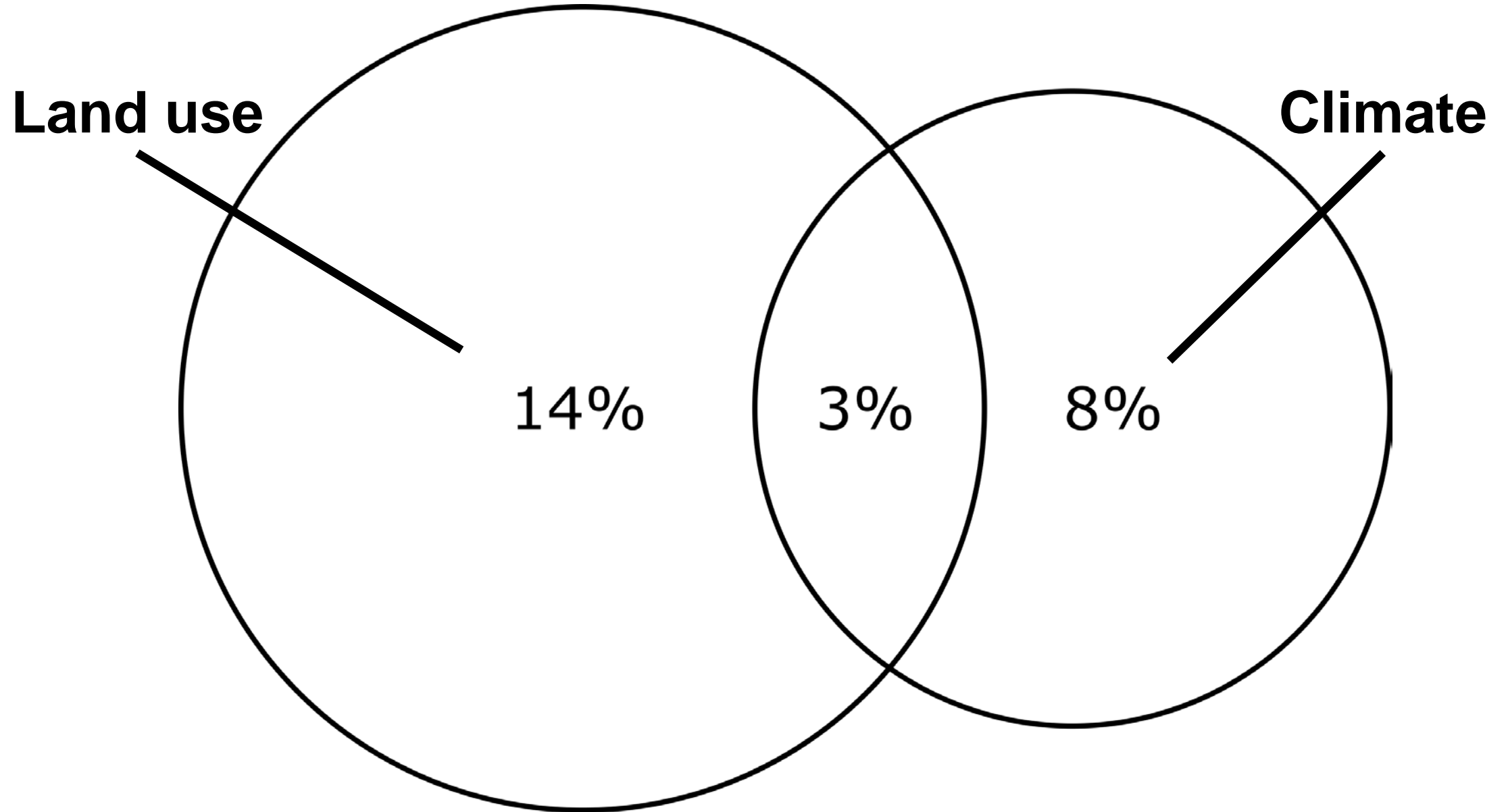
Richness

Low vegetation,
drier



Forest,
humid

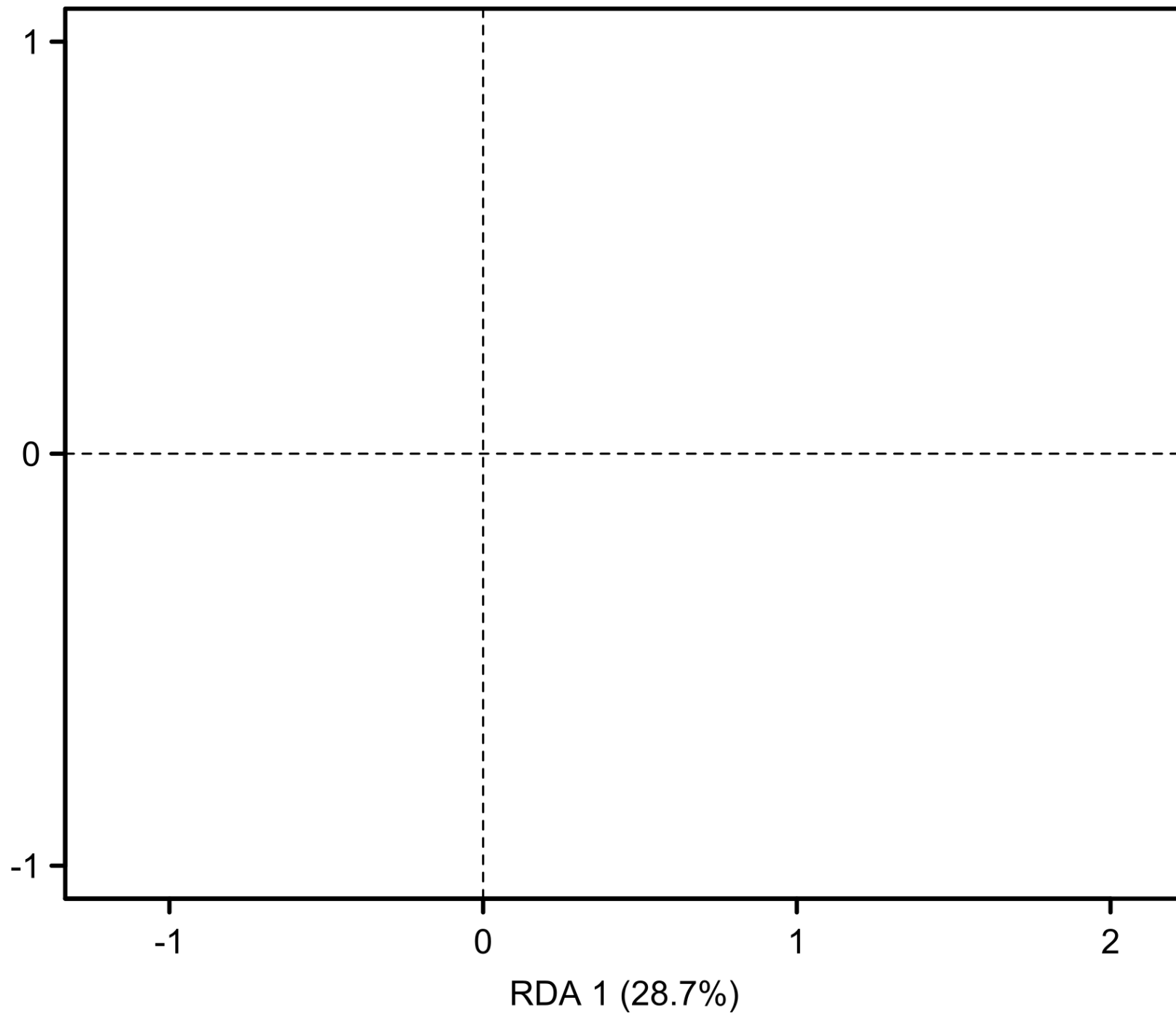
Variation partitioning



Protected Areas

Low vegetation,
drier

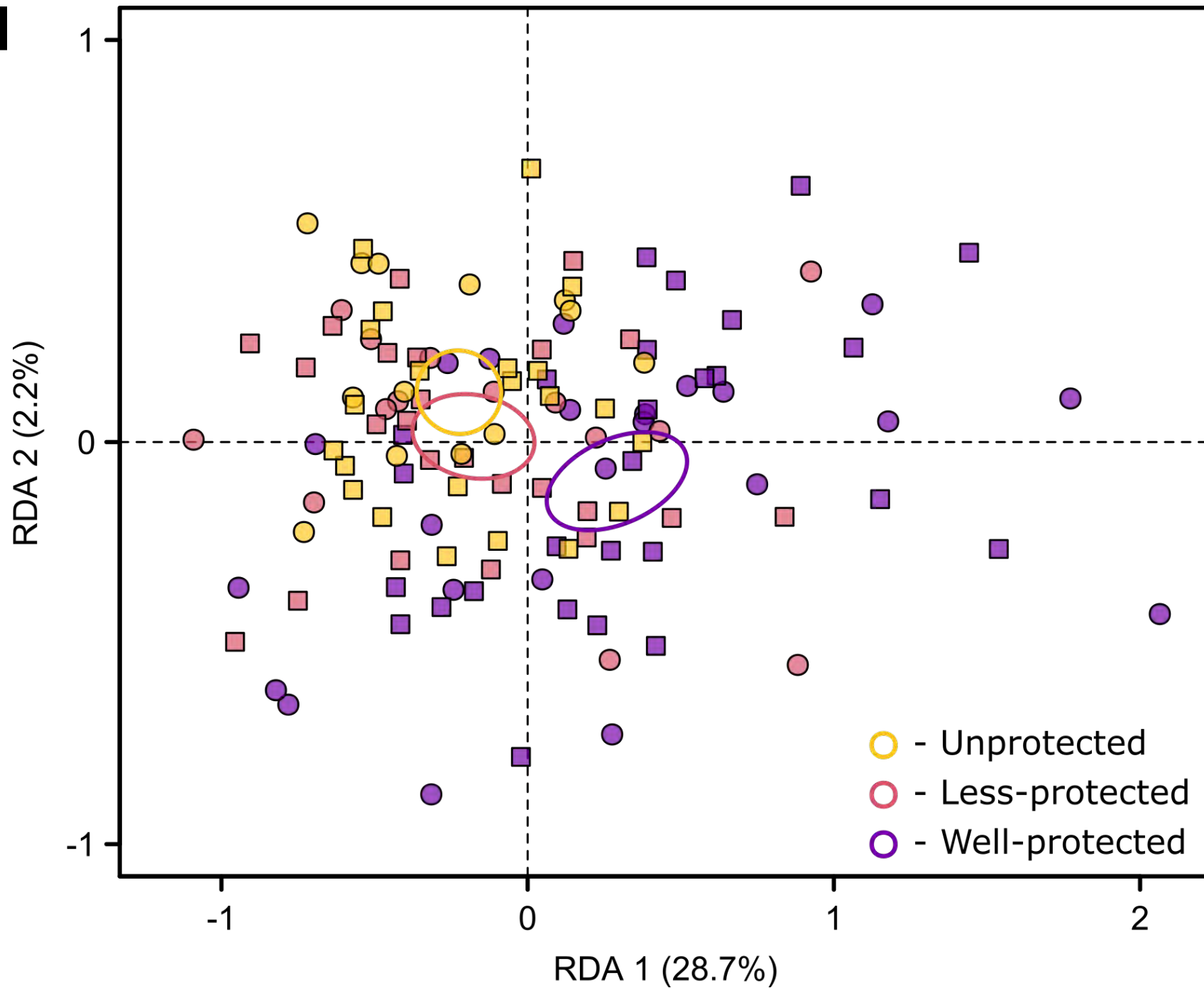
RDA 2 (2.2%)



Forest,
humid

Protected Areas

Low vegetation,
drier

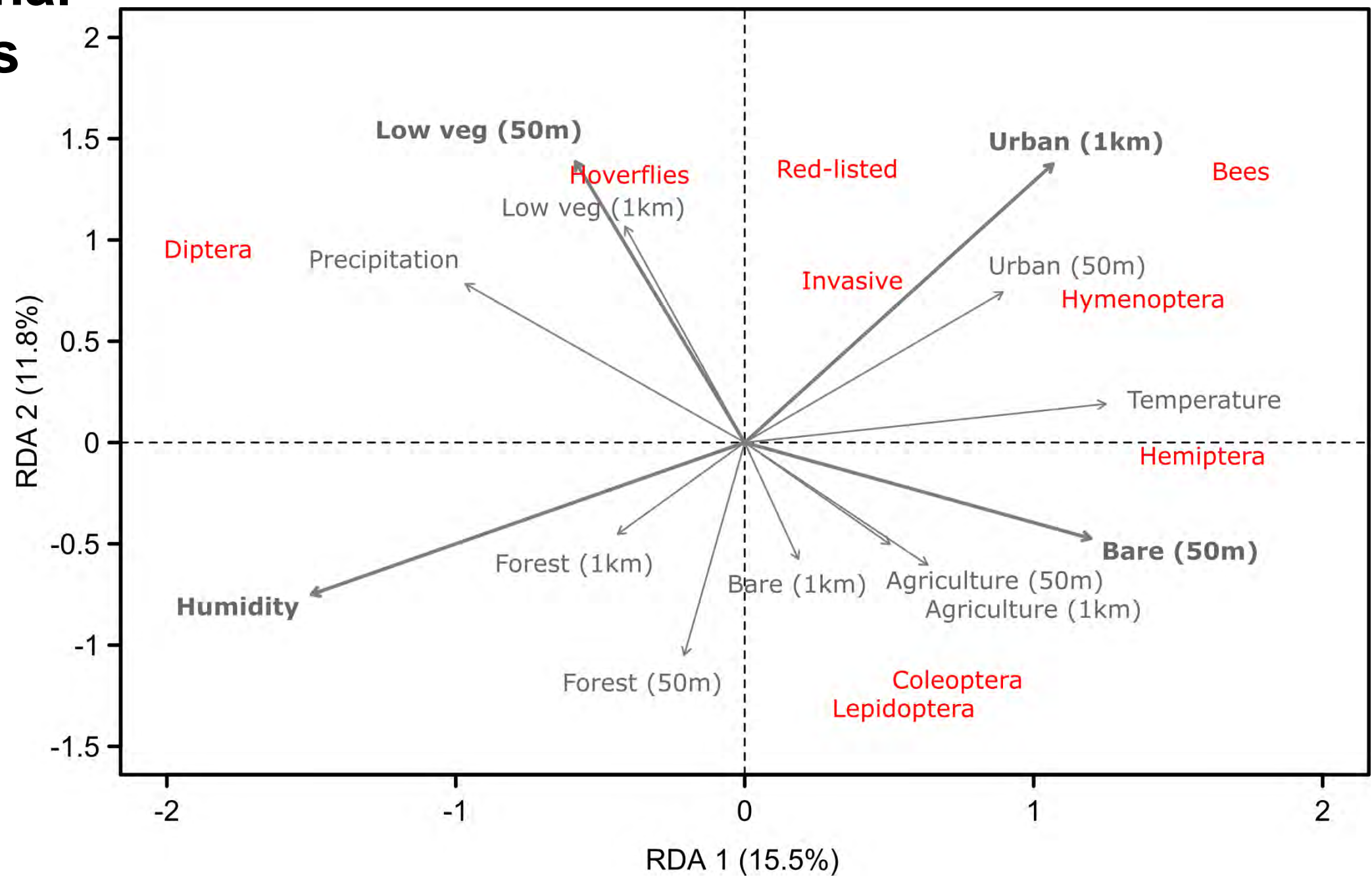


Forest,
humid

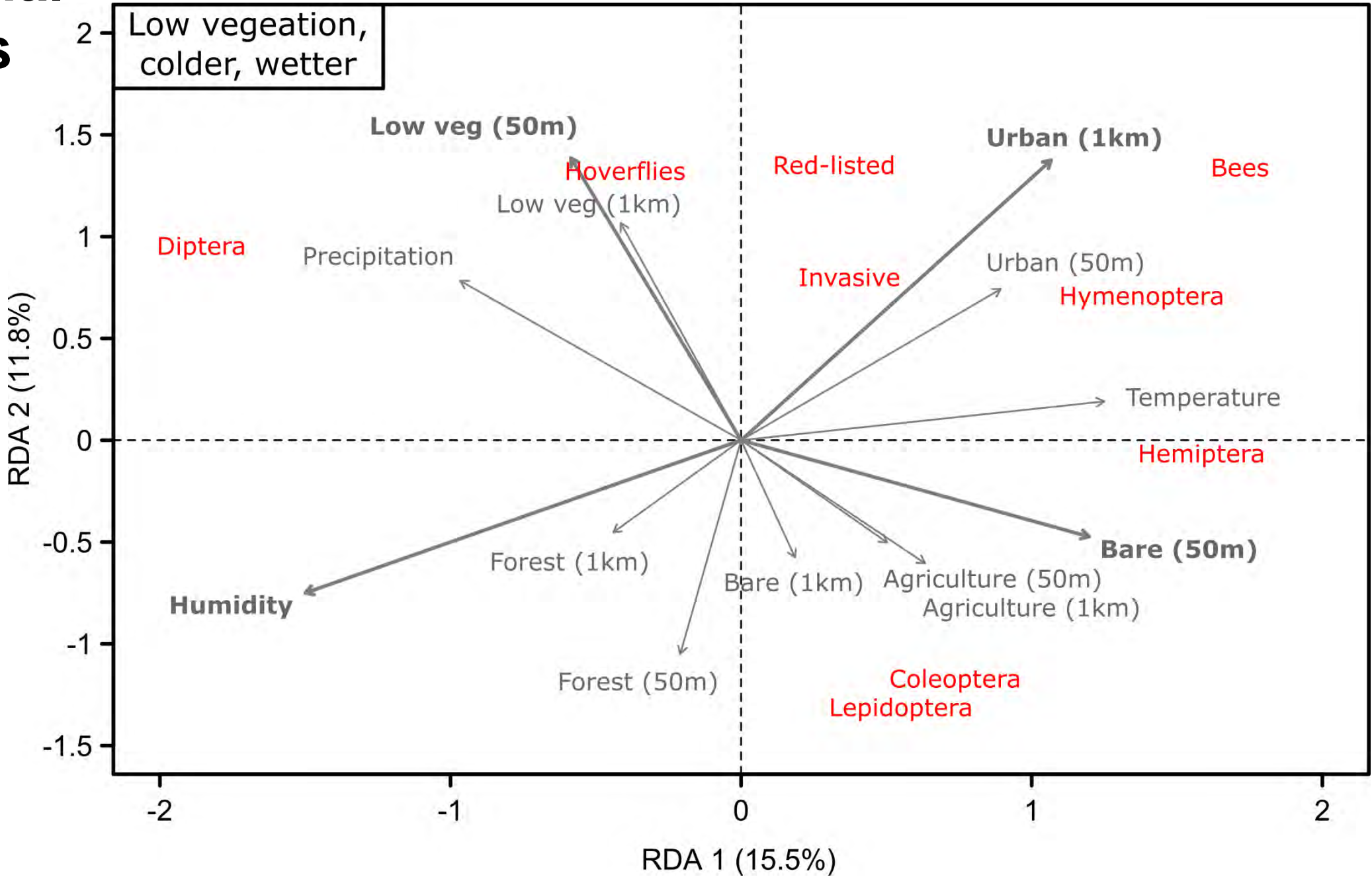
Summary

- Biomass, richness, and turnover are most related to vegetation
 - Little effect of climate or anthropogenic land use
 - Well-protected areas tend to be in forests and not in areas of maximum insect biodiversity

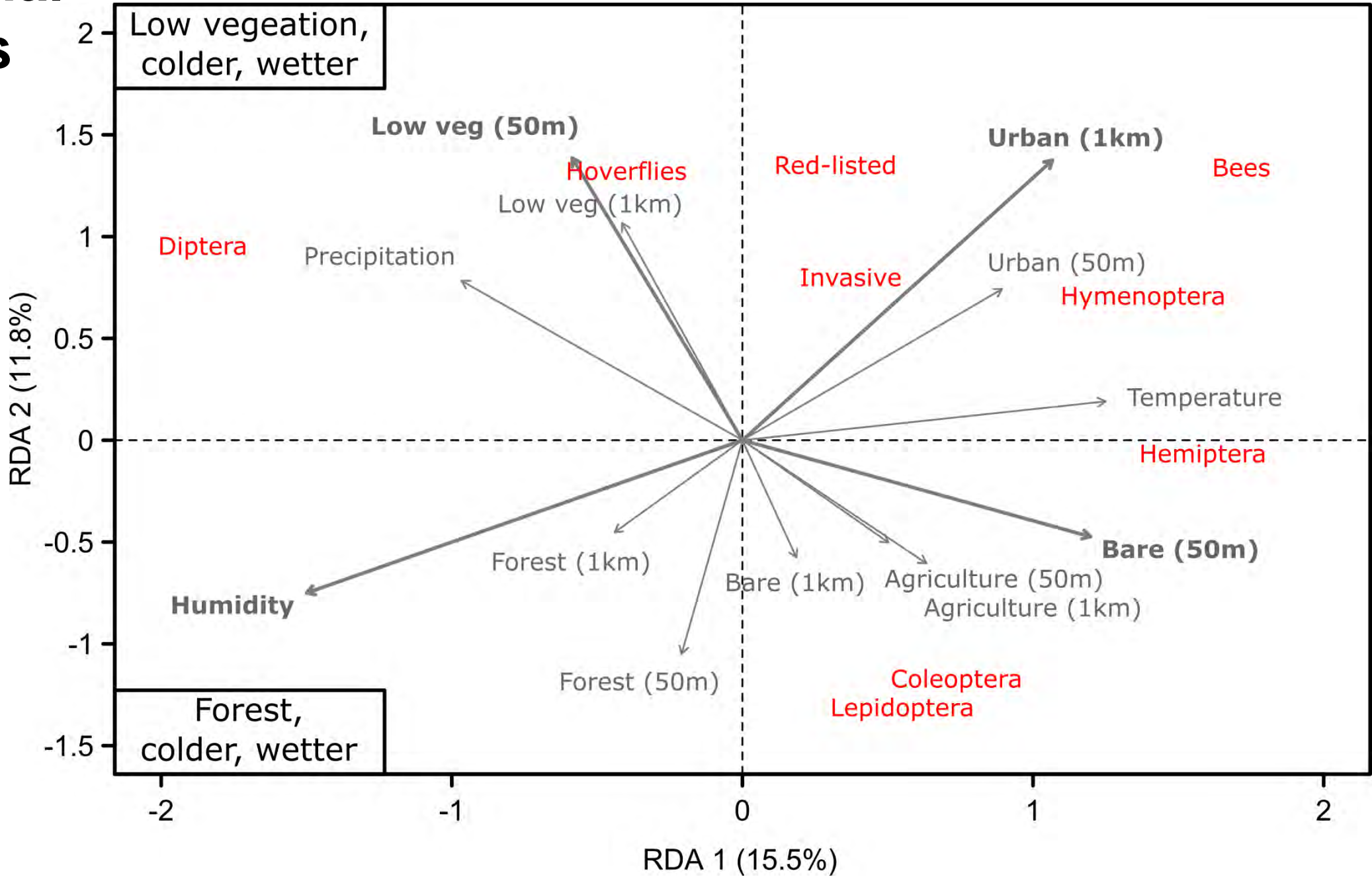
Proportional richness



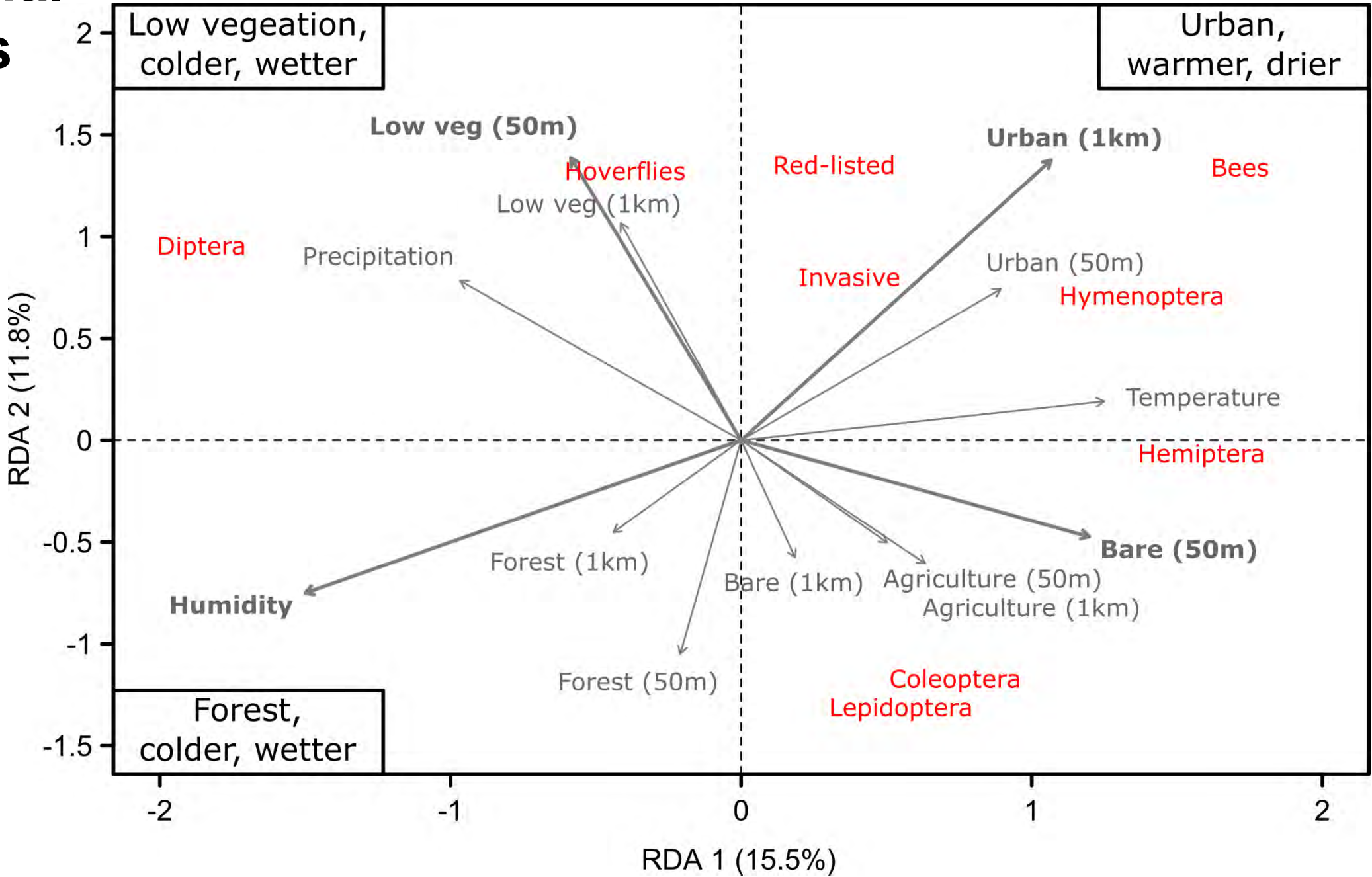
Proportional richness



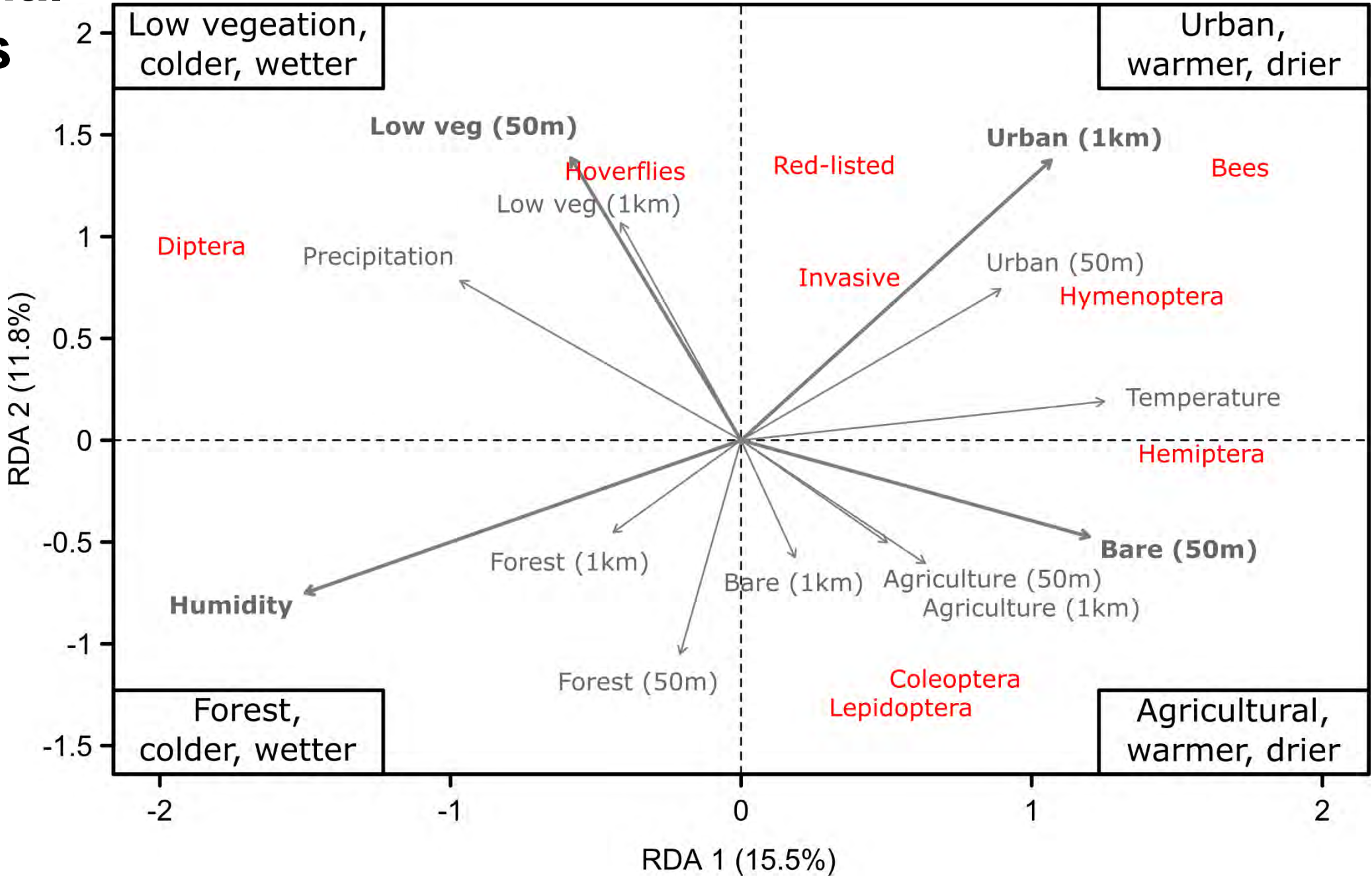
Proportional richness



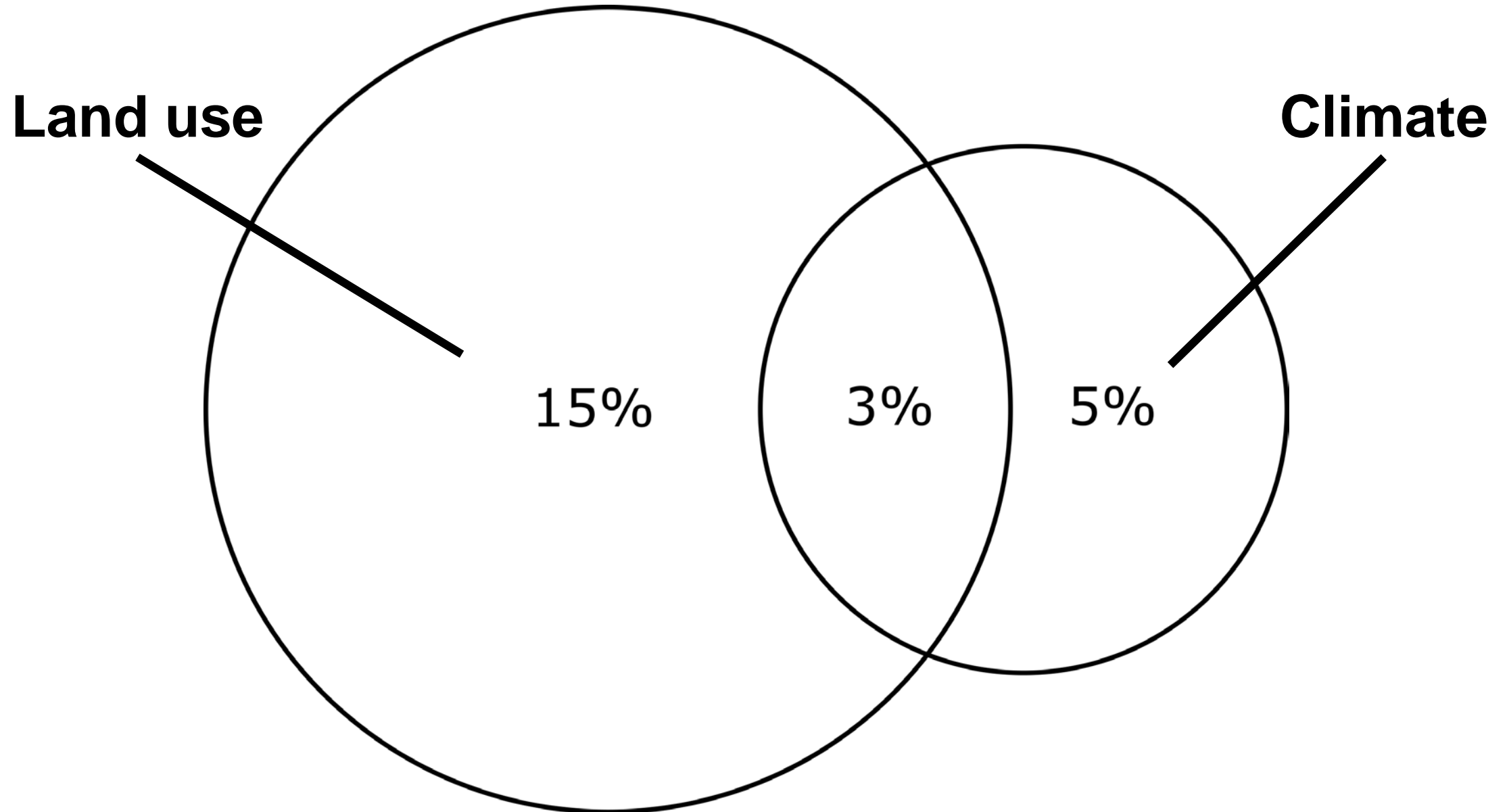
Proportional richness



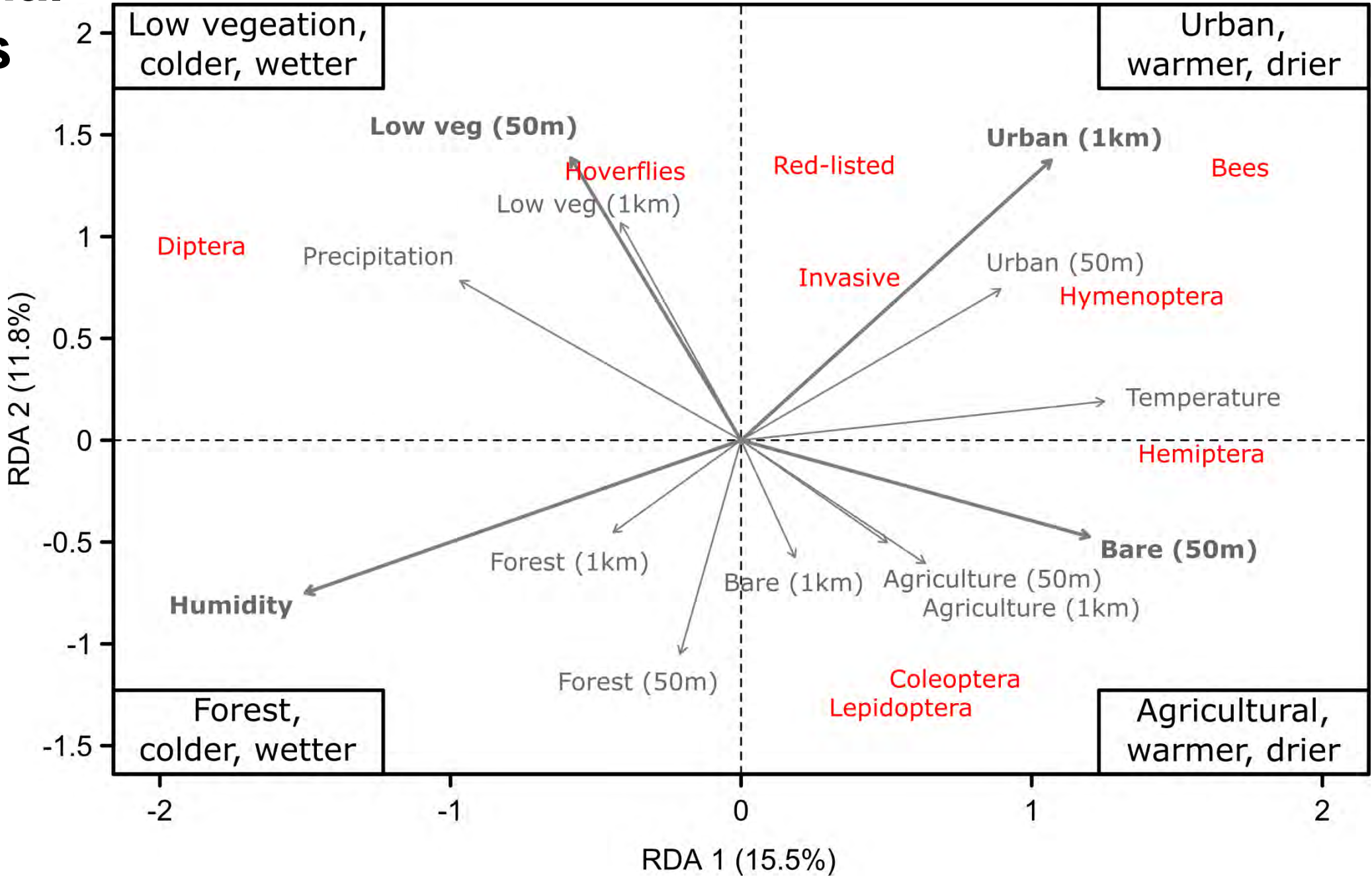
Proportional richness



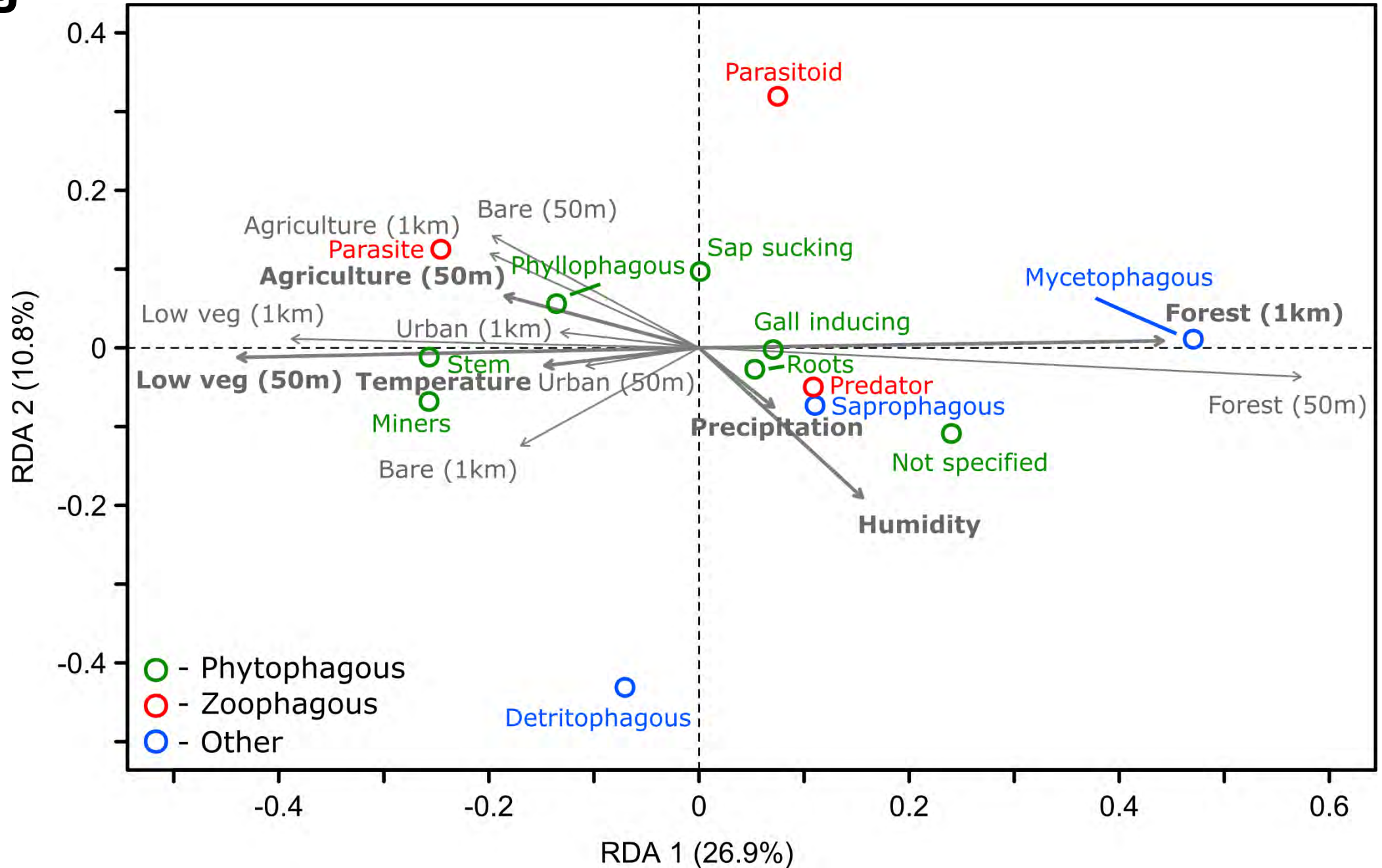
Variation partitioning



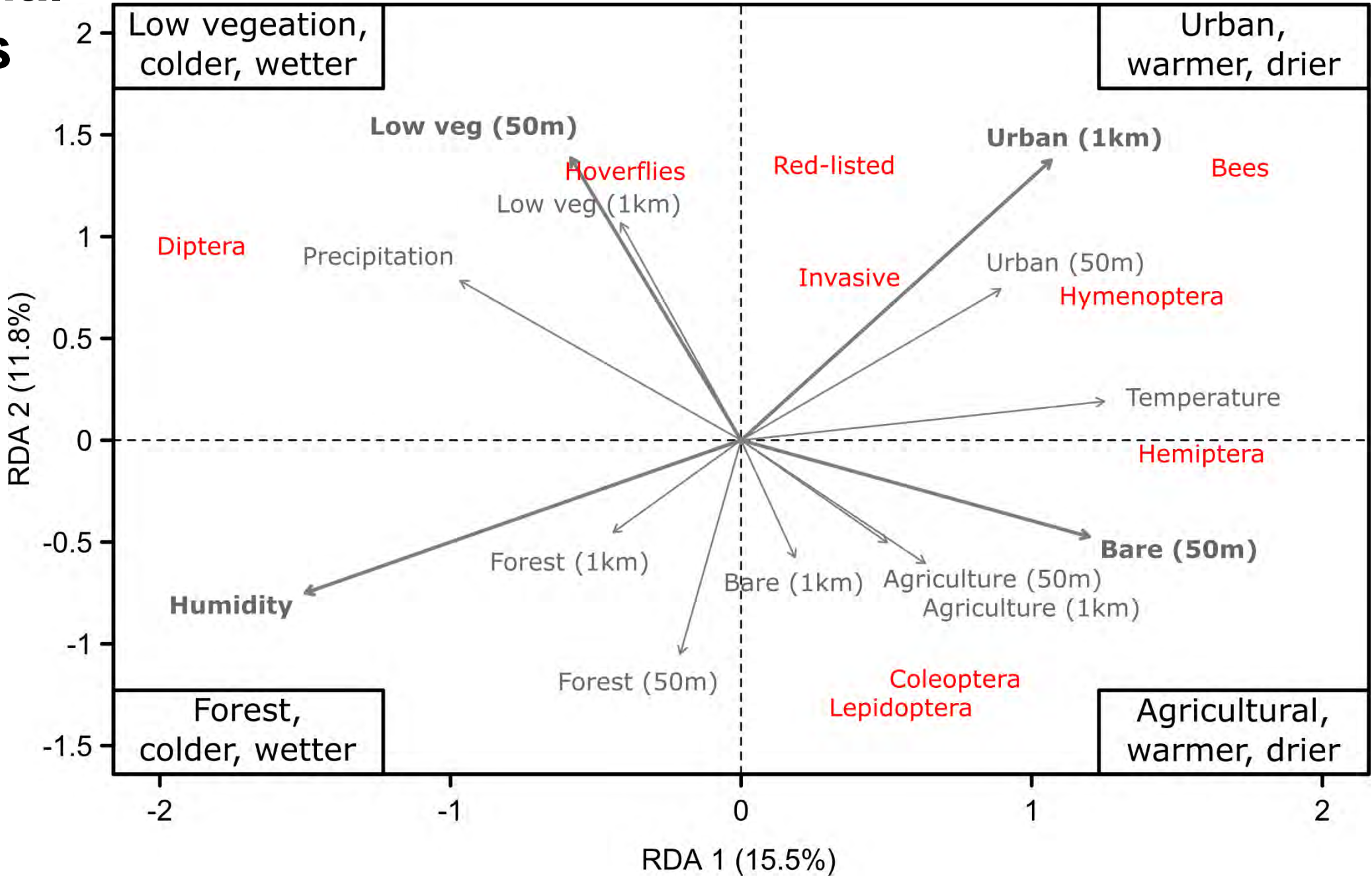
Proportional richness



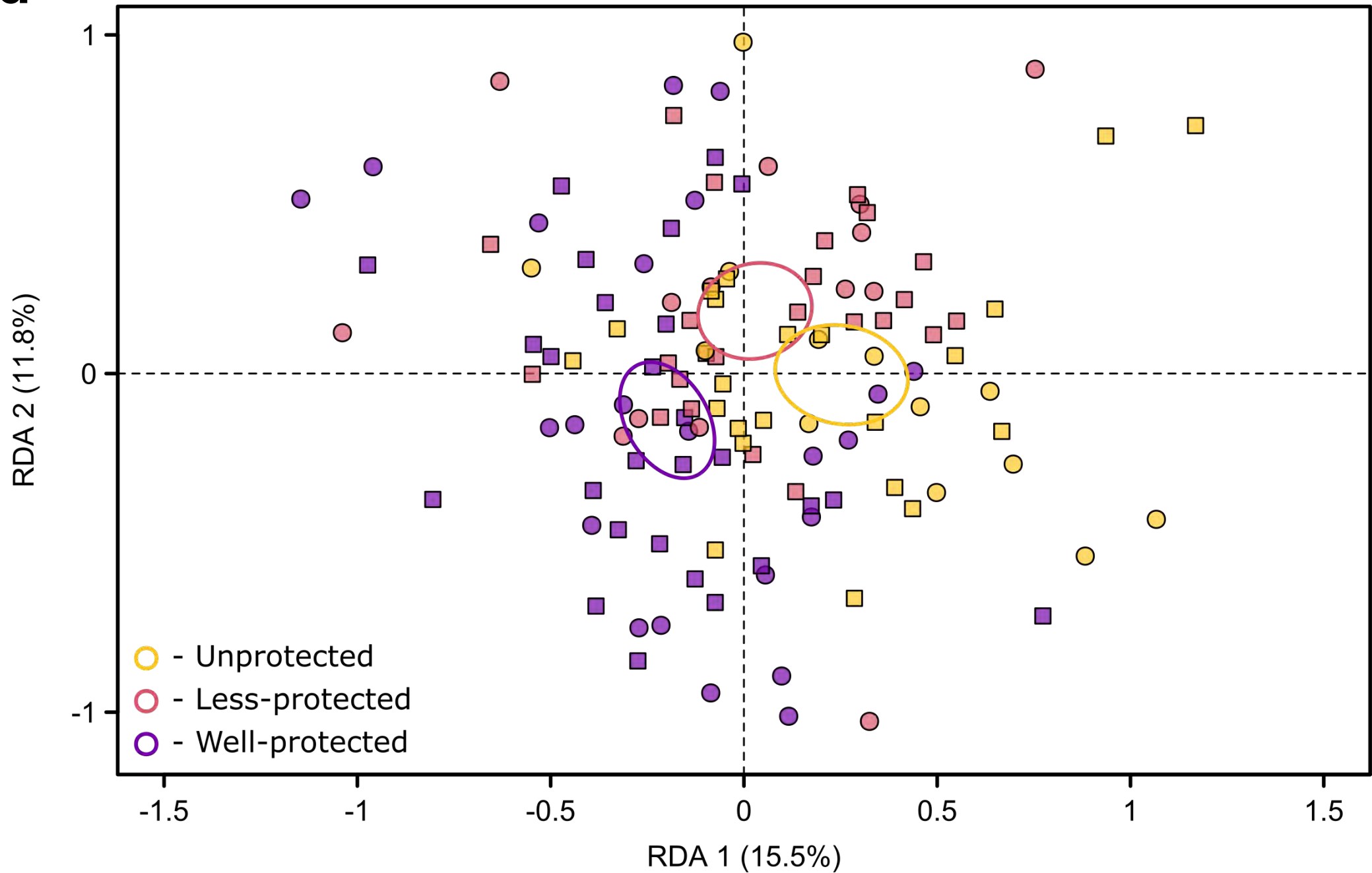
Feeding traits



Proportional richness



Protected areas



Summary

- Biomass, richness, and turnover are most related to vegetation
 - Little effect of climate or anthropogenic land use
 - Well-protected areas tend to be in forests and not in areas of maximum insect biodiversity
- Composition differs among the different land use types
 - This is where the impacts of urban and agricultural land occur
 - Linked to available resources based on feeding traits
 - Flies are well-protected but missing the other taxa groups, key pollinators, and red-listed species

Questions?

