Visitor impact to nature on nature trails – theoretical framework

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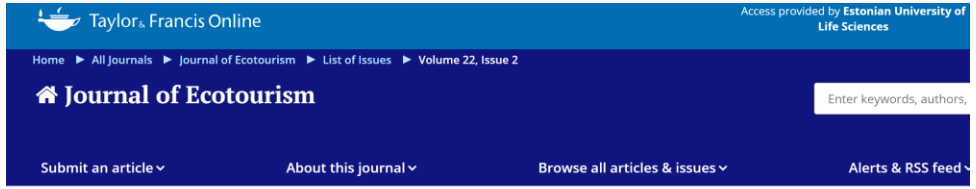
The framework – interdisciplinarity towards humans

1. workshop - tool for identifying visitor motivation
2. workshop - monitor counting methods
3. workshop - nature heritage and desiging virtual tours
4. workshop - communication and promotion of visitors
5. **workshop - visitor impact monitoring**

The ***Journal of Ecotourism*** is the world's only international journal that focuses specifically on ecotourism and nature-based tourism, and it is considered to be the leading source for knowledge on these topics.

The ***Journal of Ecotourism*** seeks to advance the field by examining the social, economic, and ecological aspects of ecotourism at a number of scales, and including regions from around the world.

The Journal welcomes conceptual, theoretical, and empirical research, particularly where it contributes to the dissemination of new ideas and models of ecotourism planning, development, management, and good practice.



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Issue 2 | Issue 1

Motivations and experiences of tourists visiting Hasankeyf as a last chance tourism destination

Mapping potential nature based tourism in Jordan using AHP, GIS and remote sensing

Community participation towards conservation of Touran National Park (TNP): an application of reciprocal altruism theory

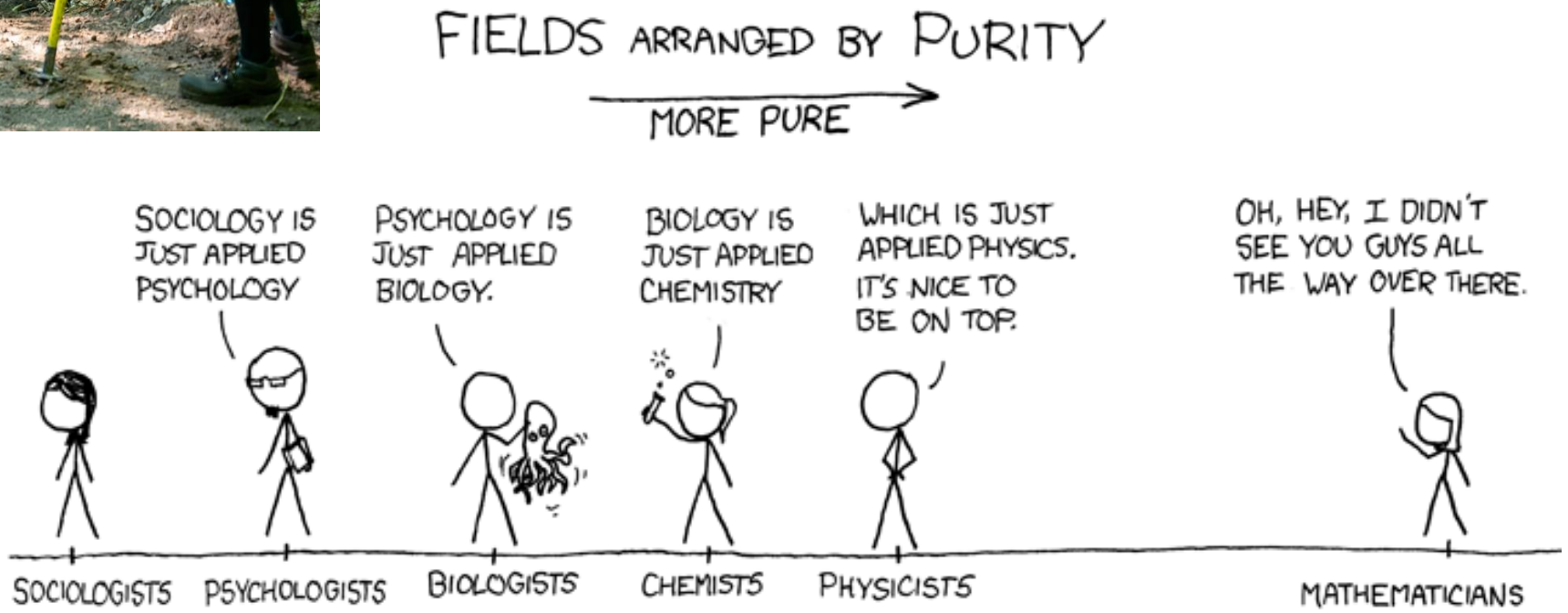
Gibbon focused tourism as a conservation tool: the behavioural response of Skywalker hoolock gibbons (Hoolock tianxing) to tourists

Why are some animals popular with wildlife tourists: insights from South Africa

Tourist expectations and satisfaction in mountain gorilla tourism in Bwindi Impenetrable National Park, Uganda

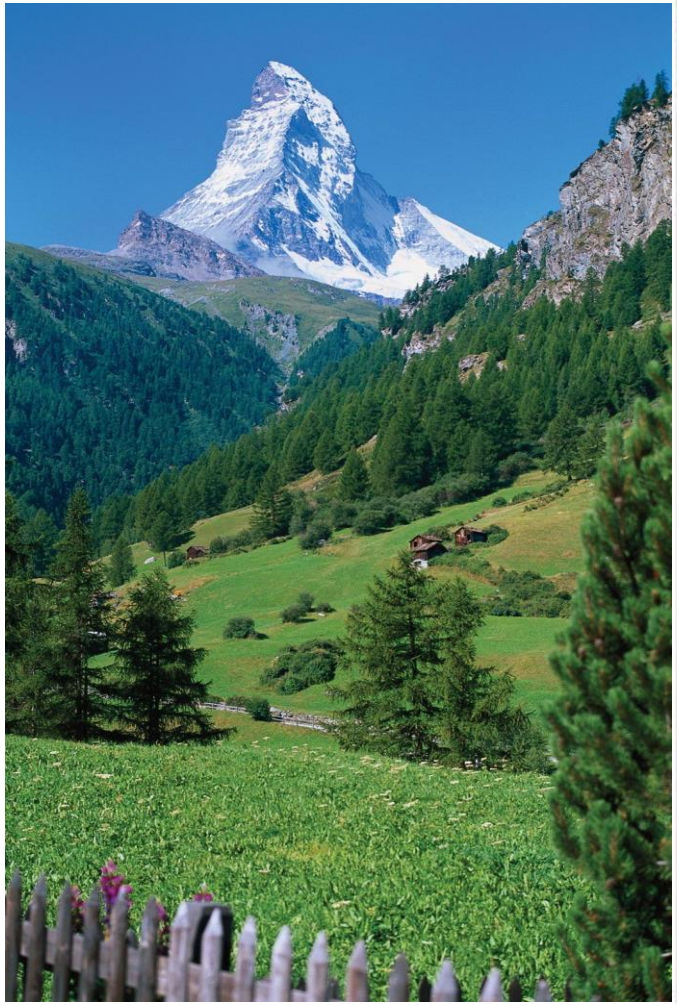
The framework – if about nature, then towards applied sciences

Recreation ecology is the scientific study of environmental impacts resulting from recreational activity in protected natural areas. This field of study includes research and monitoring assessments of biophysical changes, analyses to identify causal and influential factors or support carrying capacity planning and management, and investigations of the efficacy of educational, regulatory, and site management actions designed to minimize recreation impacts. - Wikipedia



The framework – oriented towards local

Focus on flagship and sightseeing



Focus on the juridical

The gap

Highlights

- Research on vegetation and soil impacts of recreational trail infrastructure is limited.
- Current research is biased to only a few ecosystems in protected areas in developed nations.
- Most responses measured are compositional and are measured at local scales.
- There is a need for more landscape-scale, temporal and comparative research on trail impacts.
- A greater geographical spread of research is encouraged especially in urban, unprotected or threatened ecosystems.

ELSEVIER

Journal of Environmental Management

Volume 164, 1 December 2015, Pages 53-64

Review

The impacts of trail infrastructure on vegetation and soils: Current literature and future directions

Mark Ballantyne, Catherine Marina Pickering

Why the need to fill the gap?

What do we even know?

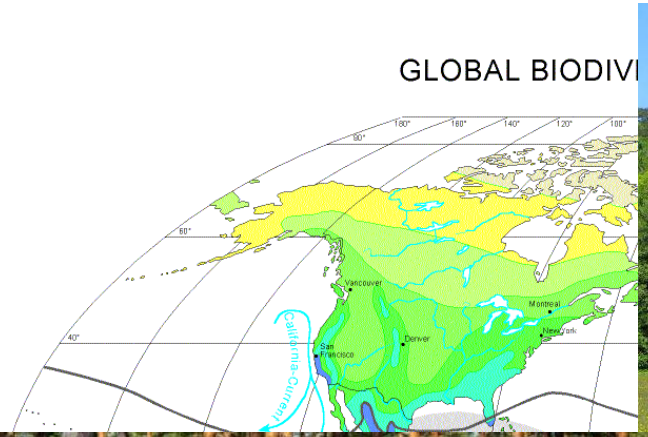
"Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tends to be the difficult ones."

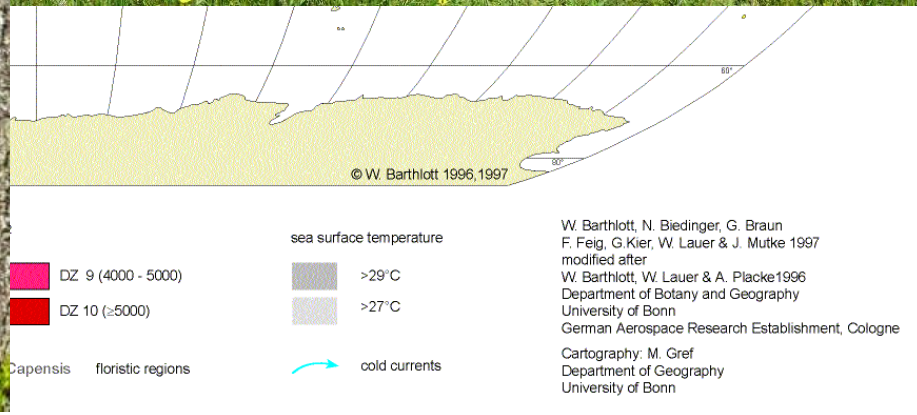
Don Rumsfeld, 2002

The complexities

Phengaris arion
Myrmica sabuleti
Thymus drucei
heterogeneity

Biodiversity – why is it important in the context of nature tourism?



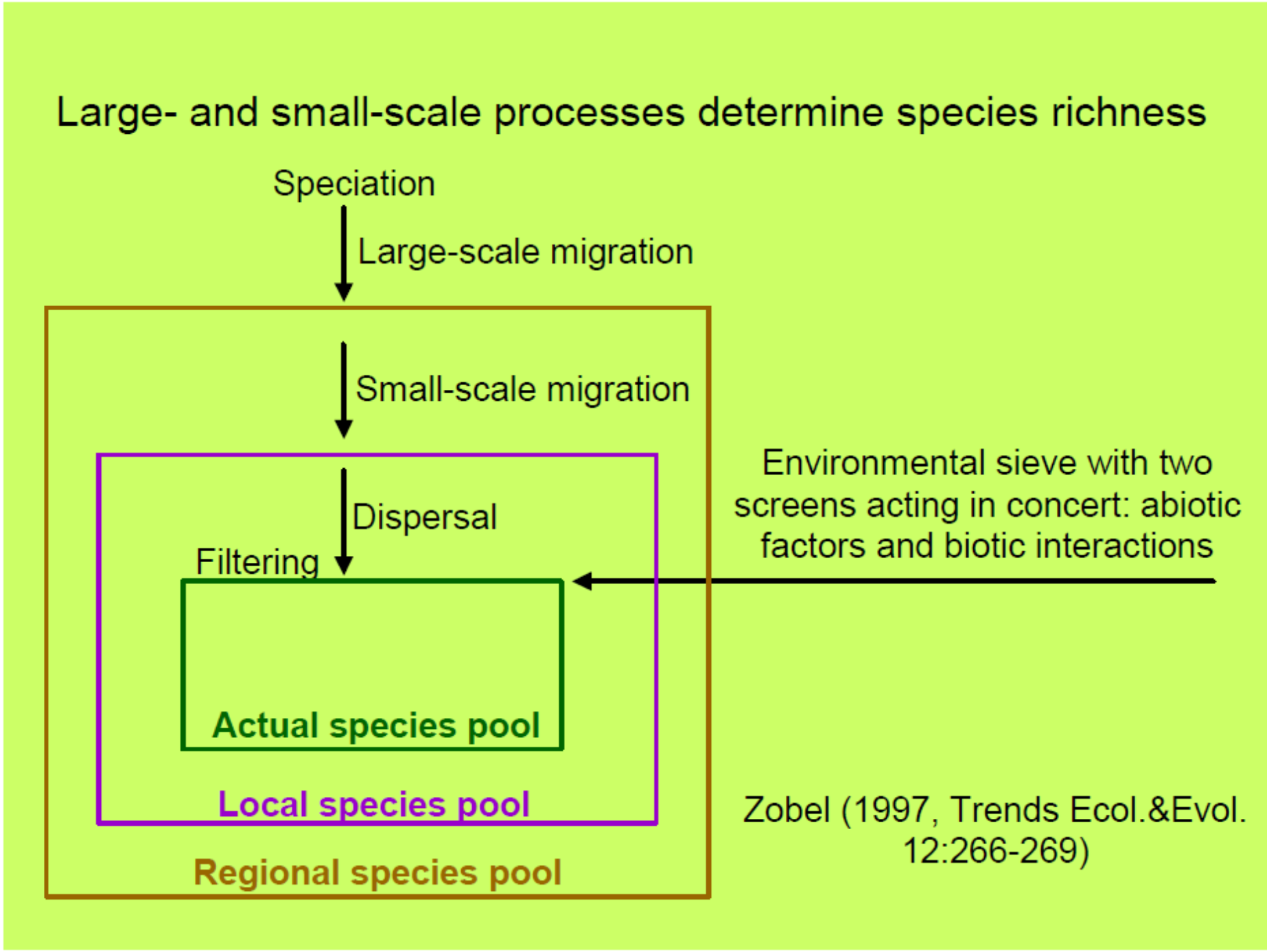


Local scale diversity paradox

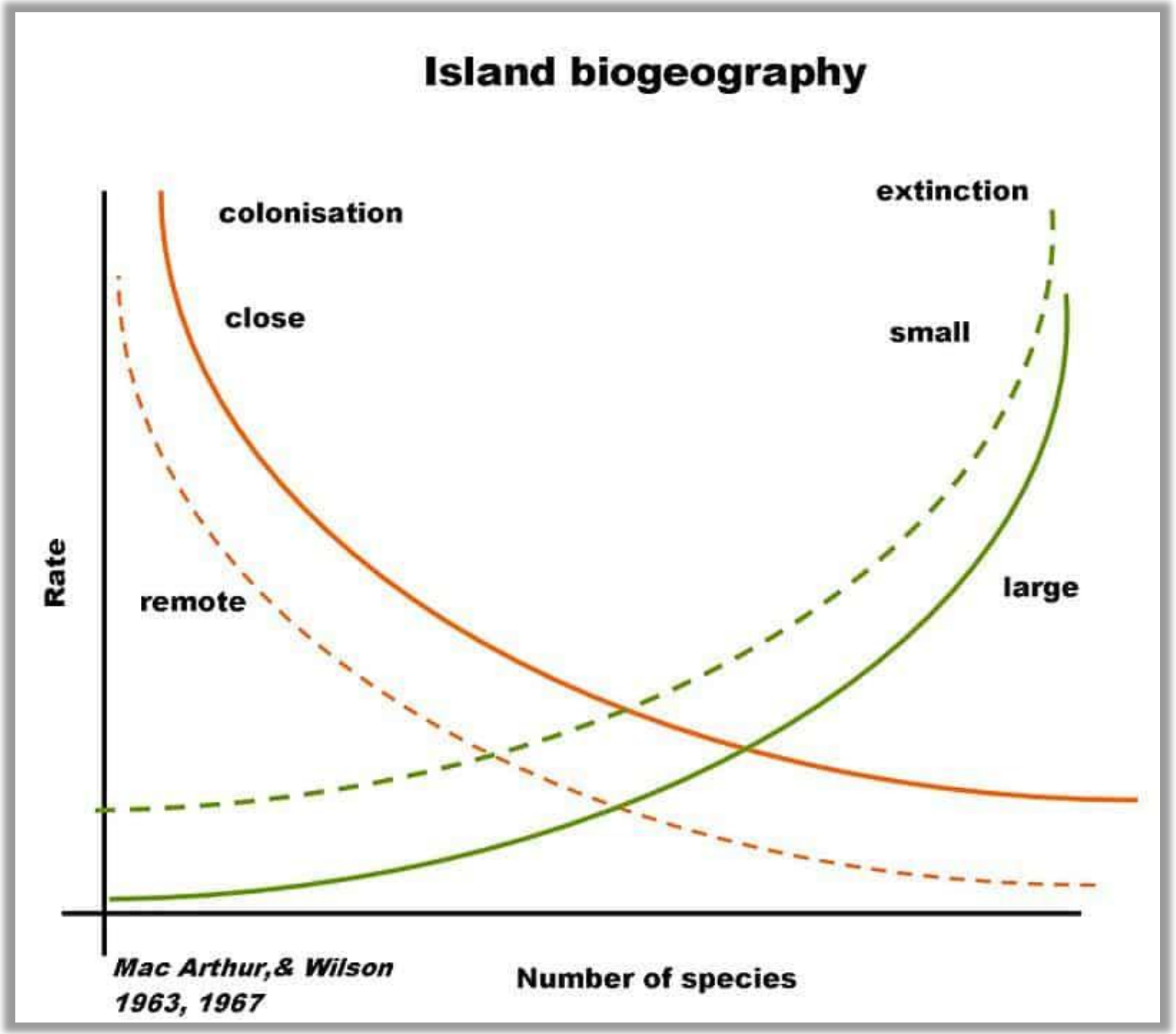
How come so many species live together?

How come so few species live together?

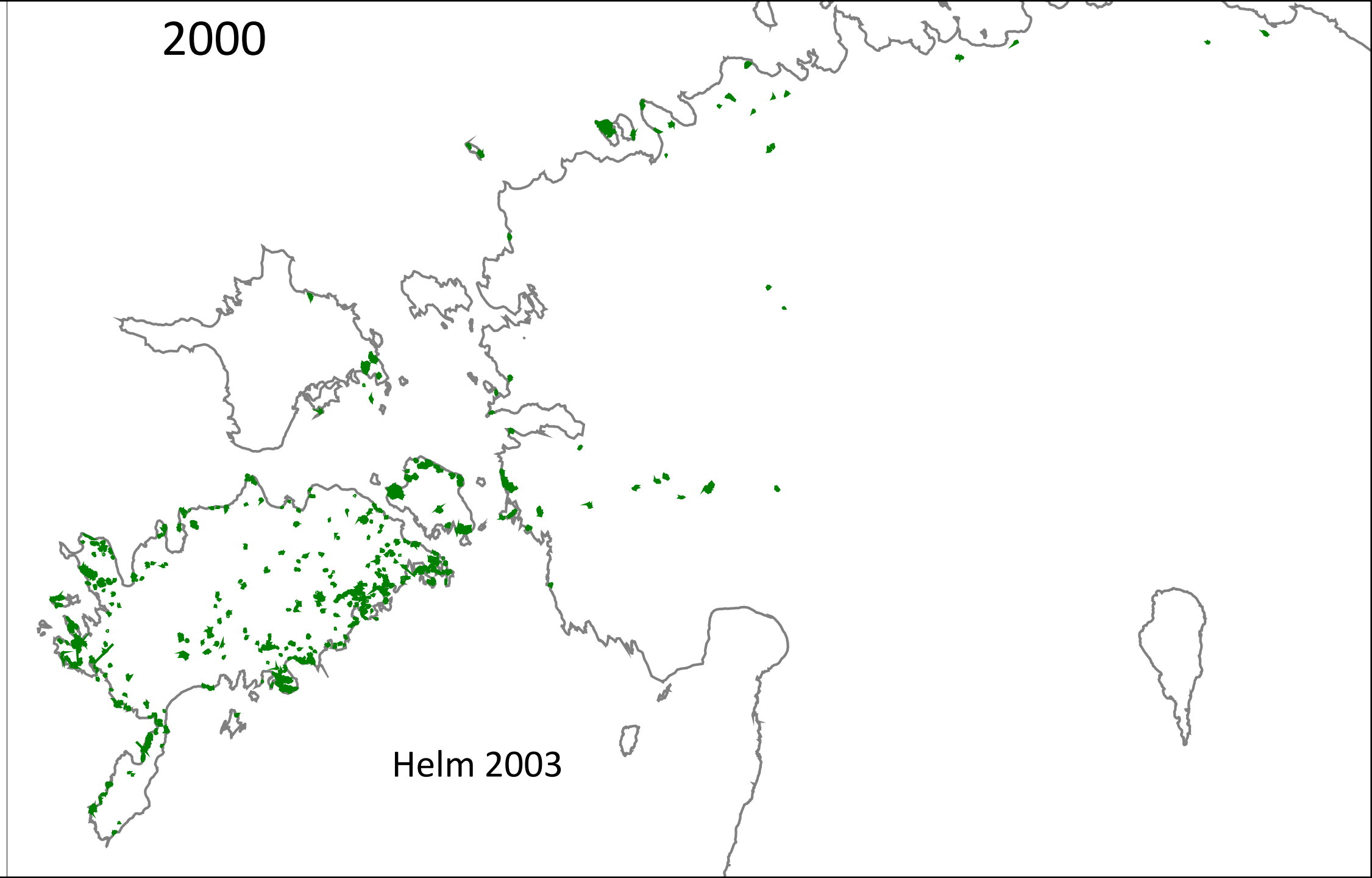
Species pool



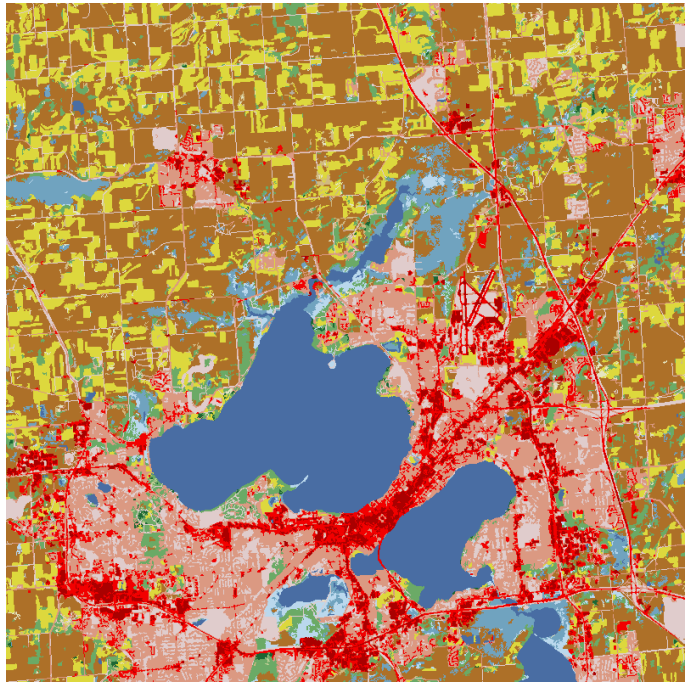
Island biogeography

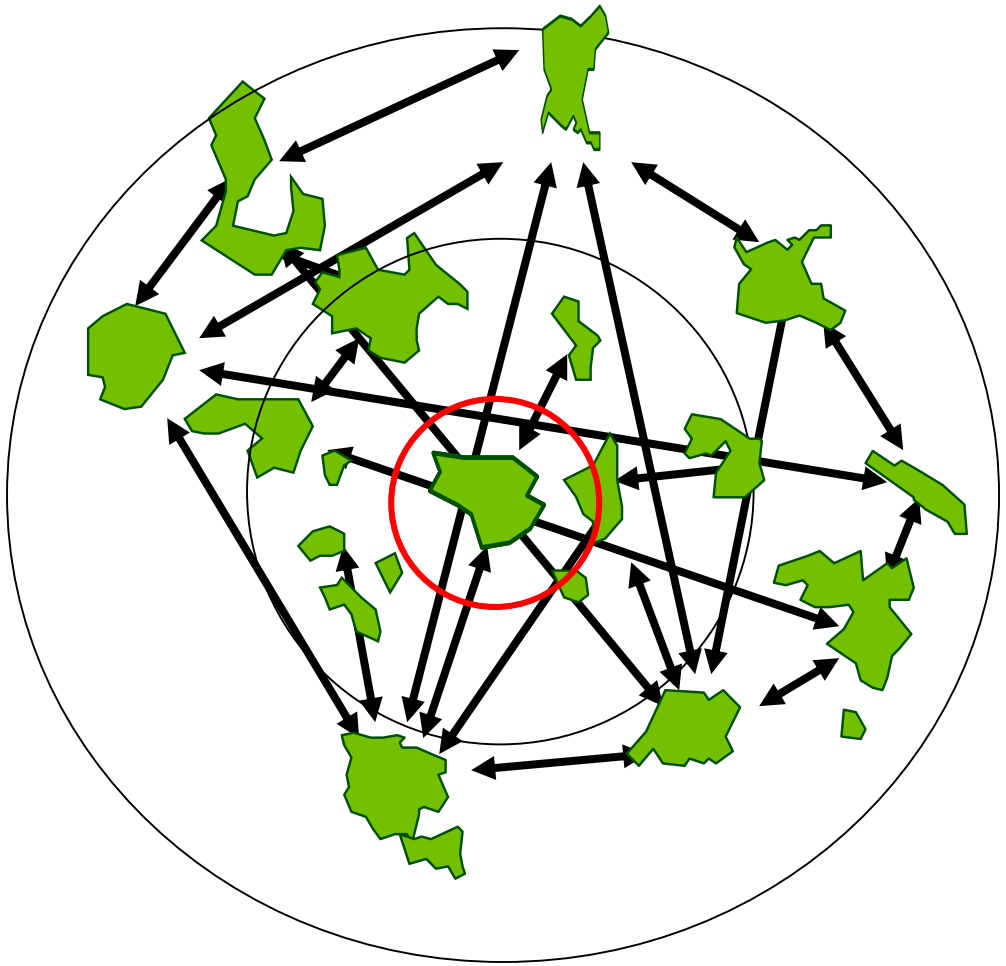


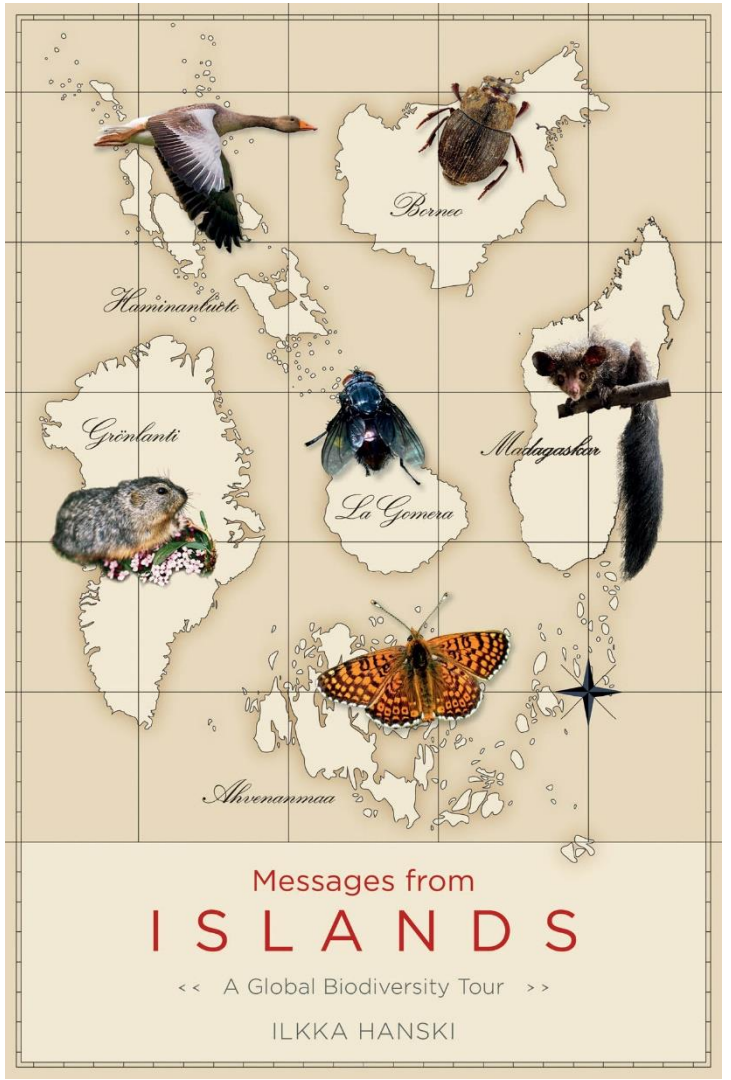
Meta-scale



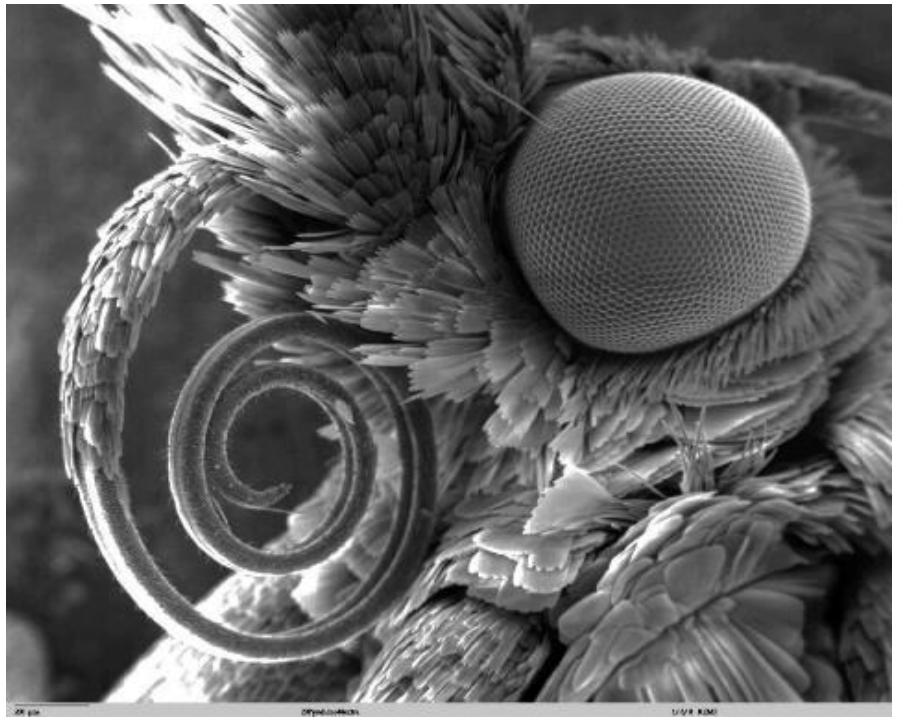
Metapopulations and -communities

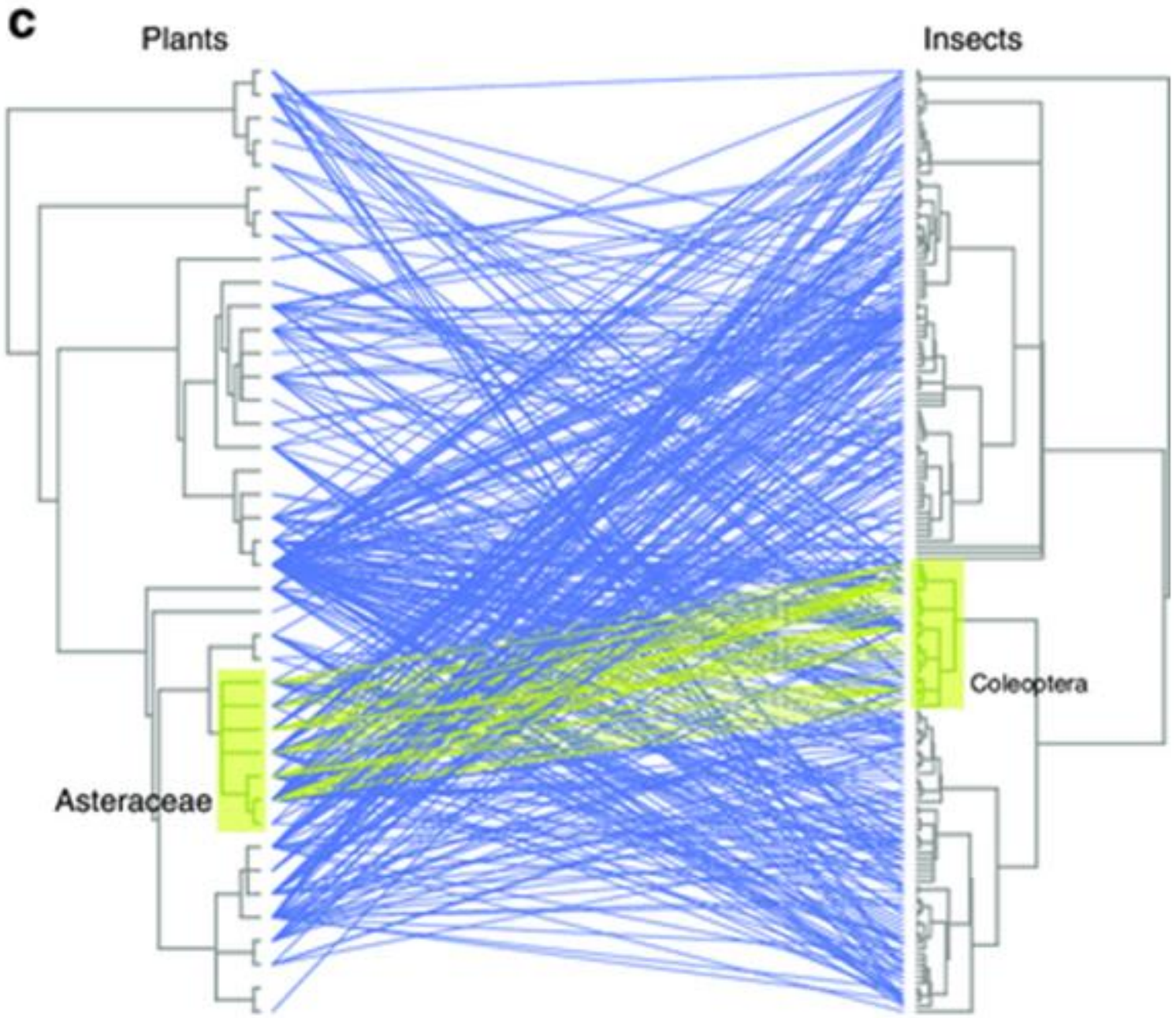






Interactions & coevolution

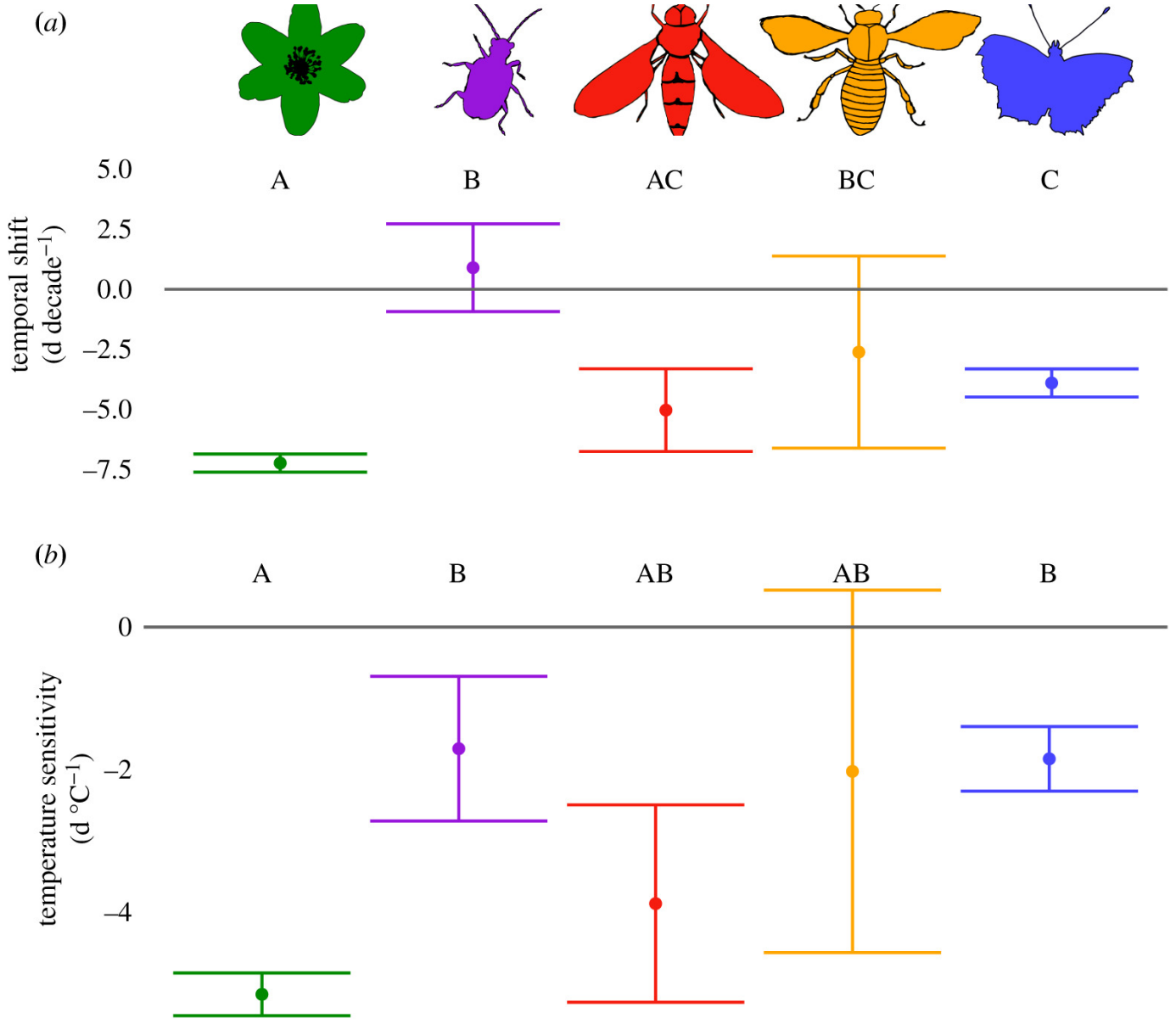




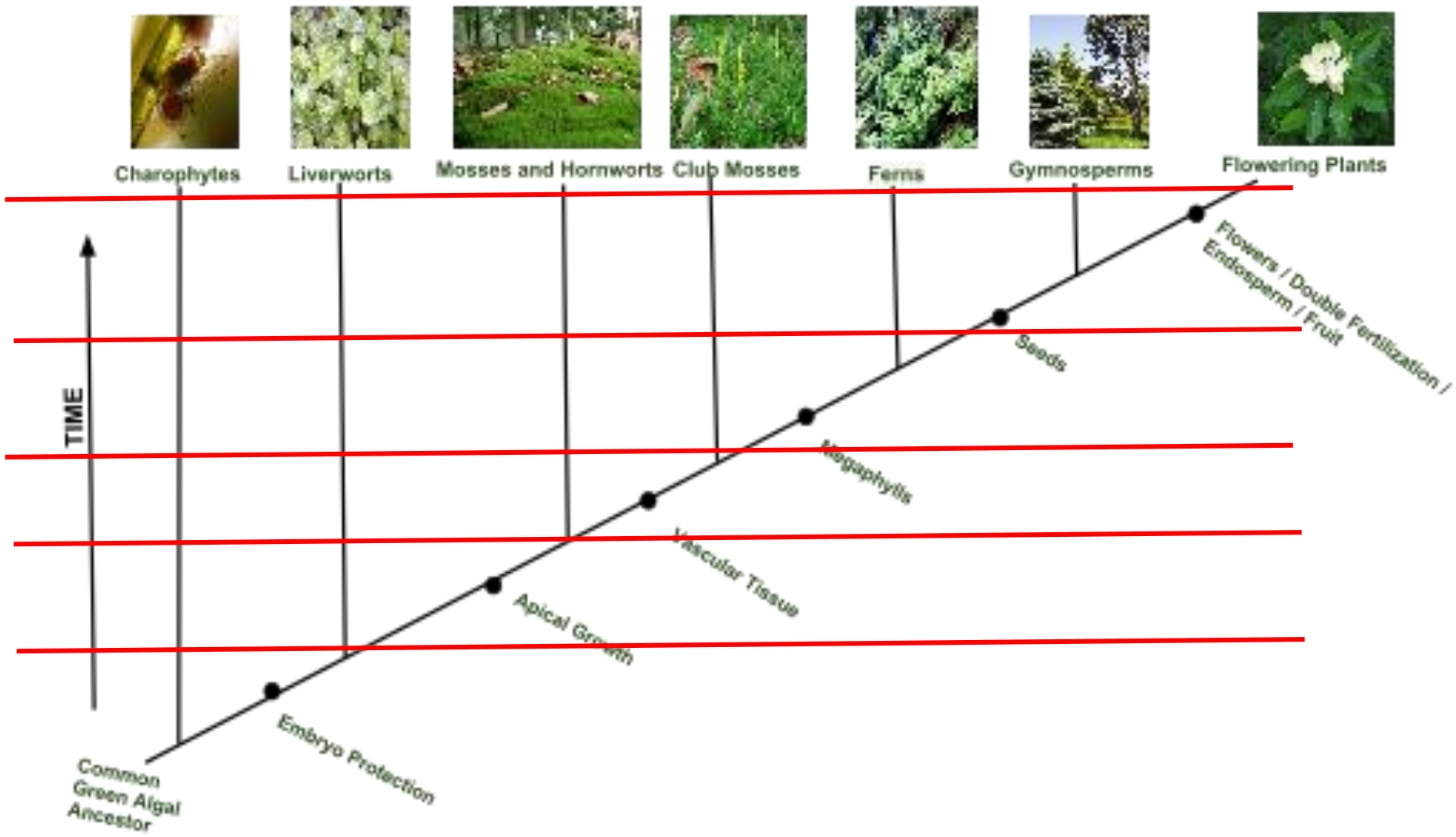
Kantsa et al 2018 NatComm

Phenological shifts

Freimuth et al. 2022 RSocProcB



Evolution of *Plantae*



Phylogenetic diversity

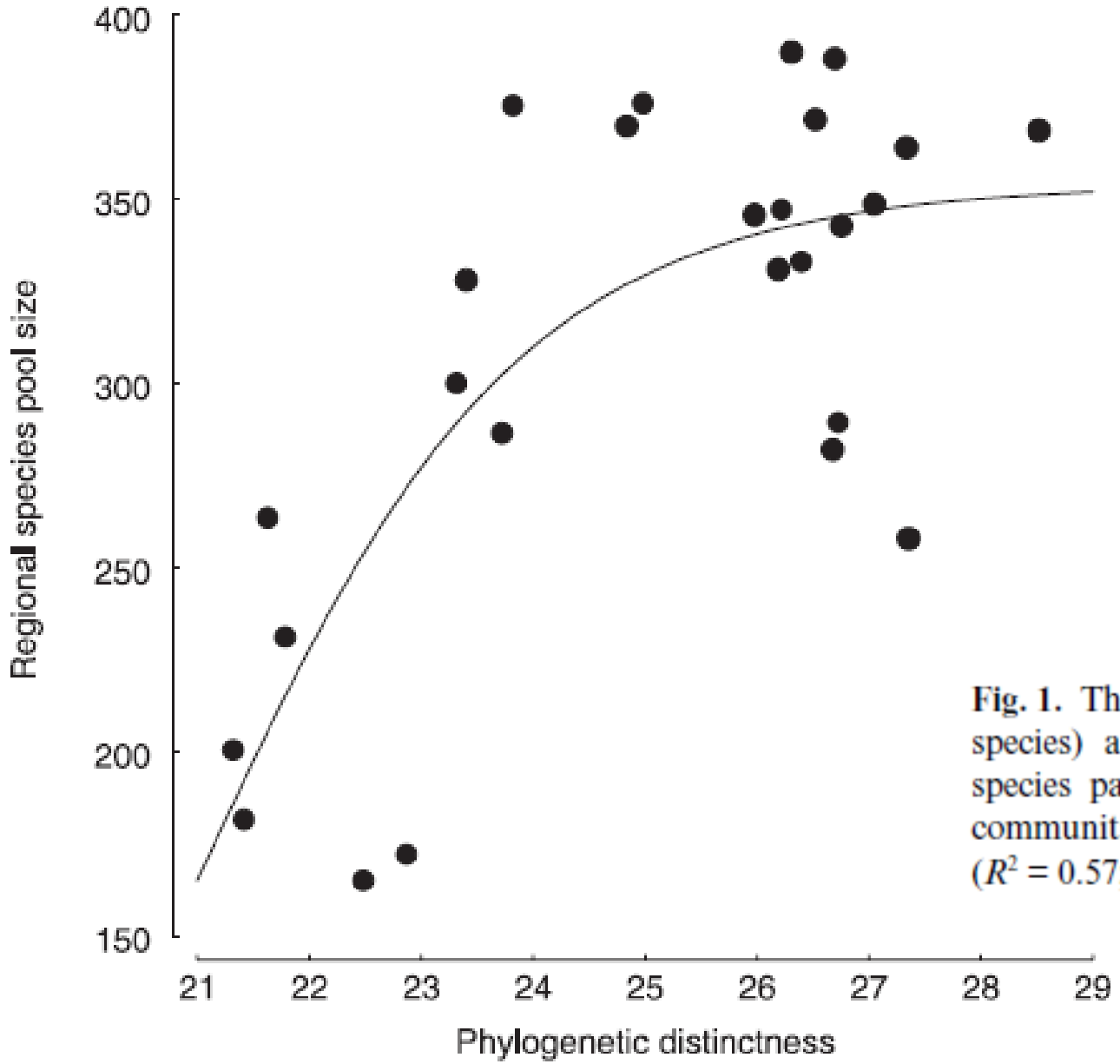
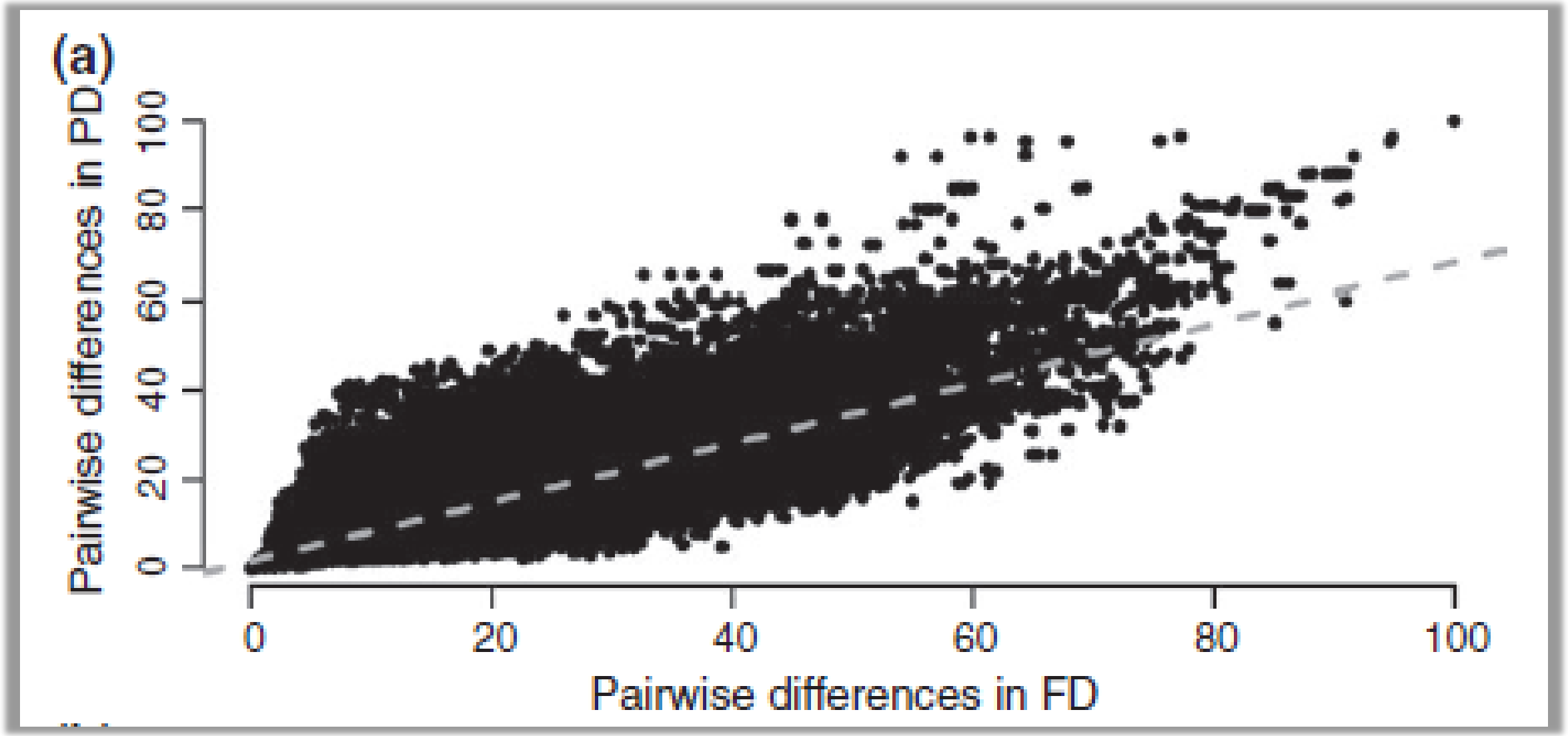


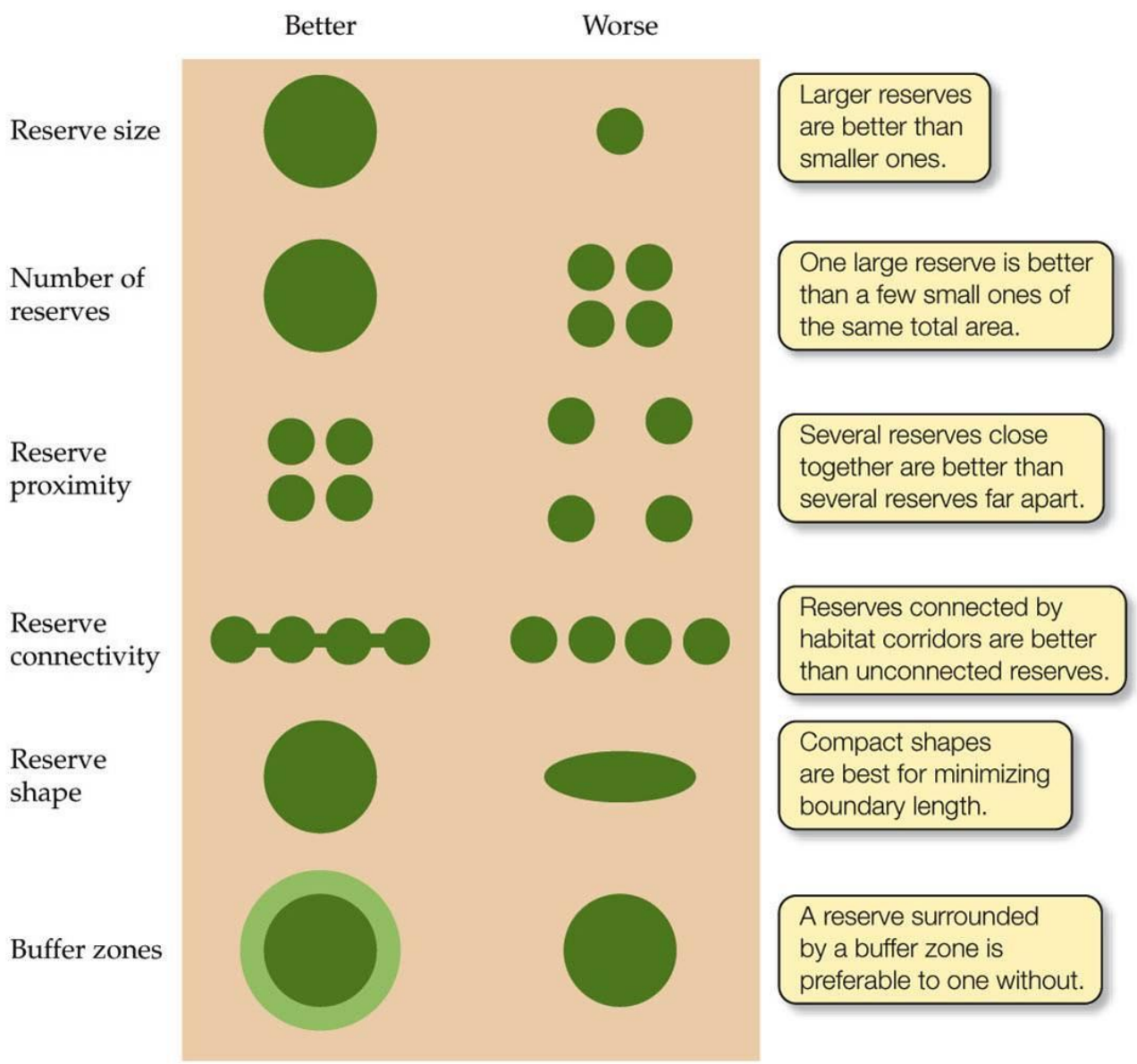
Fig. 1. The relationship between regional species pool (number of species) and phylogenetic distinctness (mean distance between species pairs in number of nodes) in 26 local herb-layer plant communities. The curve shows nonlinear saturation regression ($R^2 = 0.57$; $P < 0.001$).

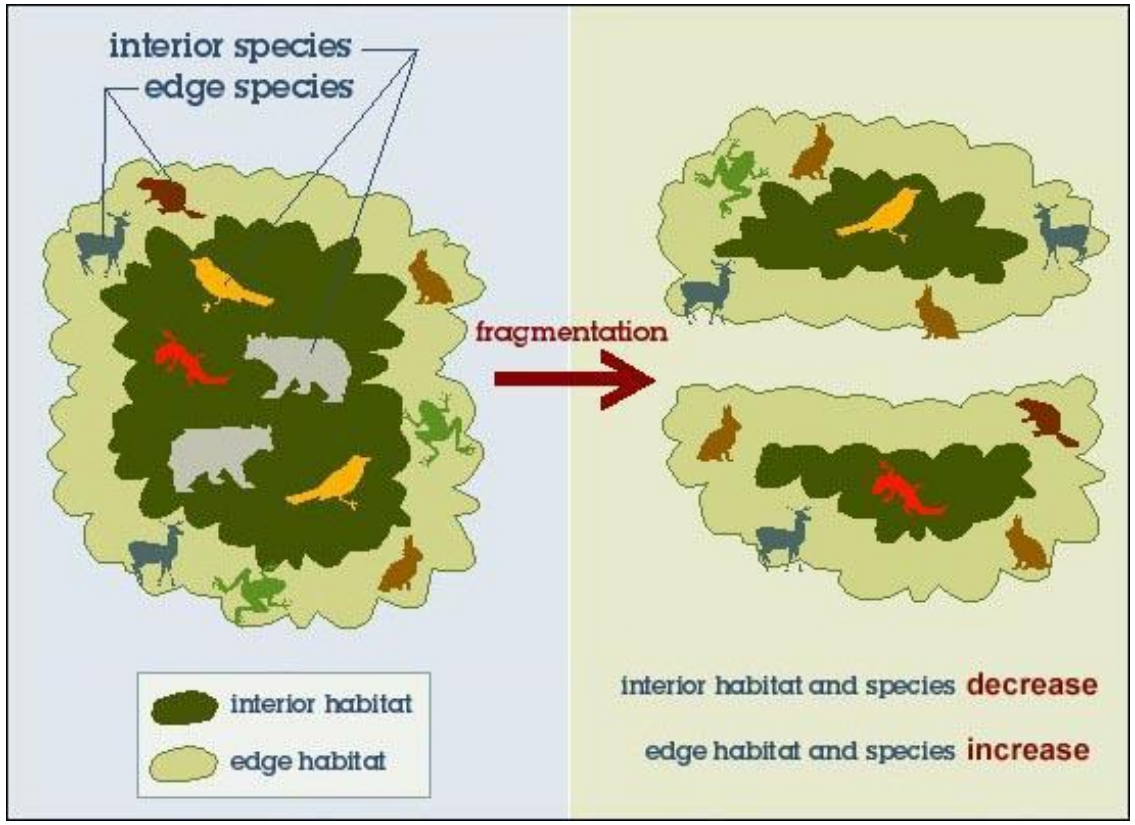
Gerhold et al. 2008 J of Ecol

Functional diversity

Carboni et al. 2013 J of Veg Sci





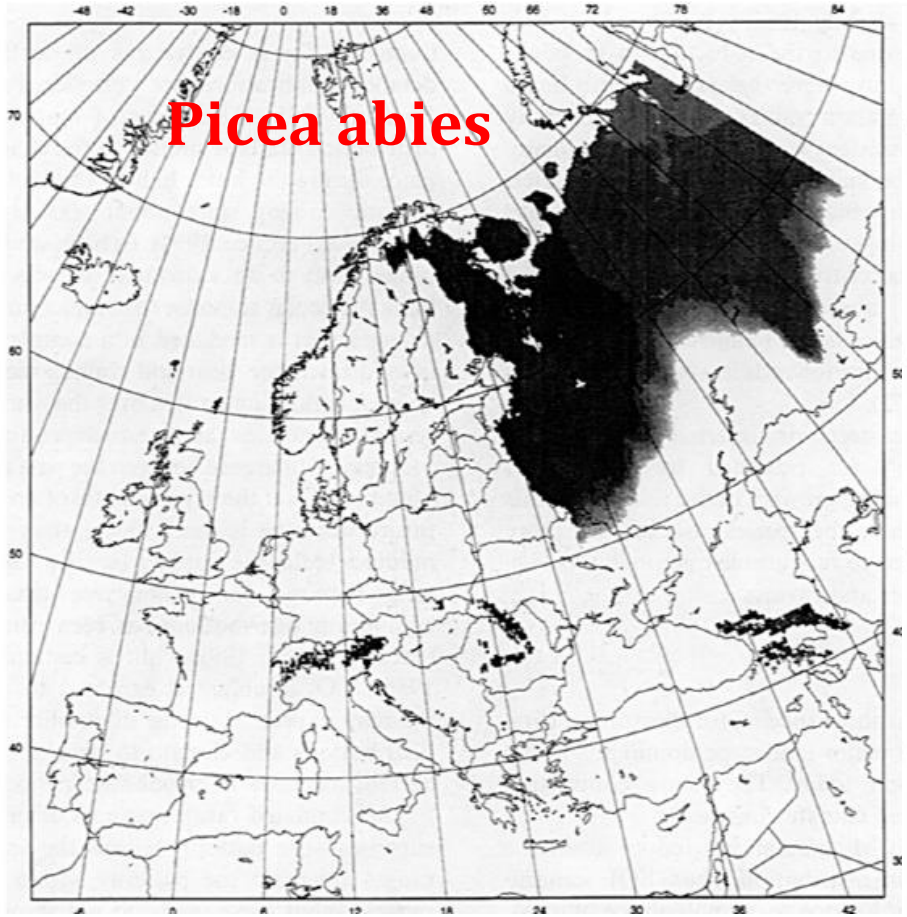


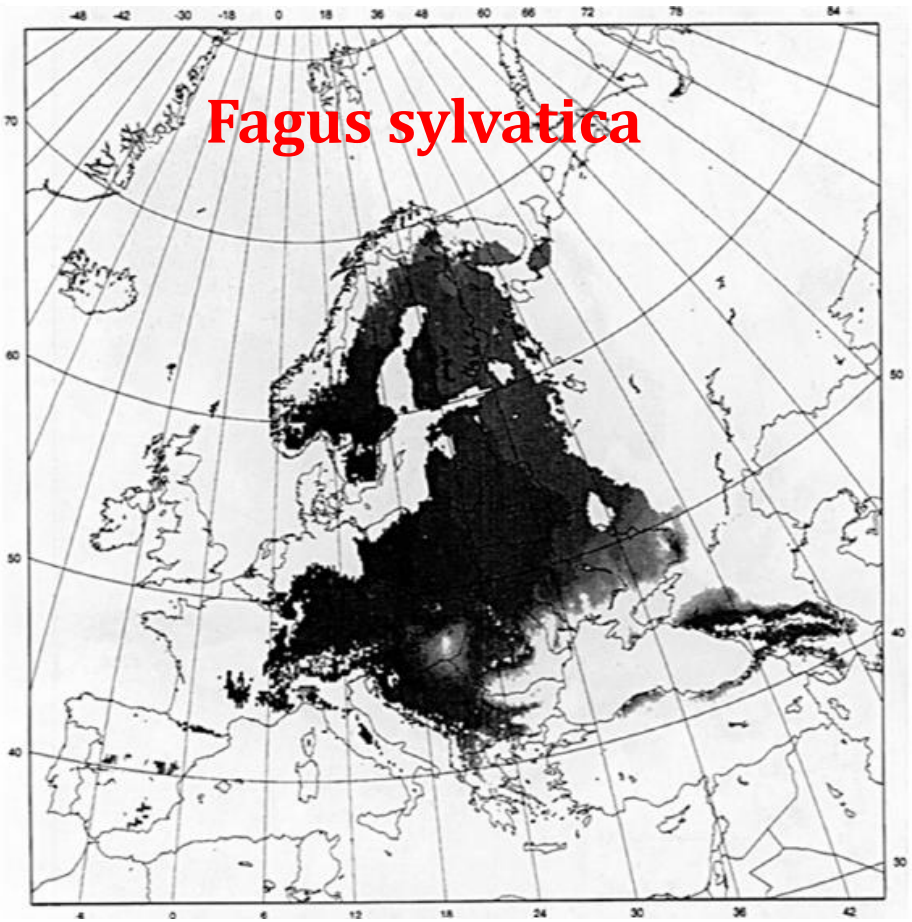
SLOSS – Single Large or Several Small

Ecosystem stability

A bioclimatic model for the potential distributions of north European tree species under present and future climates 1996

MARTIN T. SYKES*, I. COLIN PRENTICE AND WOLFGANG CRAMER† *Global Systems Group, Department of Ecology,*



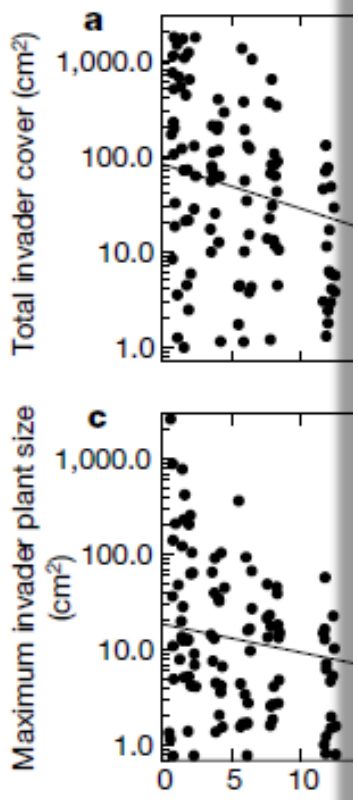


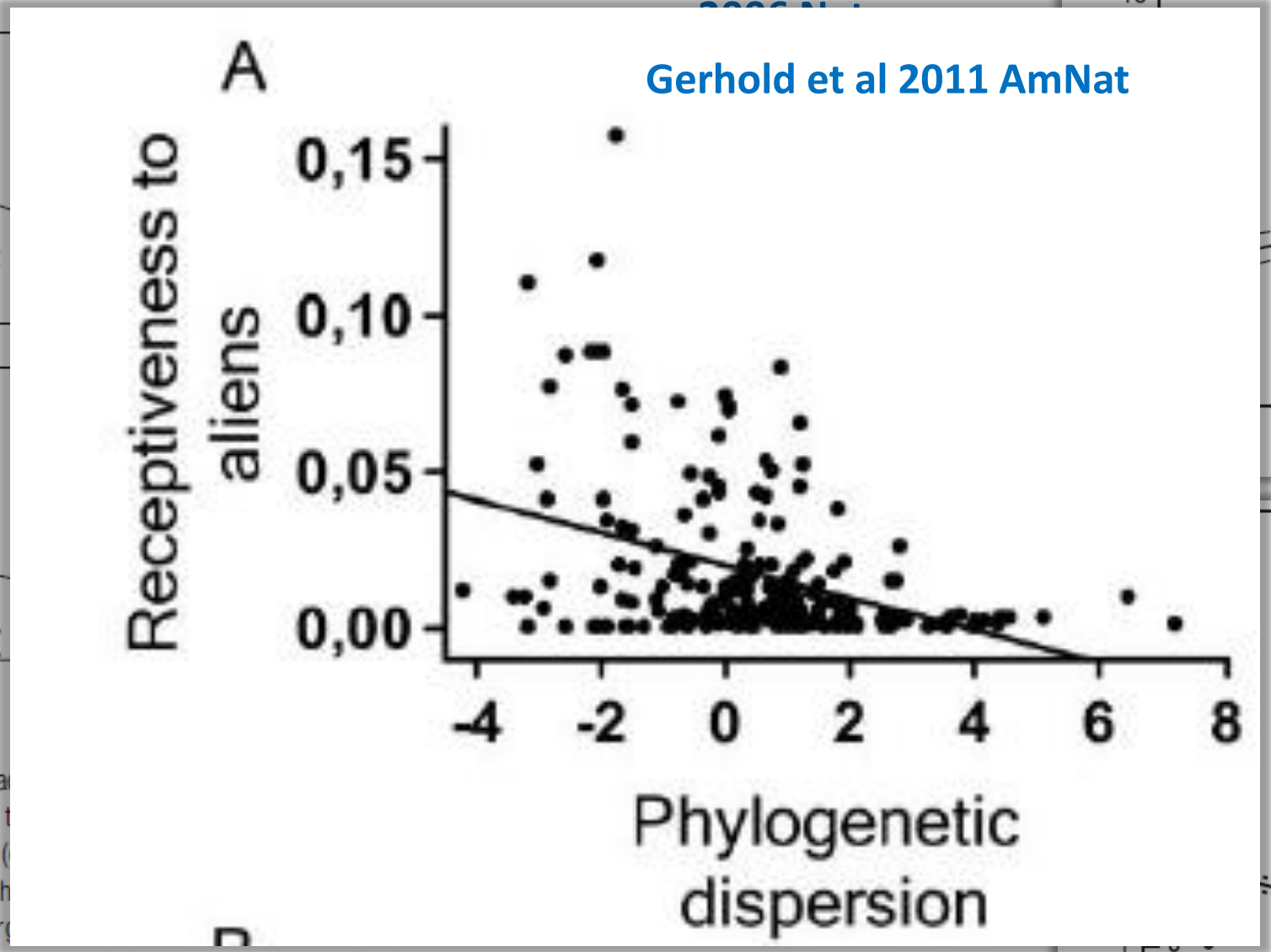
Cedar Creek (1982 - ...)

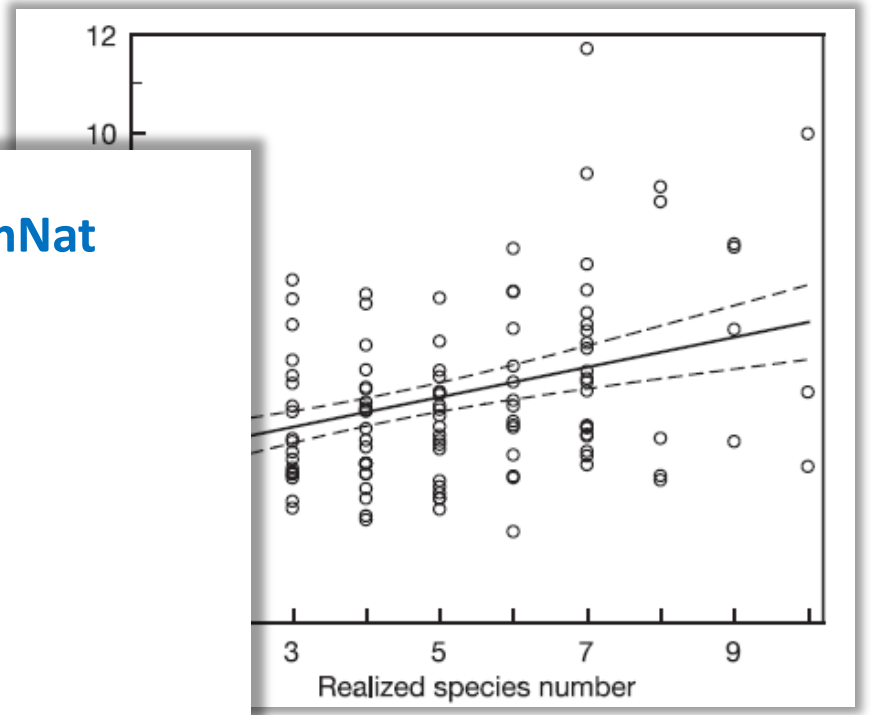
Native and non-native species

Tilman et al

Gerhold et al 2011 AmNat







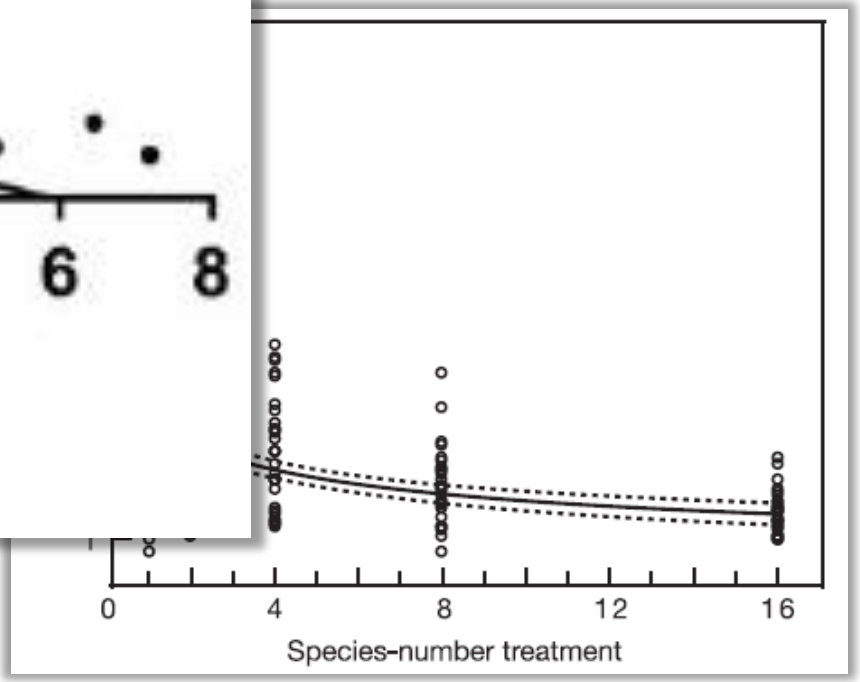


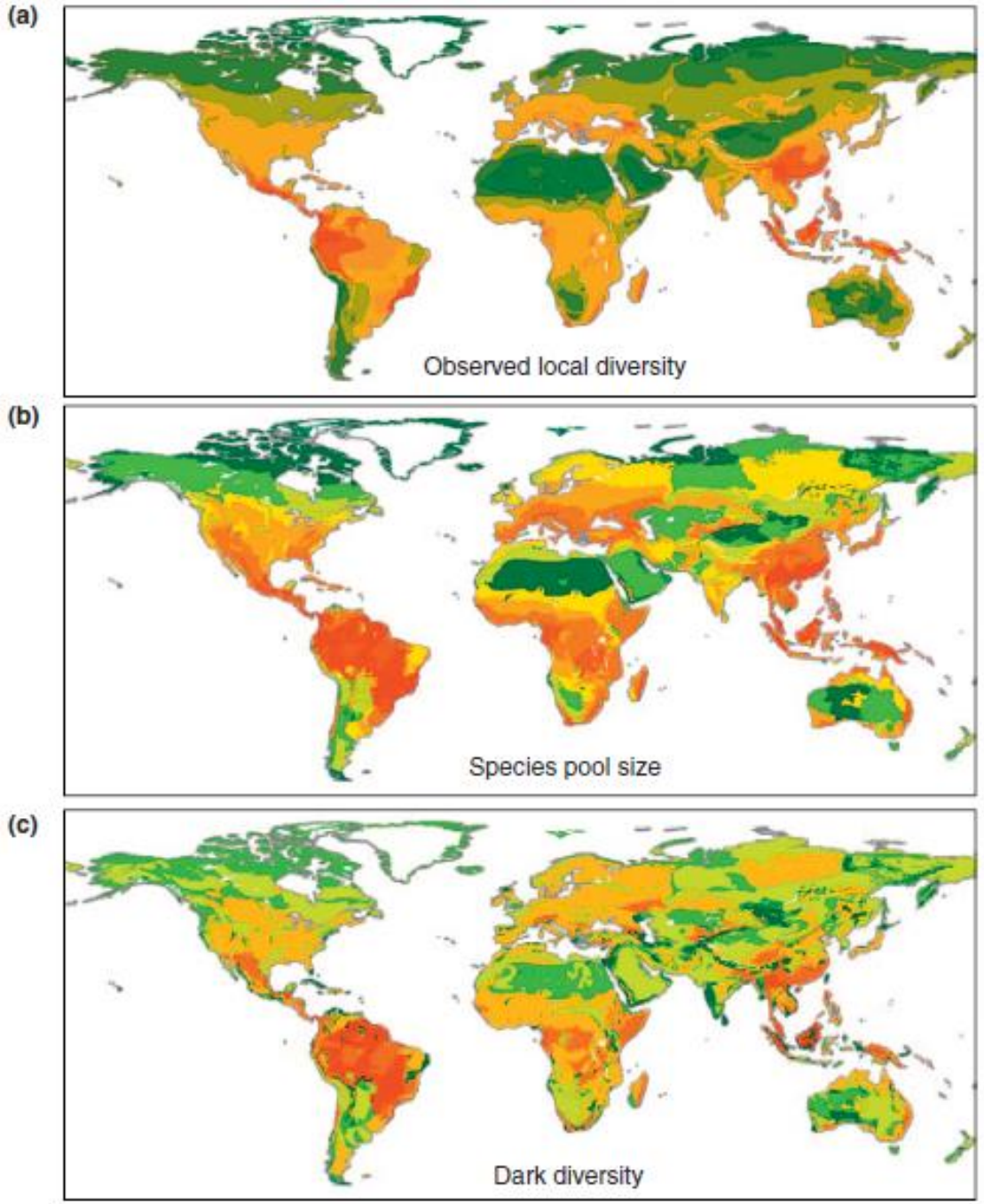
Figure 1 Plot diversity and inva
invader cover per subplot (**a**), t
individual invader per subplot (
(**d**). Plot level patterns (**a**) are th
reduction in the size of the lar
the median size of individual invaders (**d**), in more diverse plots. The least-squares regression lines are shown. Data are from 1998. Note the log scale on all *y* axes; NS, not significant.

Dark diversity

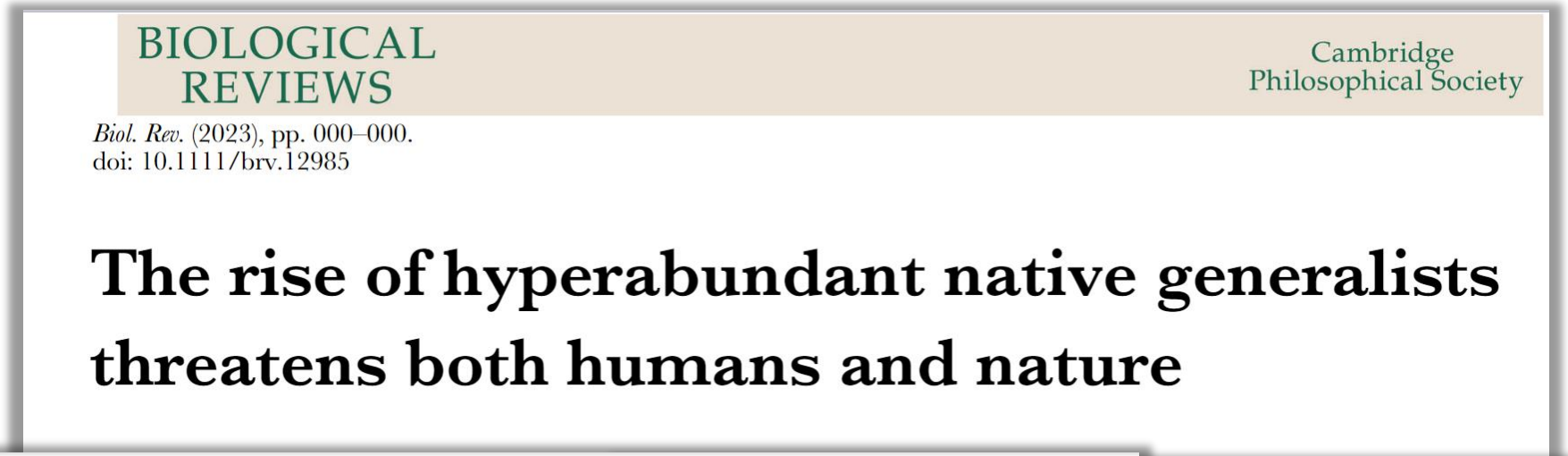
Dark diversity: shedding light on absent species

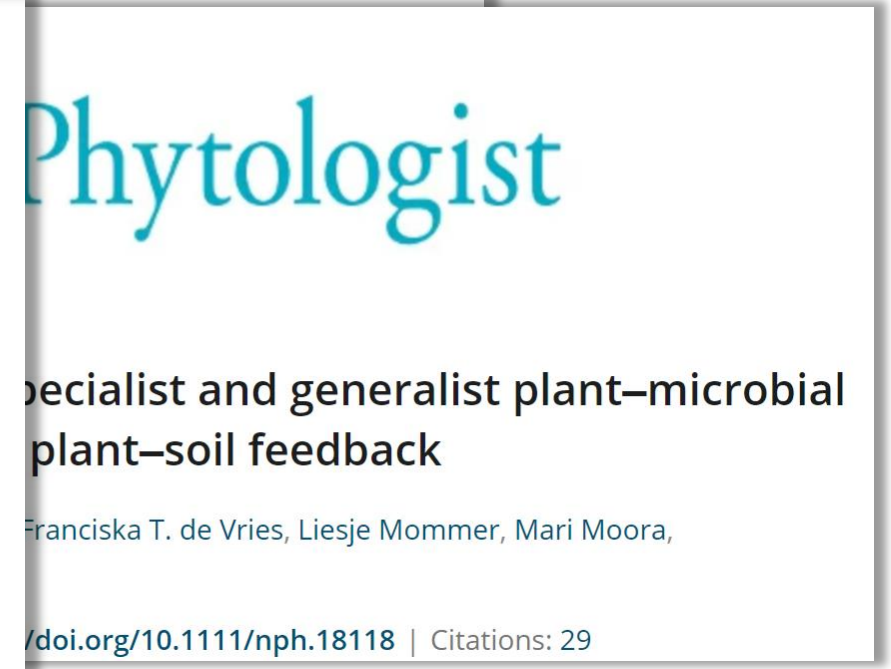
Pärtel *et al.* 2011 TREE

	Comparison	Local and dark diversity	Local:Dark
(a)	Prairies	1000 / 1500	0.7
	Pampas	1000 / 500	2.0
(b)	Rainforest	121 / 102	1.2
	Mountain forest	76 / 32	2.4
(c)	Fish	8 / 1	8.0
	Insects	24 / 13	1.8
	Plants	12 / 4	3.0



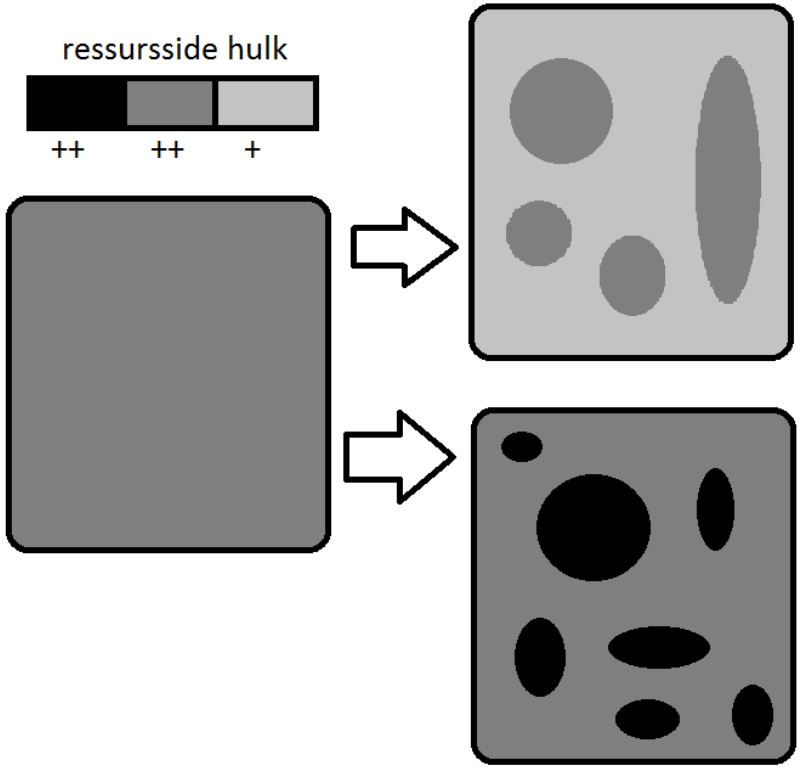
Specialist and generalist species





Heterogeneity and diversity

Heterogeneity as:
Separate niche
Affecting the mean
Microfragmentation



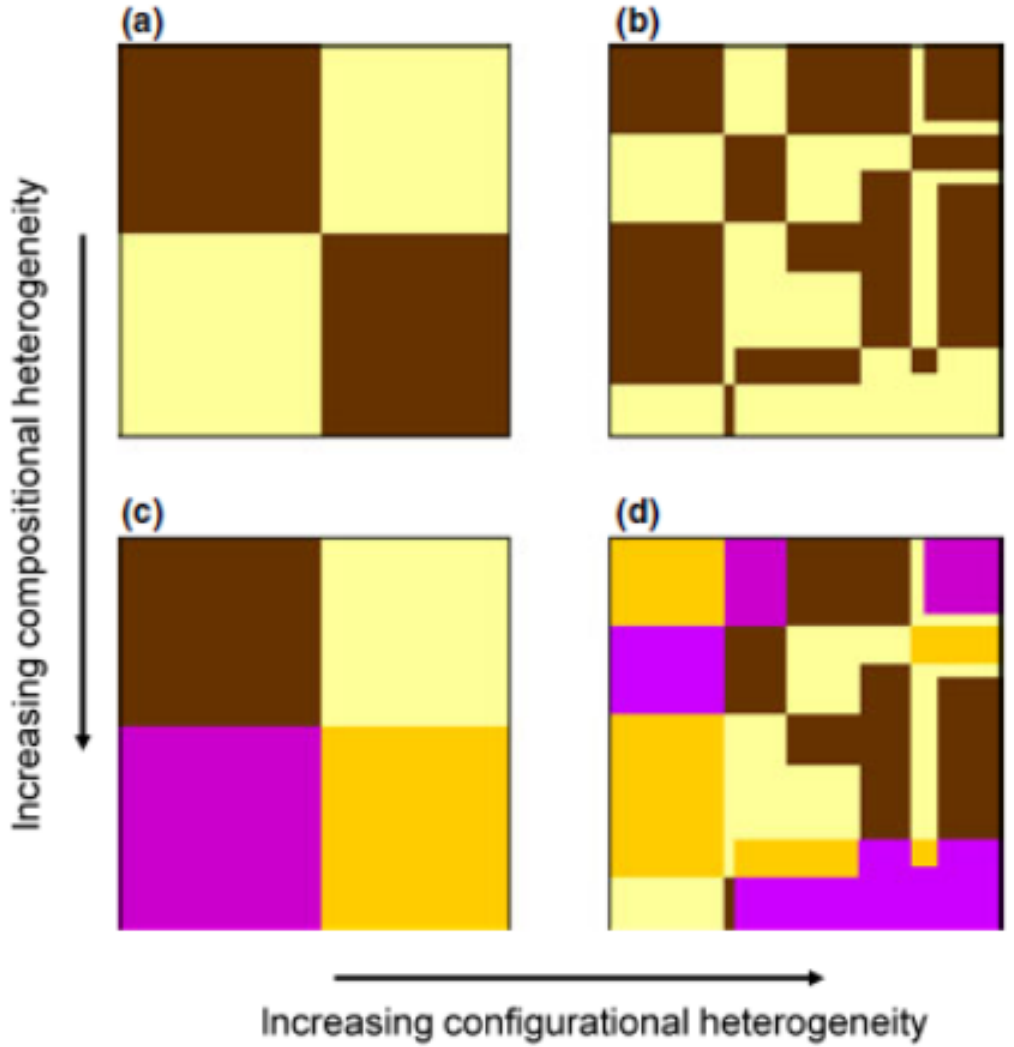
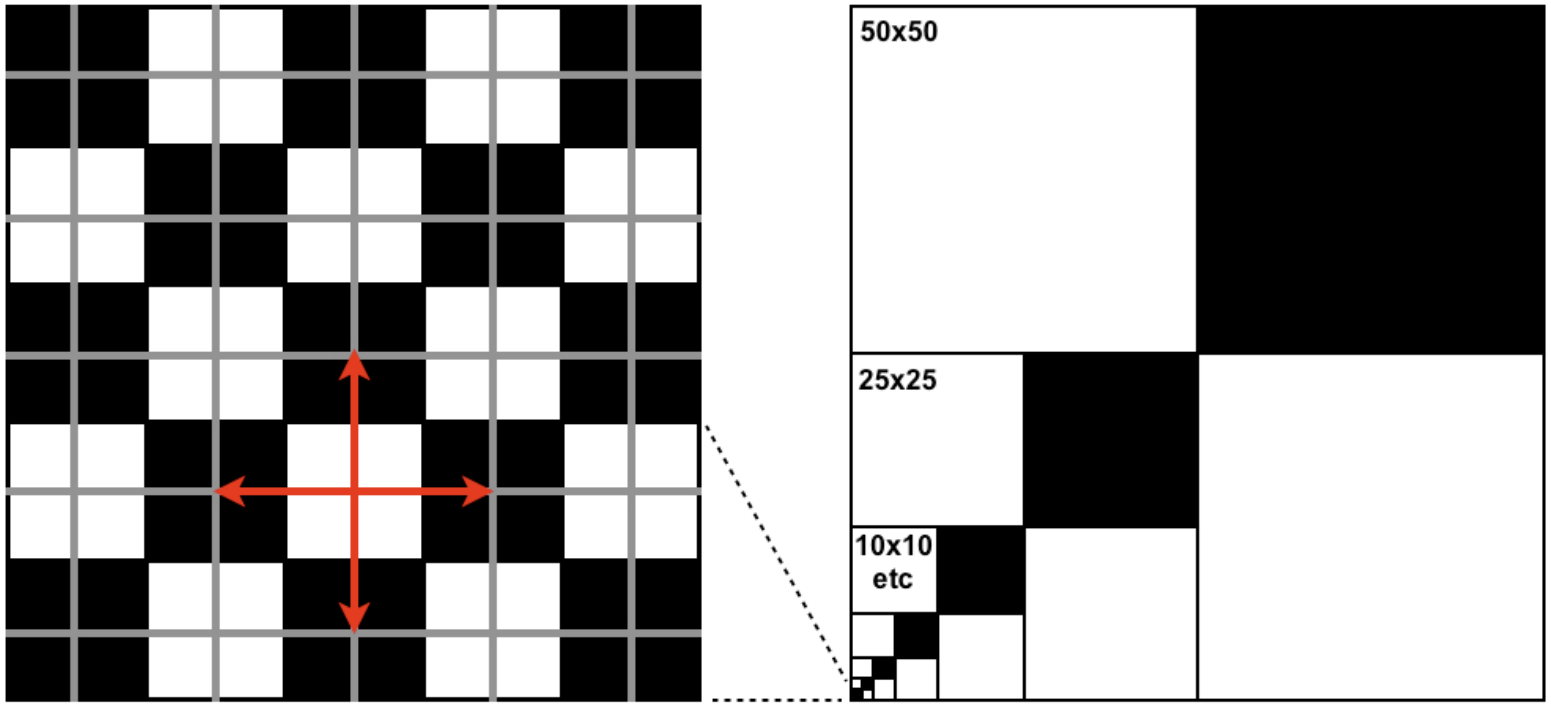


Figure 3. Illustration of the two major axes of spatial hetero-geneity: compositional and configurational heterogeneity. Each large square is a landscape and different colours represent different cover types within landscapes. *Compositional heterogeneity* increases with increasing number and / or evenness of cover types. *Configurational heterogeneity* increases with increasing complexity of the spatial pattern.

Fahrig et al. 2011 *Ecol Letters*

Microfragmentation

Heterogeneity was defined as the average chance that one of the adjacent grid nodes represents another habitat type. We generated different patch sizes in grids of **50x50 nodes** (heterogeneity = 0.08%); **25x25 nodes** (heterogeneity = 0.32%); **10x10 nodes** (heterogeneity = 2%); **5x5 nodes** (heterogeneity = 8%); **2x2 nodes** (heterogeneity = 50%) and **1x1 nodes** (heterogeneity = 100%).

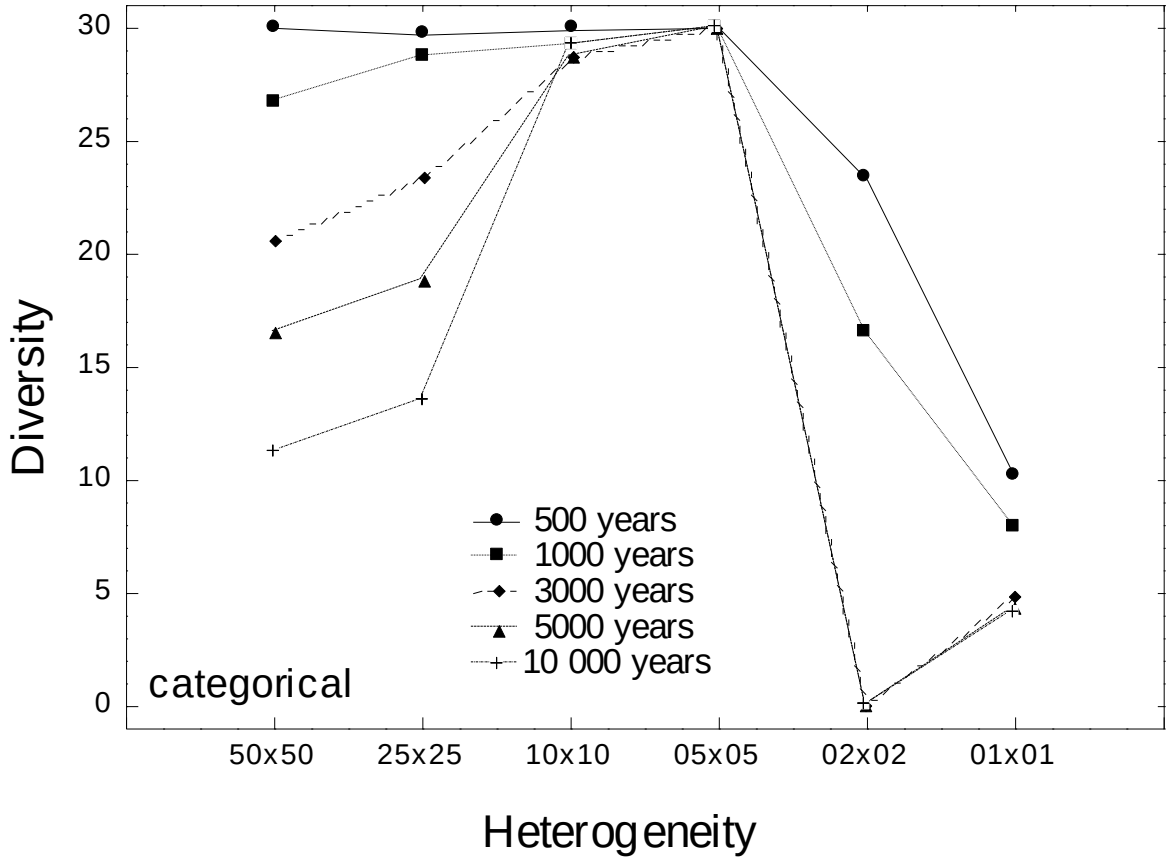


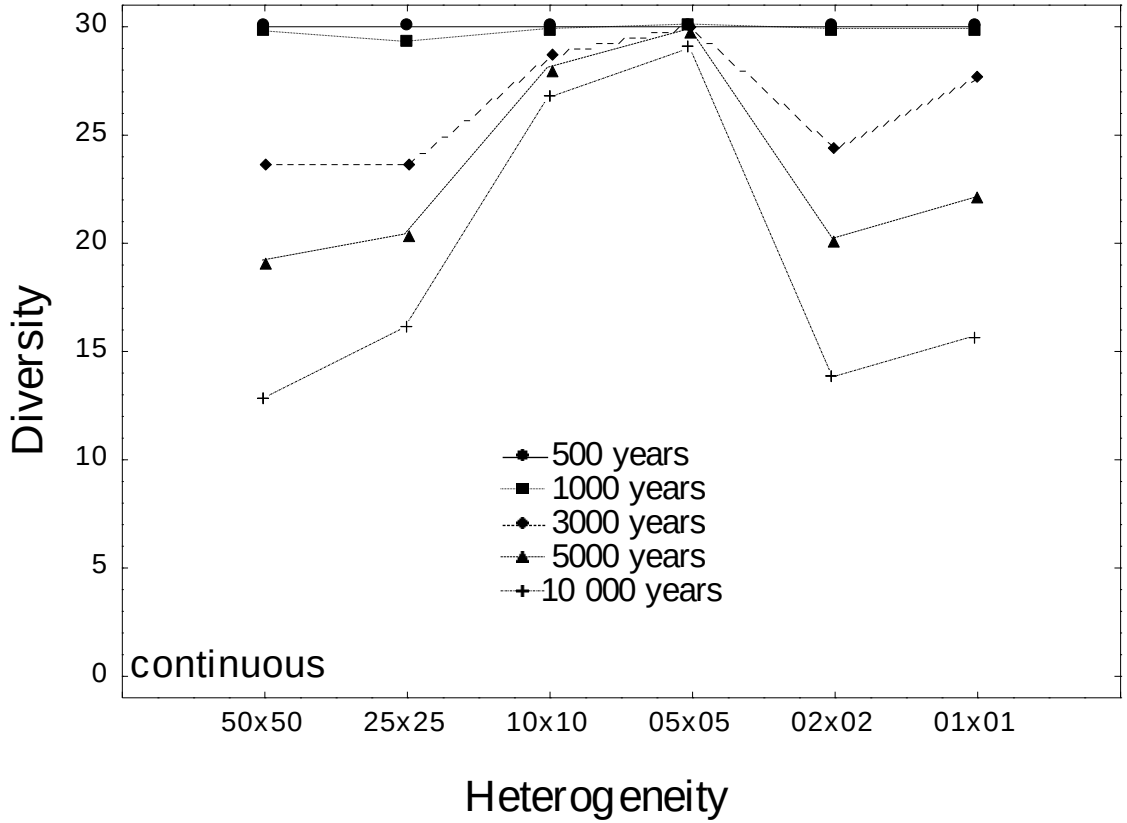
Chessboard type combinations of model landscapes (white and black represent the two habitat types) with different heterogeneities used for modeling (right panel). Magnified extract is of the most heterogeneous model landscape (left panel) and describes to where a model individual can disperse (red arrows) on the nodes of lattice (crossings of the grey lines).

Laanisto et al. 2013 Oecologia

Results – specialist species

Scenario 1 – only specialists: 15 species preferred habitat A and the other 15 species preferred habitat B.

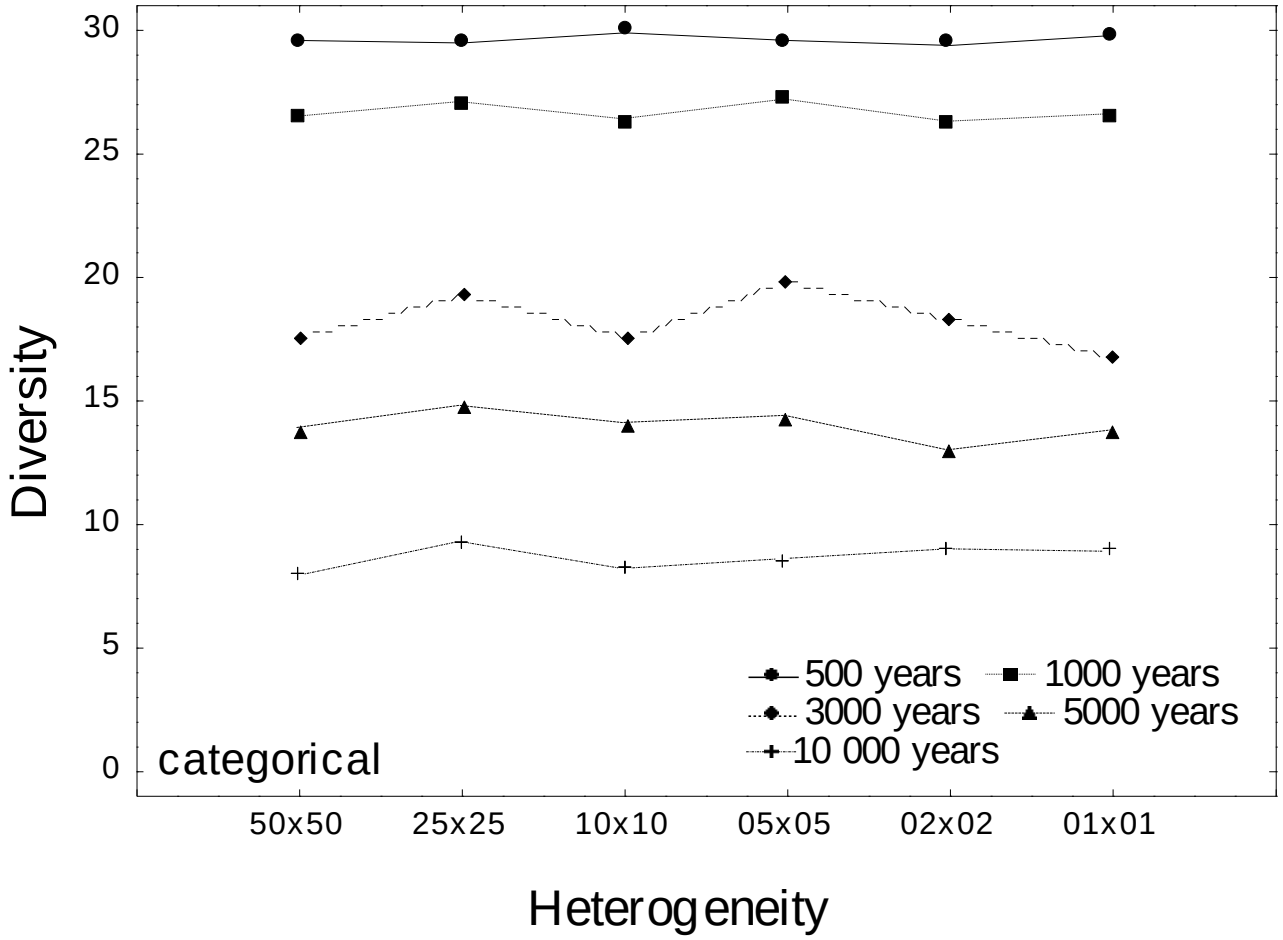




*Results of diversity simulations for **Scenario 1: only specialists**. Heterogeneity scale corresponds with patch sizes in model landscapes (low heterogeneity in left and high heterogeneity in right); diversity is in given as Simpson's Reciprocal index. Left graph represents categorical and right graph continuous framework. Different relationship lines correspond with temporal simulation steps.*

Laanisto et al. 2013 Oecologia

Results – generalists species

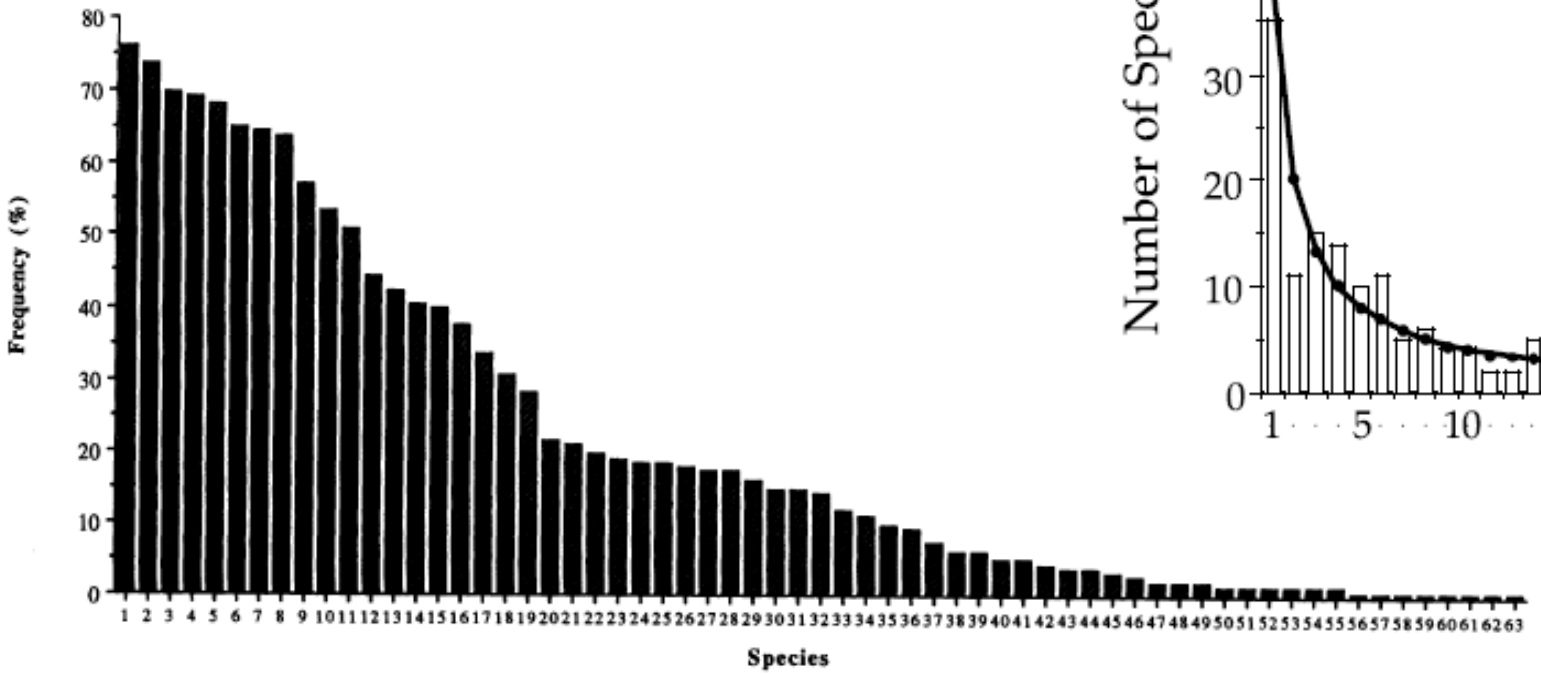


***Scenario 4 – only generalists*:** all 30 species were equally capable of living in both habitats.

Results of diversity simulations for ***Scenario 4: only generalist***.
(There was no continuous framework simulation for *Scenario 4*.)

Laanisto et al. 2013 Oecologia

Consequences



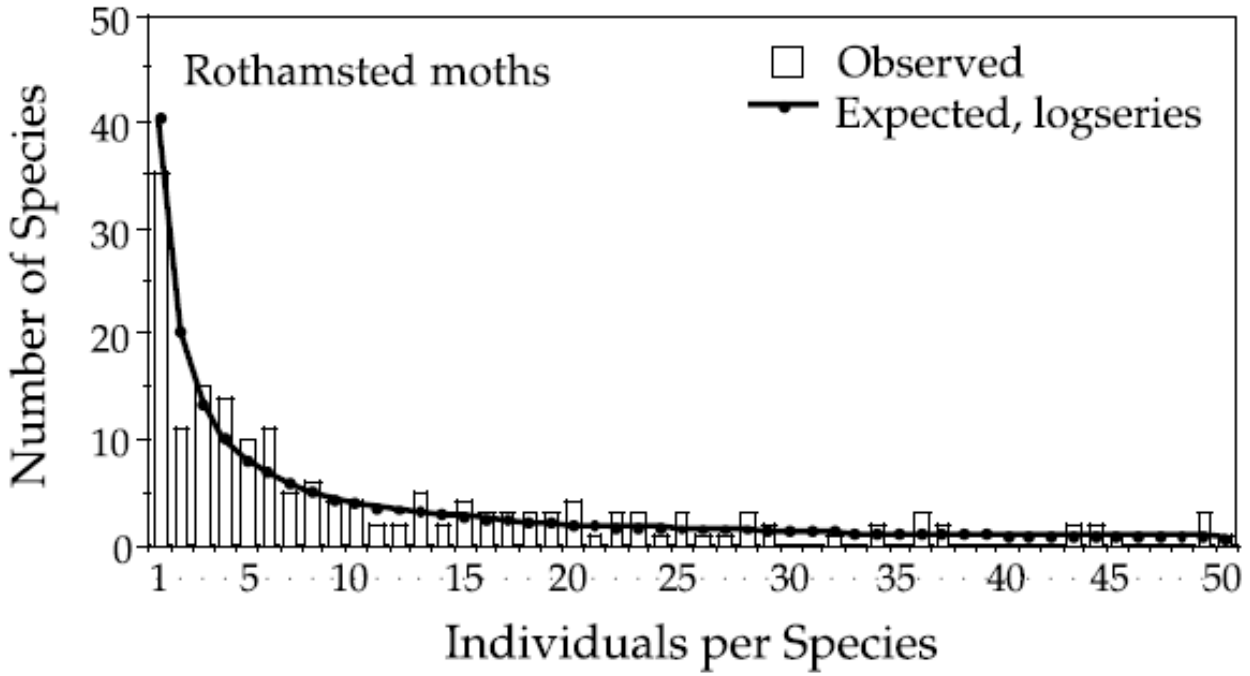
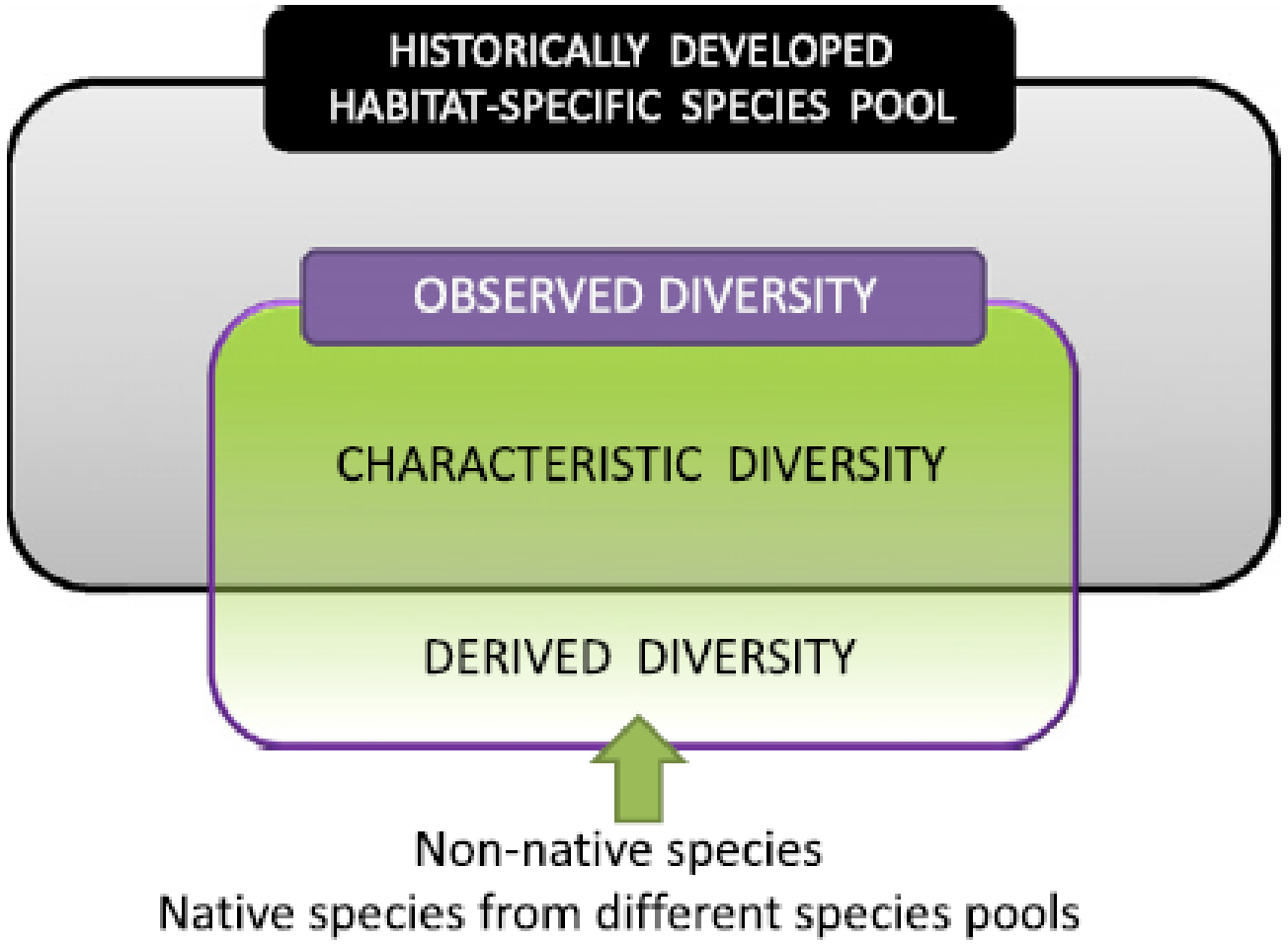


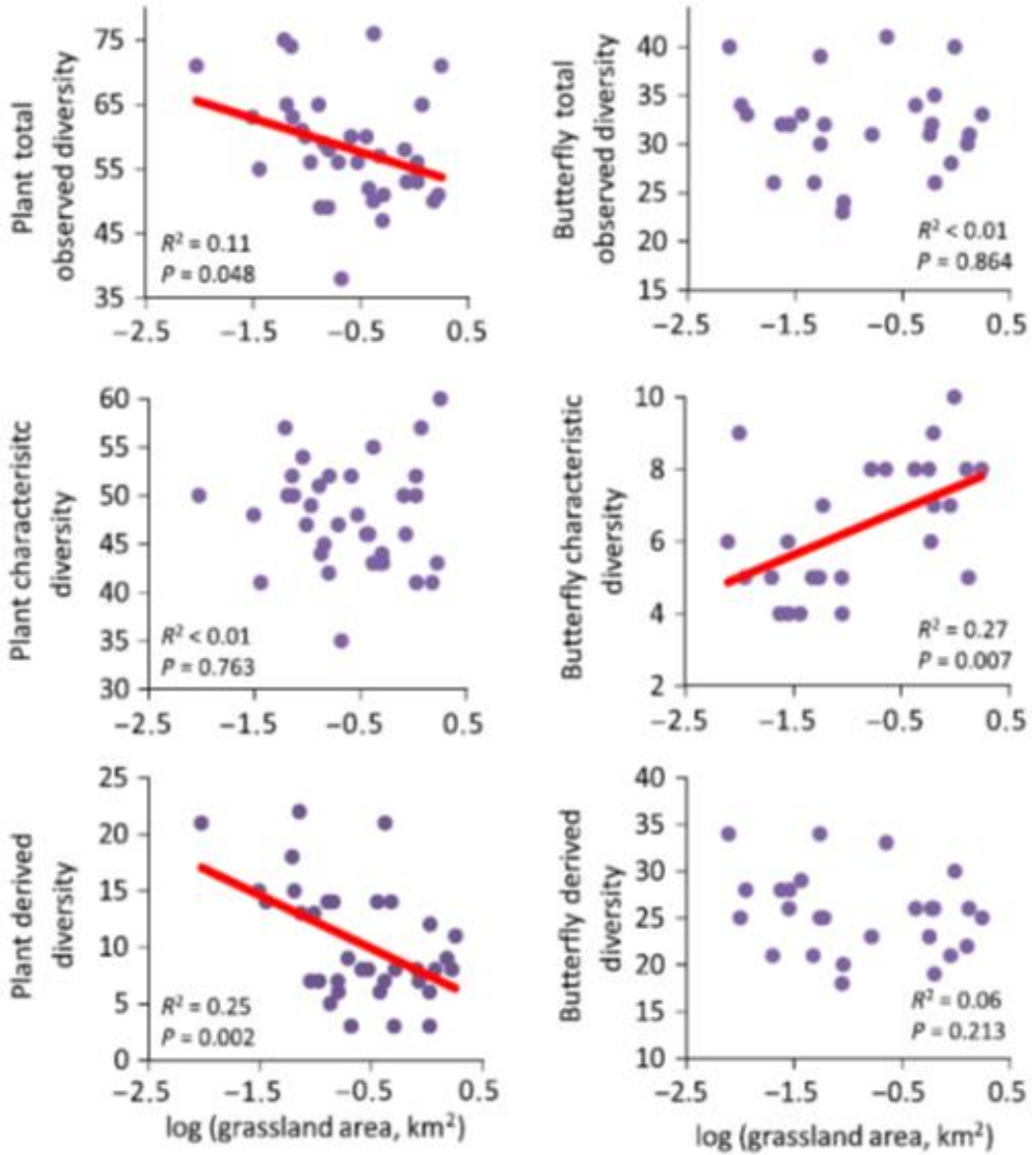
Fig. 2. Distribution of regional abundance of 63 plant species in semi-natural pastures in Södermanland, Sweden. 1 *Leucanthemum vulgare*. 2 *Polygala vulgaris*. 3 *Campanula persicifolia*. 4 *Succisa pratensis*. 5 *Ajuga pyramidalis*. 6 *Galium boreale*. 7 *Briza media*. 8 *Centaurea jacea*. 9 *Trifolium medium*. 10 *Carex panicea*. 11 *Antennaria dioica*. 12 *Saxifraga granulata*. 13 *Rhinanthus minor*. 14 *Danthonia decumbens*. 15 *Platanthera bifolia*. 16 *Hieracium pilosella*. 17 *Ranunculus polyanthemos*. 18 *Helianthemum nummularium*. 19 *Scorzonera humilis*. 20 *Dianthus deltoides*. 21 *Crepis praemorsa*. 22 *Carex disticha*. 23 *Euphrasia stricta*. 24 *Hypochoeris maculata*. 25 *Linum catharticum*. 26 *Polygonum viviparum*. 27 *Carlina vulgaris*. 28 *Nardus stricta*. 29 *Plantago media*. 30 *Dactylorhiza maculata*. 31 *Potentilla tabernaemontani*. 32 *Taraxacum* gr. *Erythrosperma*. 33 *Gentianella campestris*. 34 *Fragaria viridis*. 35 *Lychnis flos-cuculi*. 36 *Potentilla crantzii*. 37 *Phleum phleoides*. 38 *Botrychium lunaria*. 39 *Calamagrostis stricta*. 40 *Molinia caerulea*. 41 *Salix repens*. 42 *Trifolium montanum*. 43 *Euphrasia nemorosa*. 44 *Platanthera chlorantha*. 45 *Carex cespitosa*. 46 *Selinum carvifolia*. 47 *Carex pulicaris*. 48 *Inula salicina*. 49 *Parnassia palustris*. 50 *Carex vulpina*. 51 *Cynosurus cristatus*. 52 *Gymnadenia conopsea*. 53 *Melampyrum cristatum*. 54 *Thalictrum flavum*. 55 *Viola persicifolia*. 56 *Campanula cervicaria*. 57 *Eleocharis quinqueflora*. 58 *Euphrasia rostkoviana*. 59 *Lathyrus palustris*. 60 *Pedicularis palustris*. 61 *Primula farinosa*. 62 *Rhinanthus serotinus*. 63 *Viola rupestris*. The following 14 species were included in parts of the inventory but excluded from species richness analyses: *Agrimonia eupatoria, Agrostis capillaris, Calluna vulgaris, Carex leporina, Carex nigra, Gnaphalium sylvaticum, Lotus corniculatus, Potentilla erecta, Primula veris, Ranunculus bulbosus, Serratula tinctoria, Thymus serpyllum, Trifolium fragiferum, Viola canina.*

Eriksson et al 1995 Ecography

Division and divergence

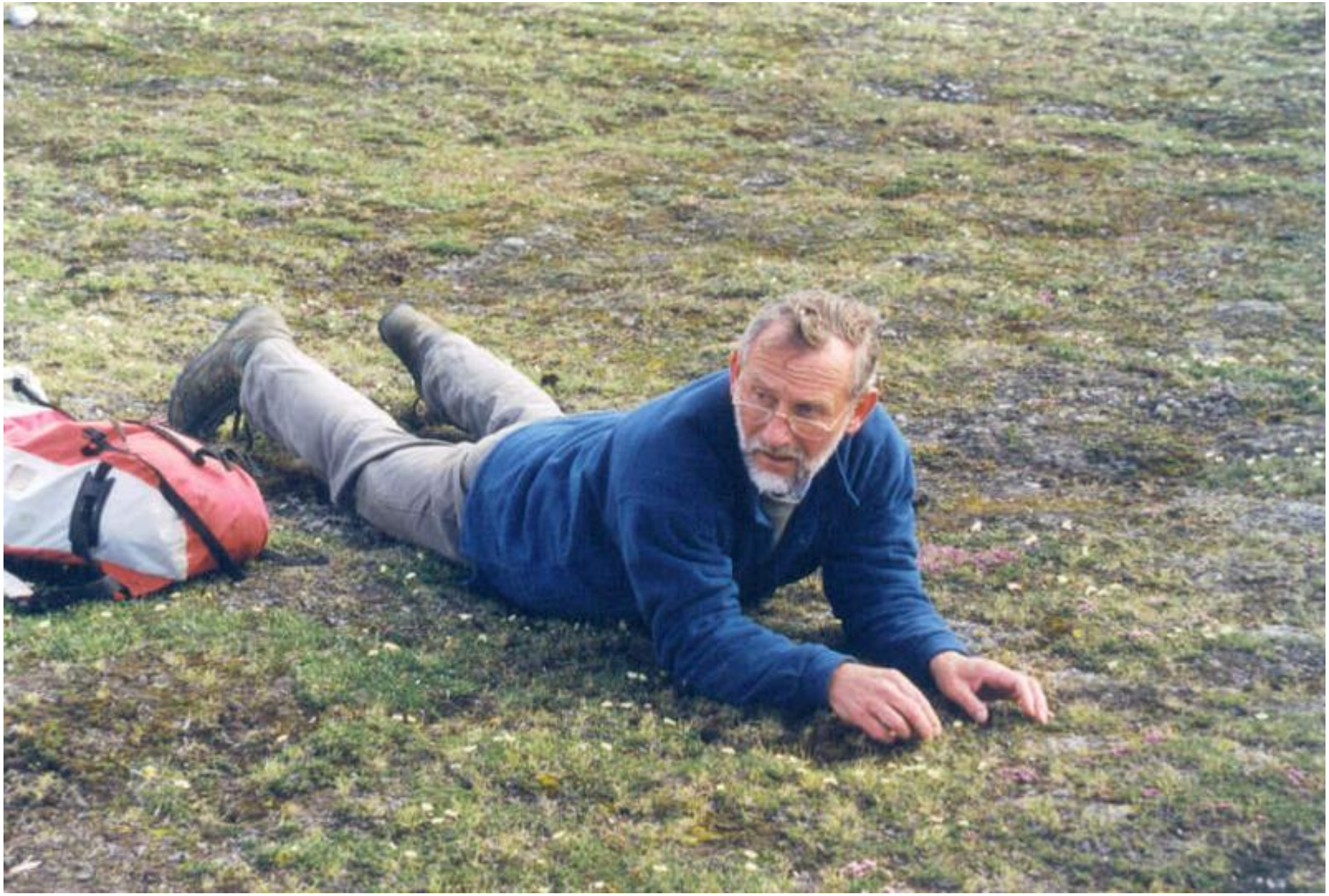
Diversity and Distributions, (Diversity Distrib.) (2014) 1–11





(Community) ecology is like stamp collecting

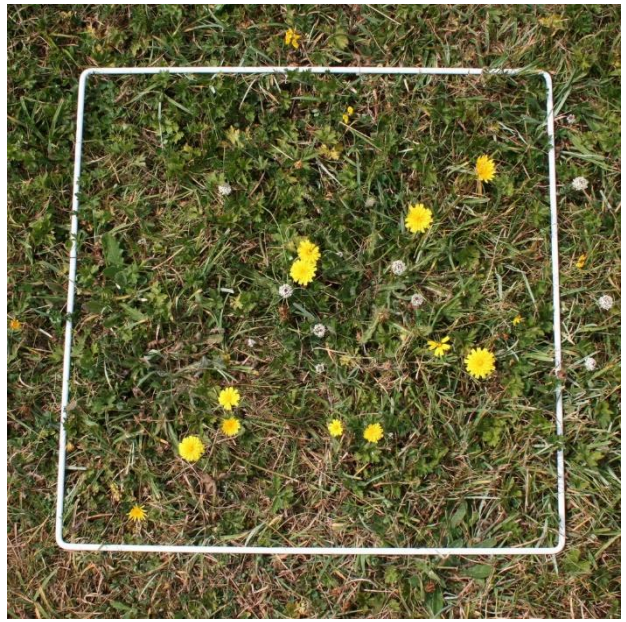
John Lawton



Conclusions and questions

- Nature tourism related science is mostly either social or applied
- We have very little comparative biological data on nature tourism
- We do not know the unknown unknowns in nature tourism context
- Do the unknown unknowns matter for the trail manager/owner?
- What is the spatial and temporal scale of the changes that matter?

The solution



REVIEWS REVIEWS REVIEWS

Coordinated distributed experiments: an emerging tool for testing global hypotheses in ecology and environmental science

Lauchlan H Fraser[1*], Hugh AL Henry[2], Cameron N Carlyle[1,3], Shannon R White[4], Carl Beierkuhnlein[5], James F Cahill Jr[4], Brenda B Casper[6], Elsa Cleland[7], Scott L Collins[8], Jeffrey S Dukes[9], Alan K Knapp[10], Eric Lind[11], Ruijun Long[12], Yiqi Luo[13], Peter B Reich[14,15], Melinda D Smith[16], Marcelo Sternberg[17], and Roy Turkington[3]

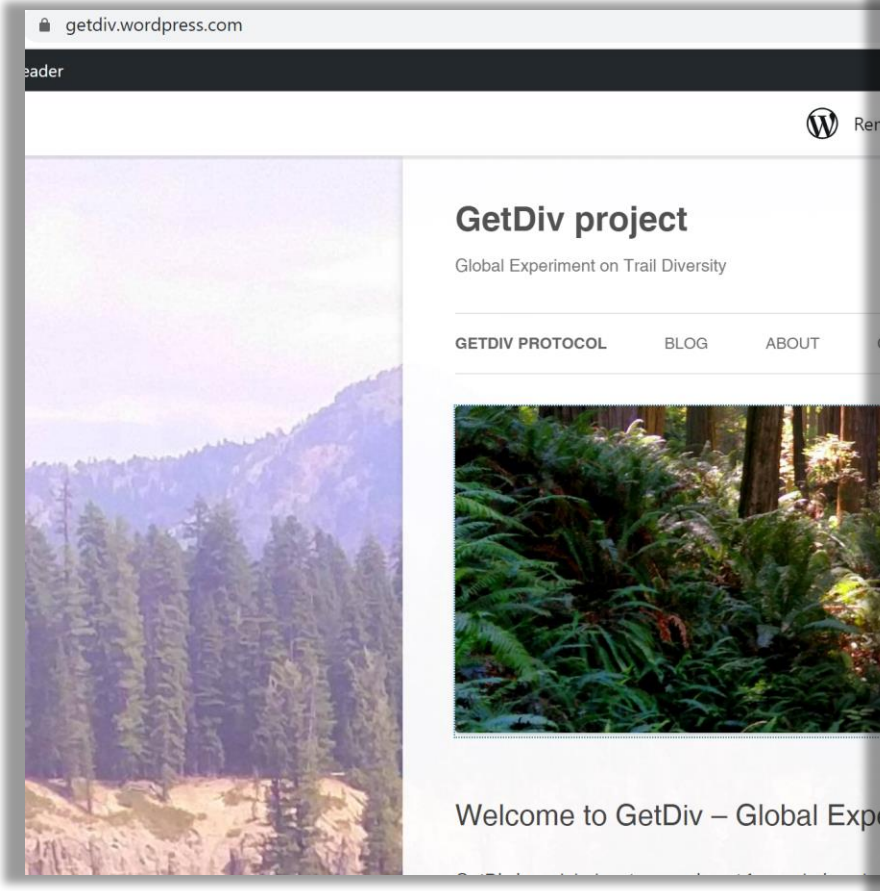
2013 Frontiers in Ecology and the Environment

- Everybody does the exact same thing in their study site/area
- Fieldwork is relatively simple (taking not more than a day or two)
- Providing data and subsequent ms editing = co-authorship
- Possibility to use network´s data for testing your own questions
- New questions and possibilities add through time (add-on studies)

MiREN

www.mountaininvasions.org

GetDiv.wordpress.com



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https://doi.org/10.1080/14724049.2023.2191894

Routledge
Taylor & Francis Group

Check for updates

GetDiv – a call for a global coordinated study on plant diversity changes on nature trails

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ABSTRACT

Despite the growing popularity of nature tourism, we have limited systemic knowledge of how it affects nature, from both an abiotic and biotic perspective, and what these effects are in different regions, habitats or trail types. Here we propose a coordinated global experiment framework – GetDiv – for a comprehensive understanding of the effects of visitor's load on the vegetation of nature trails. For preliminary analysis we selected 20 trails in Estonia, and we show that plant diversity along the trails is negatively affected by visitor's load in both forest and open habitat. We present here the rationale for the methodological approach, and call for a coordinated global effort to collect comparable and comprehensive data of diverse aspects of nature trails, with a focus on plant diversity. All the necessary guidelines and protocols to fill out for participating in GetDiv are included in the GetDiv webpage: https://getdiv.wordpress.com/. For participation in the first GetDiv study, the deadline for contribution is December 2024.

ARTICLE HISTORY
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KEYWORDS
Nature trails; meta-experiment; plant diversity; global methodology; visitor's load

The ambition – GetDiv meta-experiment

Global study on trail diversity

- Comprehensive understanding the effects of visitor´s load to the vegetation of nature trails
- Comparable analysis of the effects of different trail aspects in wide spatial and cultural space
- Assessment of vegetation changes and the range of these changes within and between trails
- Disentangling the role of different factors in affecting both the diversity and visitors´ load
- Generalizations of these effects on different spatial scales and in different habitats etc.
- Possibility of assessing overcrowdedness without actual visitors´ load data

- **Pilot study**
- 33 trails in Estonia, covering the whole cultural space, and all main habitat types
- We wanted to test whether the method works via three main hypothesis:
  - a) We expected overall negative relationship between visitors´ load and plant diversity of the trail
  - b) We expected different effects of visitors´ load on diversity in different habitat types
  - c) There are habitat-specific changes within transects (on the proximity to trail gradient)

https://getdiv.wordpress.com/