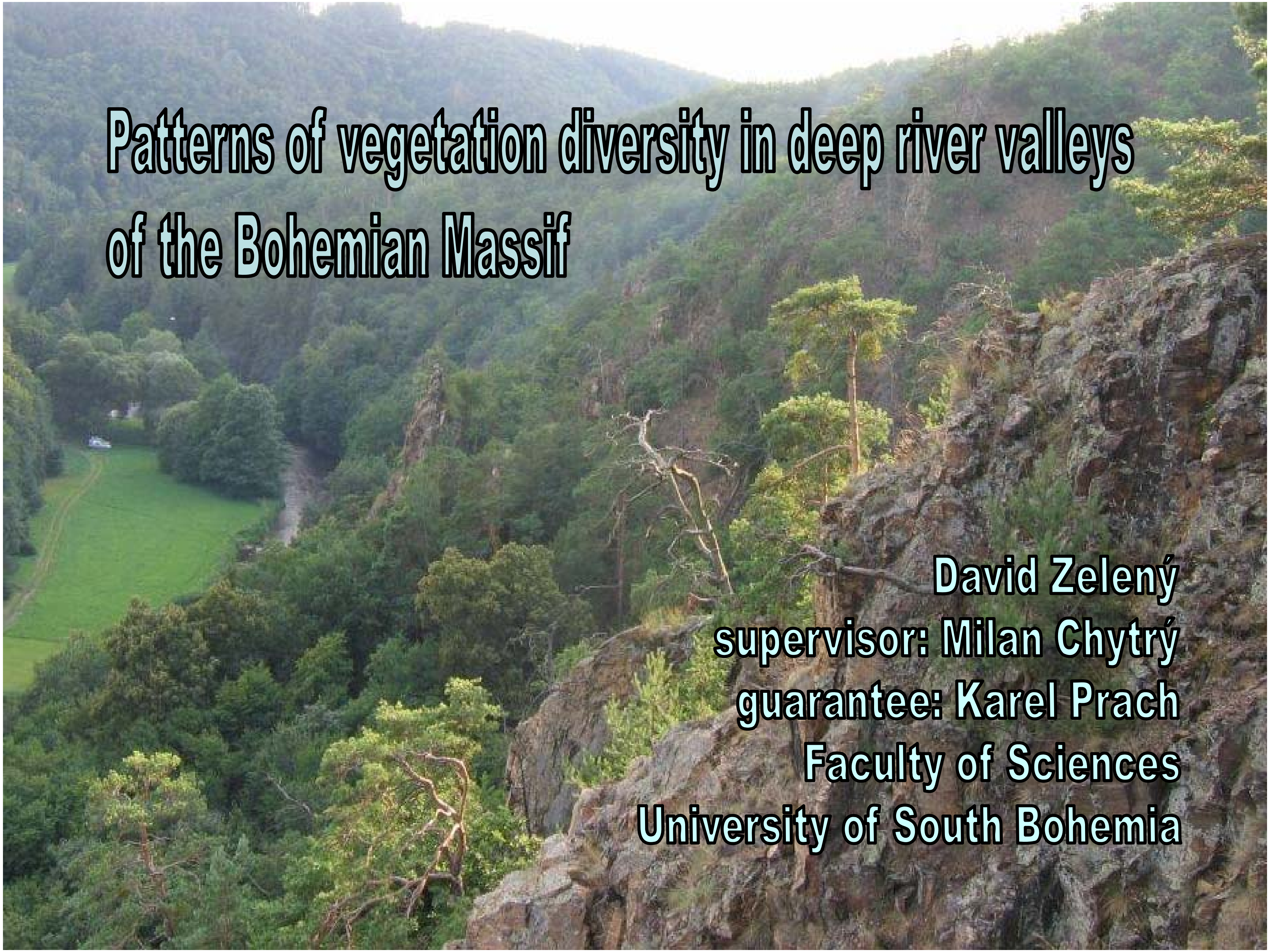

Patterns of vegetation diversity in deep river valleys of the Bohemian Massif
David Zelený
supervisor: Milan Chytrý
guarantee: Karel Prach
Faculty of Sciences
University of South Bohemia

Patterns of vegetation diversity in deep river valleys of the Bohemian Massif

Zelený D. & Chytrý M. (2007): Environmental control of the vegetation pattern in deep river valleys of the Bohemian Massif. – ***Preslia*** 79: 205-222.

Zelený D. & Chytrý M.: Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif – **manuscript.**

Zelený D., Li C.-F. & Chytrý M.: Pattern of plant species richness along the gradient of landscape topographical heterogeneity: result of spatial mass effect or environmental shift? – **submitted manuscript.**

Zelený D. (2008): Co-occurrence-based assessment of species habitat specialization is affected by the size of species pool: reply to Fridley *et al*. (2007). – **Journal of Ecology**, *in press.*

Zelený D. & Chytrý M. (2007):

Environmental control of the vegetation pattern in deep river valleys of the Bohemian Massif.

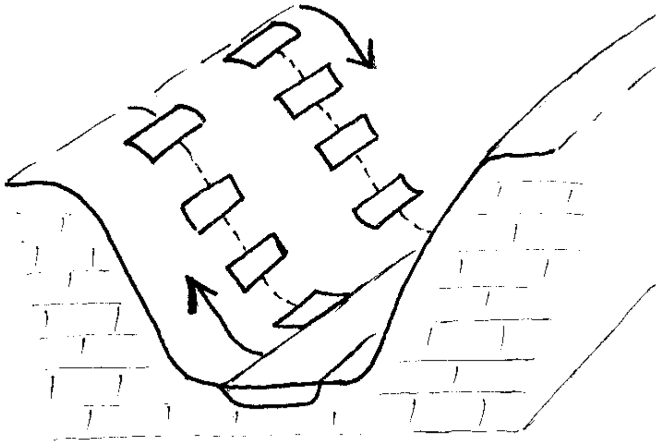
Preslia **79**: 205-222

Question: What is the relationship between species composition of vegetation and the main ecological gradients in deep river valleys?

Study area: Vltava valley (DZ) and Dyje valley (MCh)

Data: vegetation plots sampled along transects down the slope of the valley

Analyses: NMDS, CCA, moving window CCA



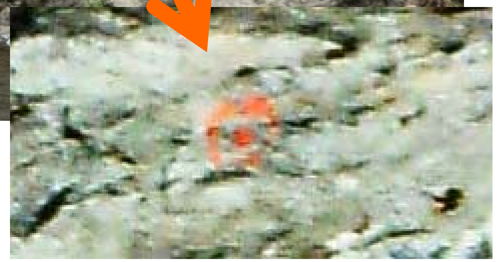
Collecting field data:

where: steep valley slopes with natural and seminatural vegetation;

how: plots 10x15 m in even distances along the transect downslope;

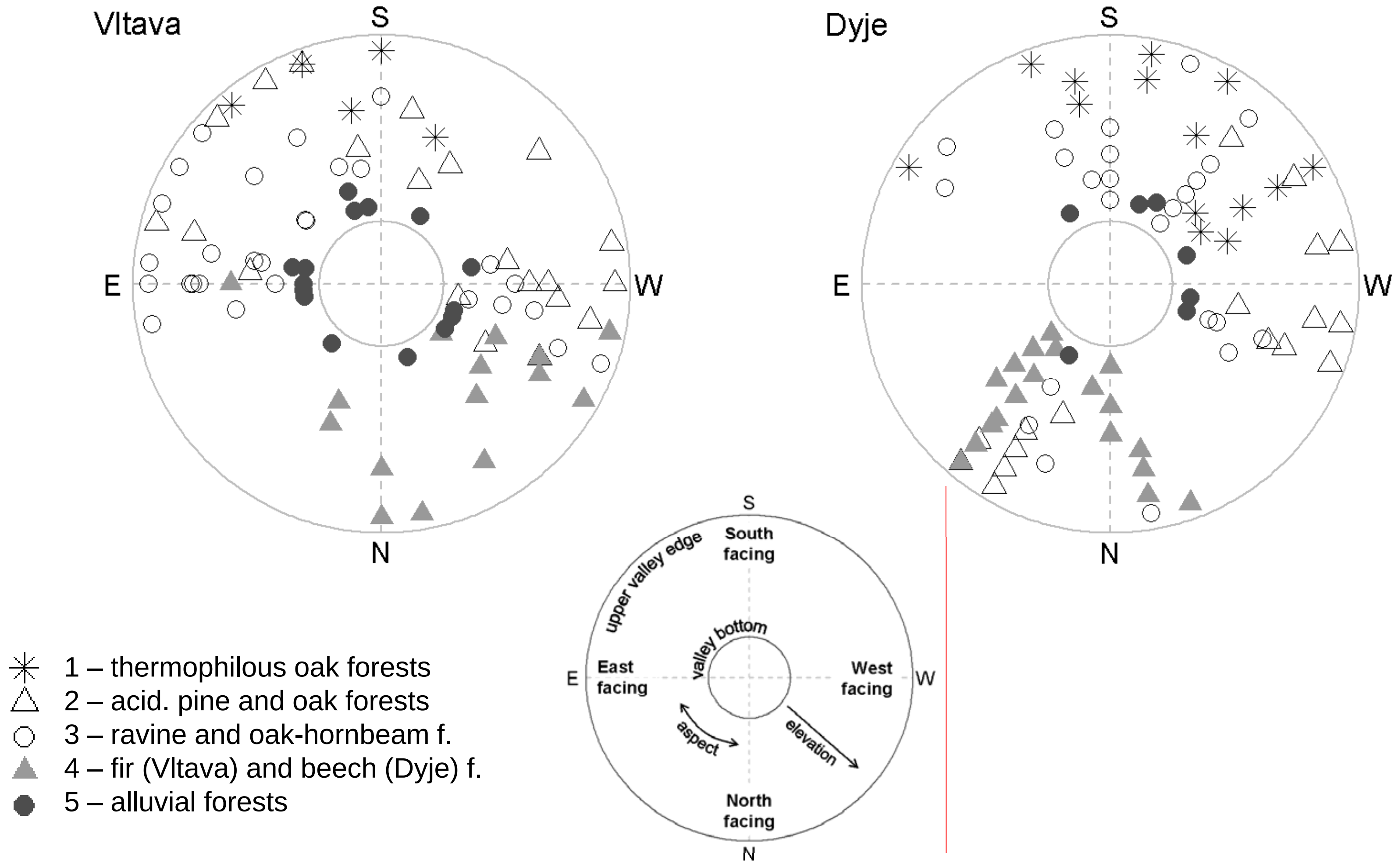
what was collected: data about vegetation (relevé) and environmental factors (topographical and soil);

how many: 94 plots (Vltava, collected by DZ) and 82 plots (Dyje, collected by MCh).



Vltava valley, close to Rohan, summer 2008 (photo by Ching Feng Li)

Distribution of vegetation types – iris diagrams



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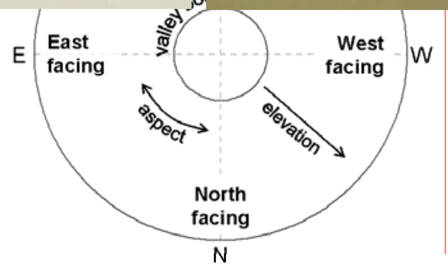
Distribution of vegetation types – iris diagrams



- 1 – thermophilous oak forests
- 2 – acid. pine and oak forests
- 3 – ravine and oak-hornbeam f.
- 4 – fir (Vltava) and beech (Dyje) f.
- 5 – alluvial forests

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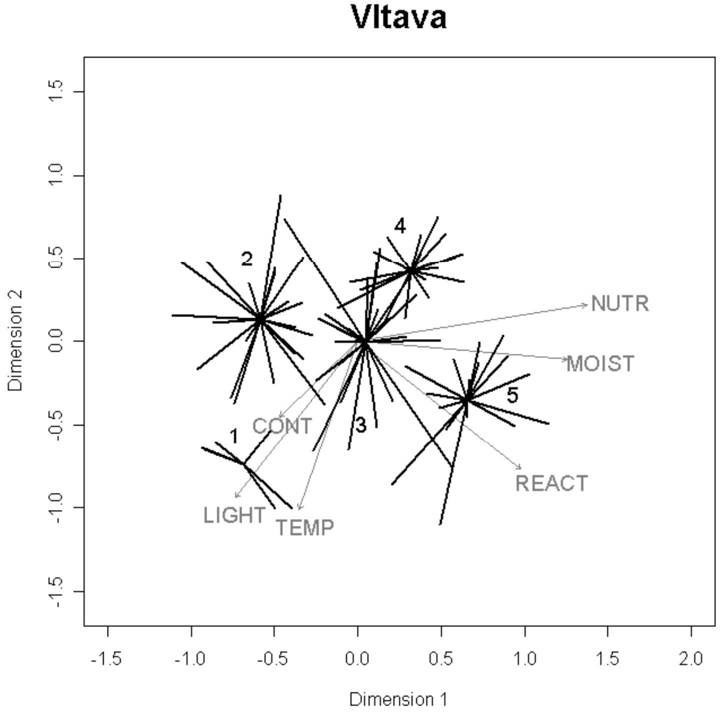
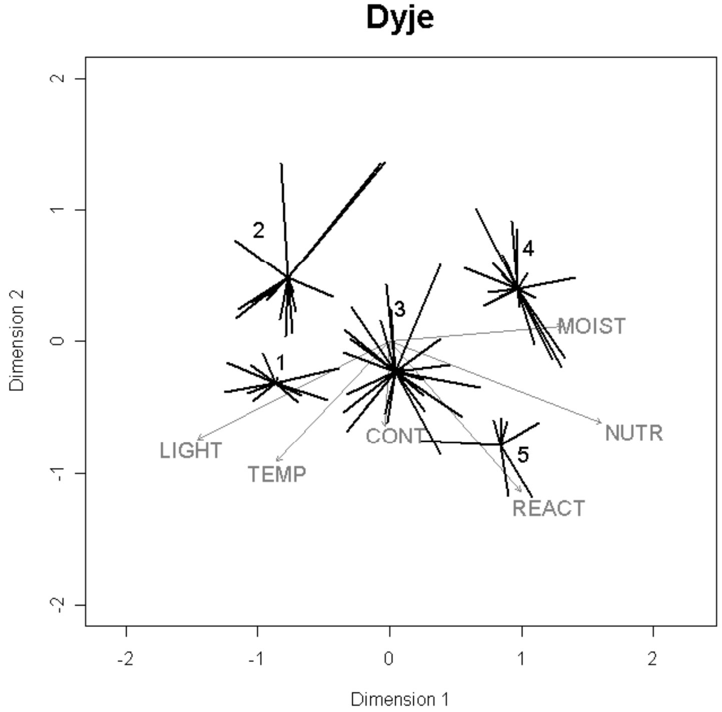
NMDS ordination diagrams





1 – thermophilous oak forests

2 – acidophilous oak and pine f.

3 – ravine and oak-hornbeam f.

4 – fir (Vltava) and beech (Dyje) f.

5 – alluvial forests

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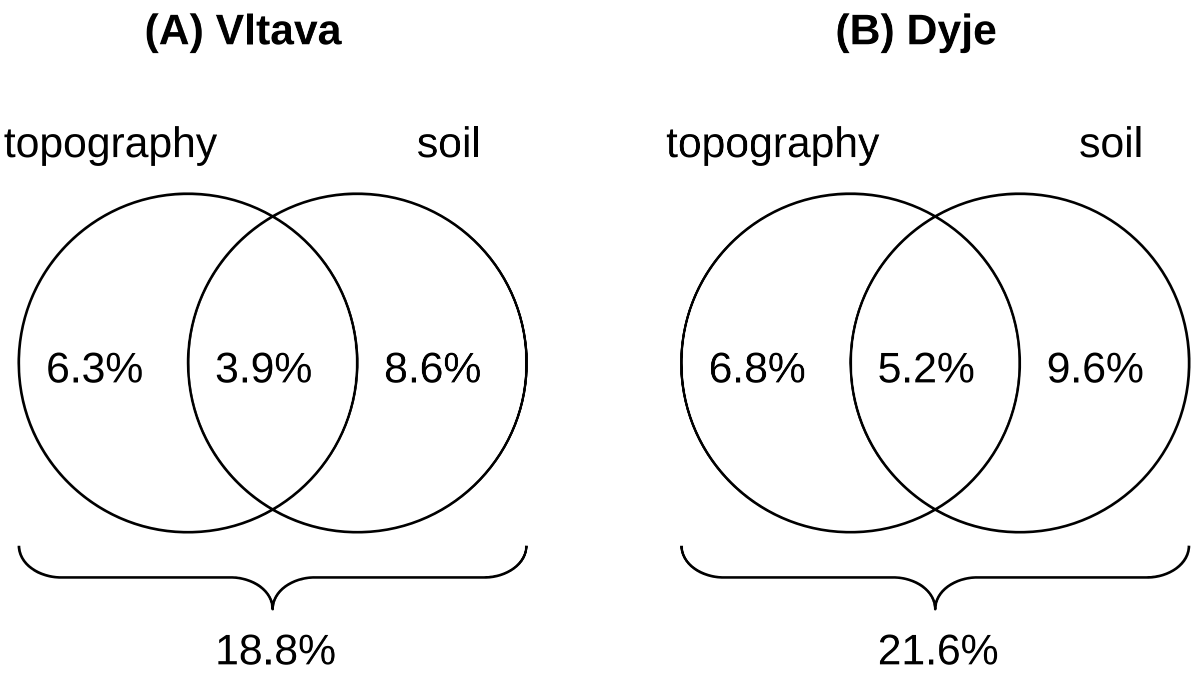
Variation in species composition explained by topographical and soil explanatory variables (CCA)



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Moving window CCA

Is aspect as an environmental variable more important at the valley bottom, upper valley edge or in the middle?

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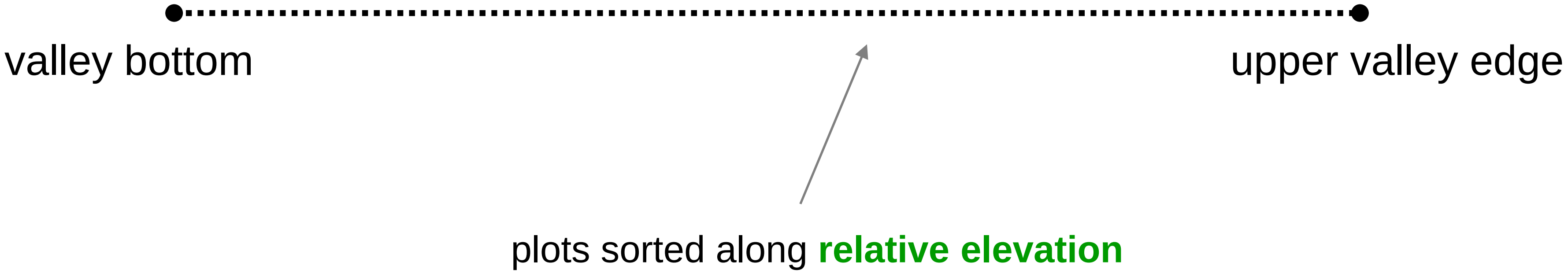
Moving window CCA



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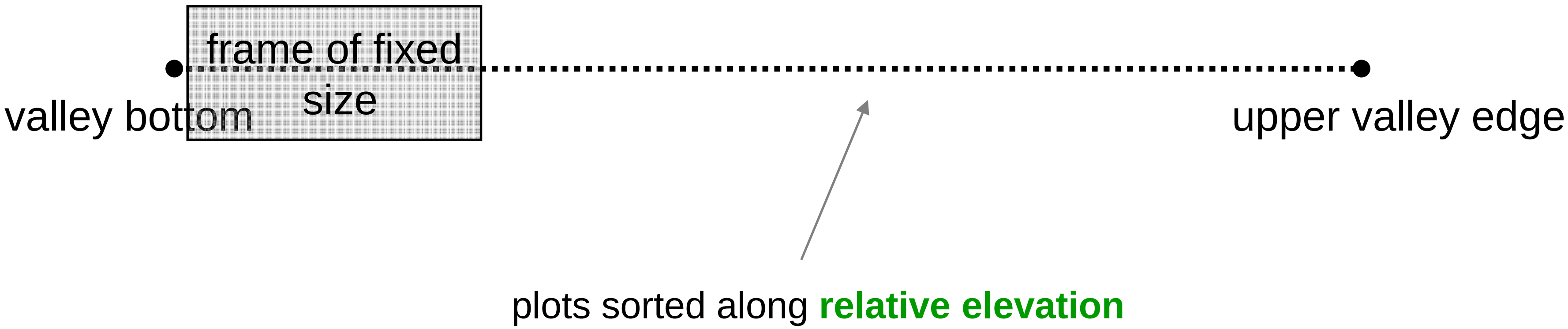
Moving window CCA



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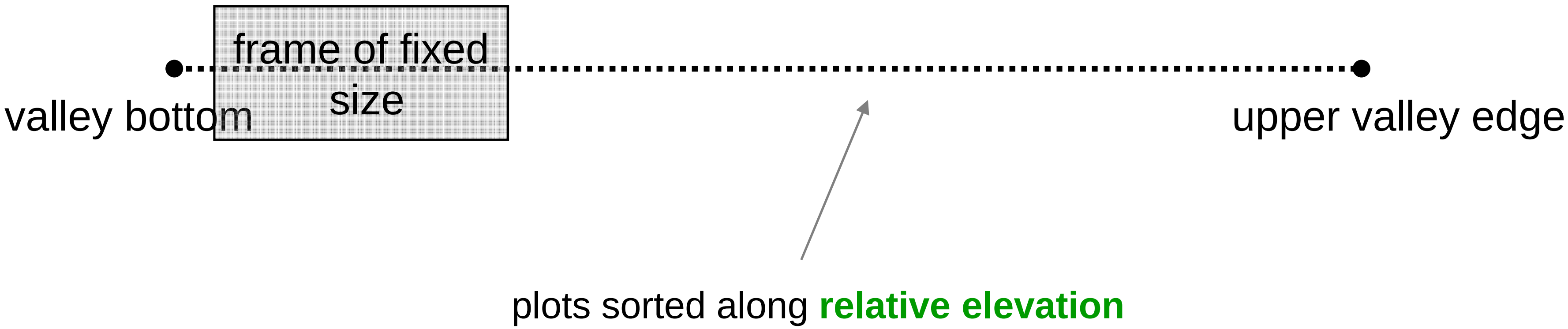
Moving window CCA



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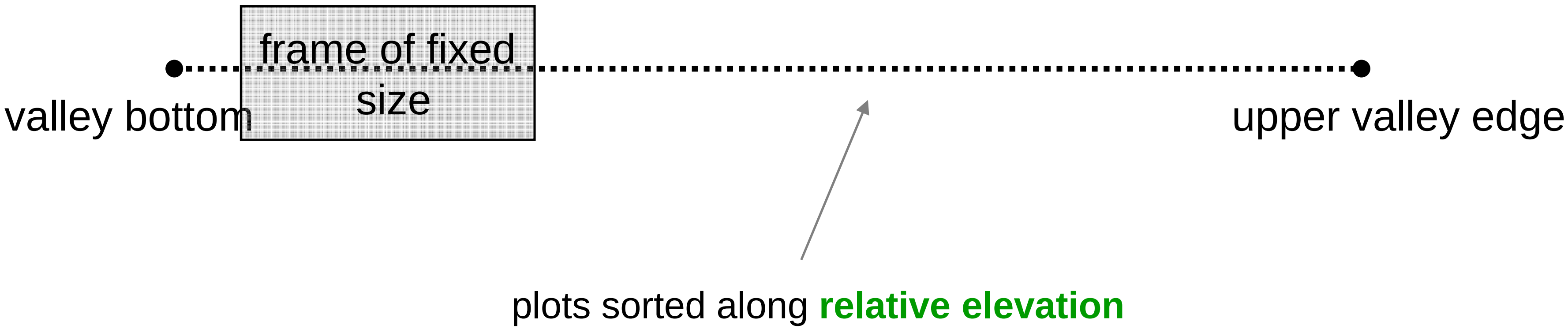
Moving window CCA



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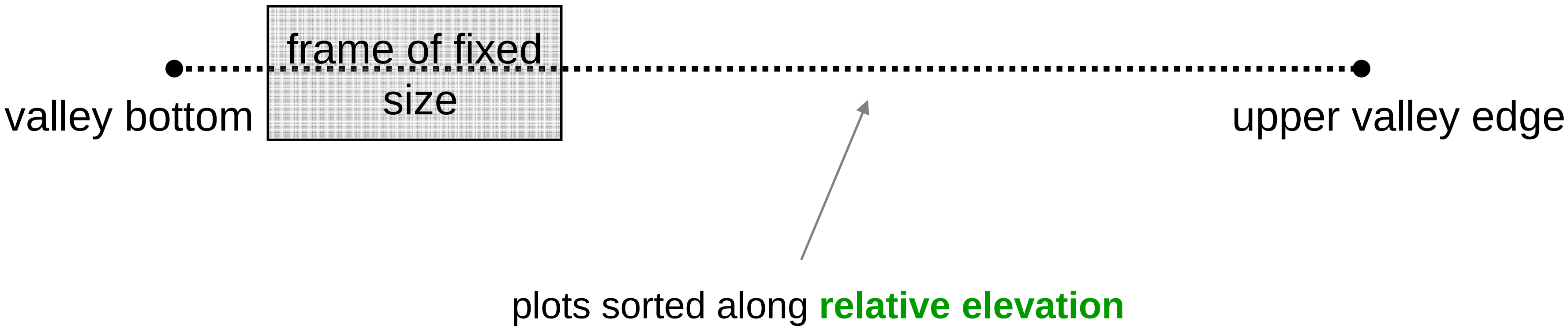

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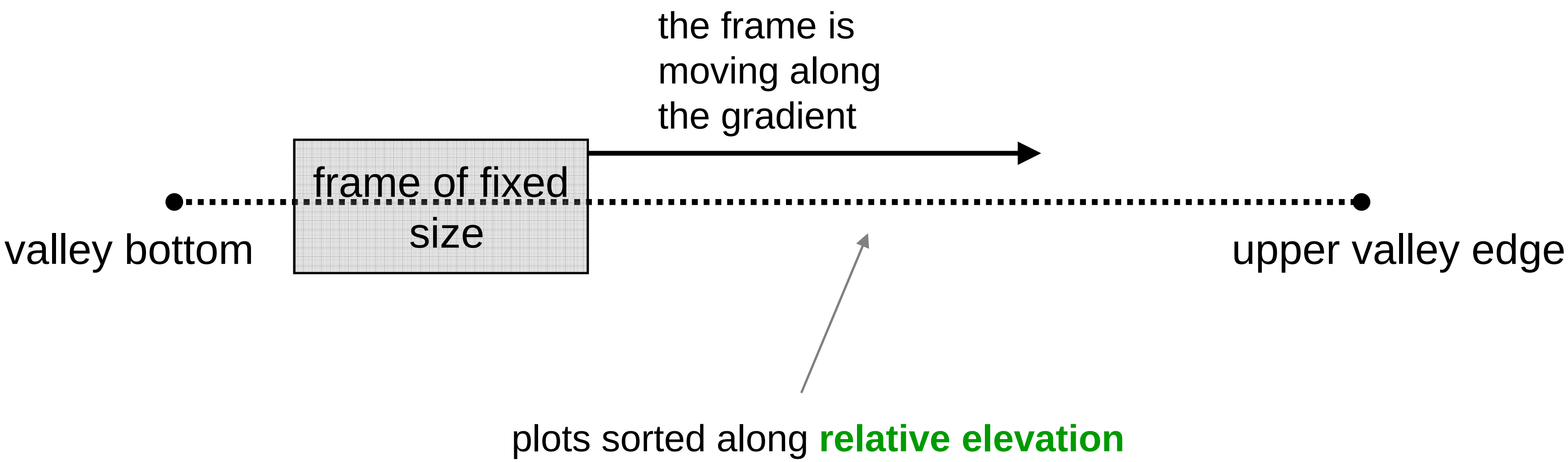

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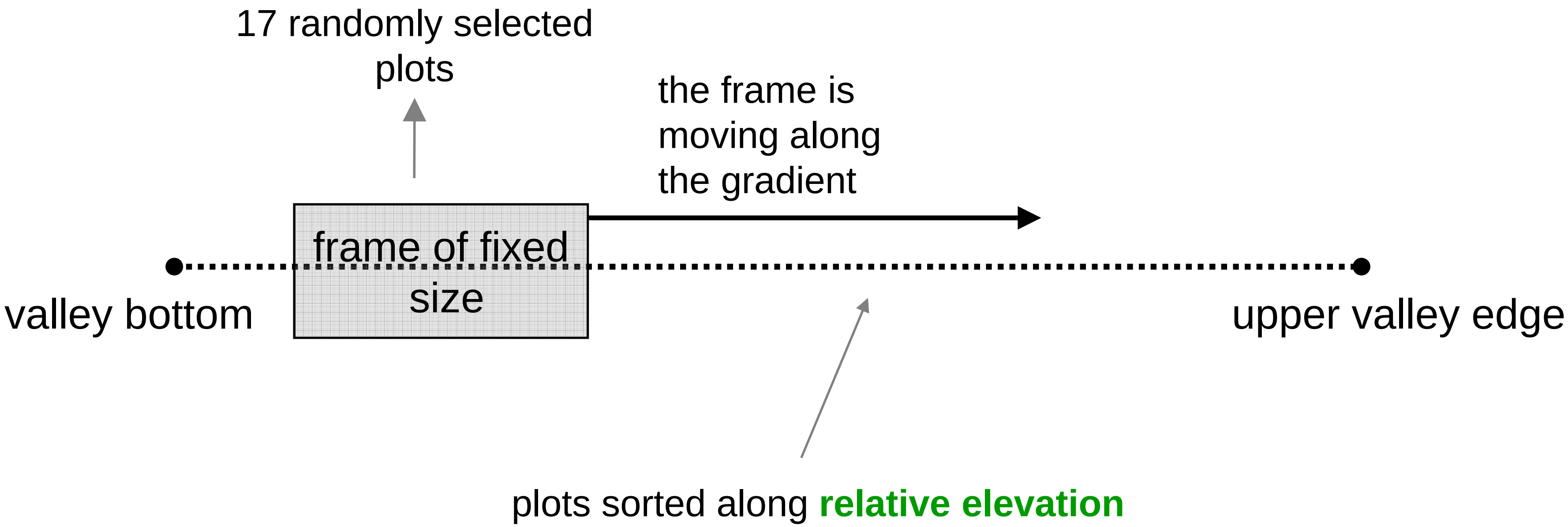
Moving window CCA



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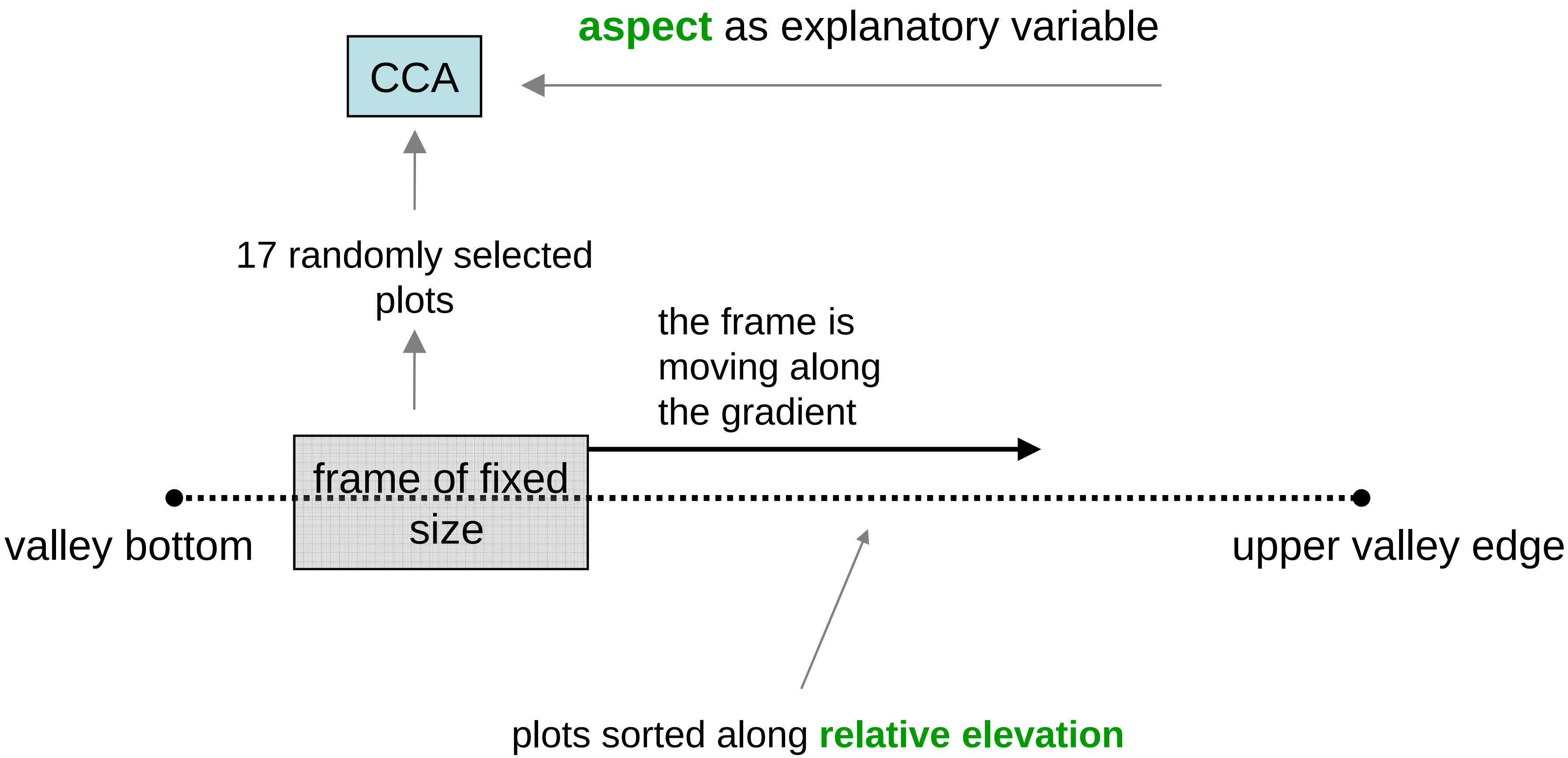

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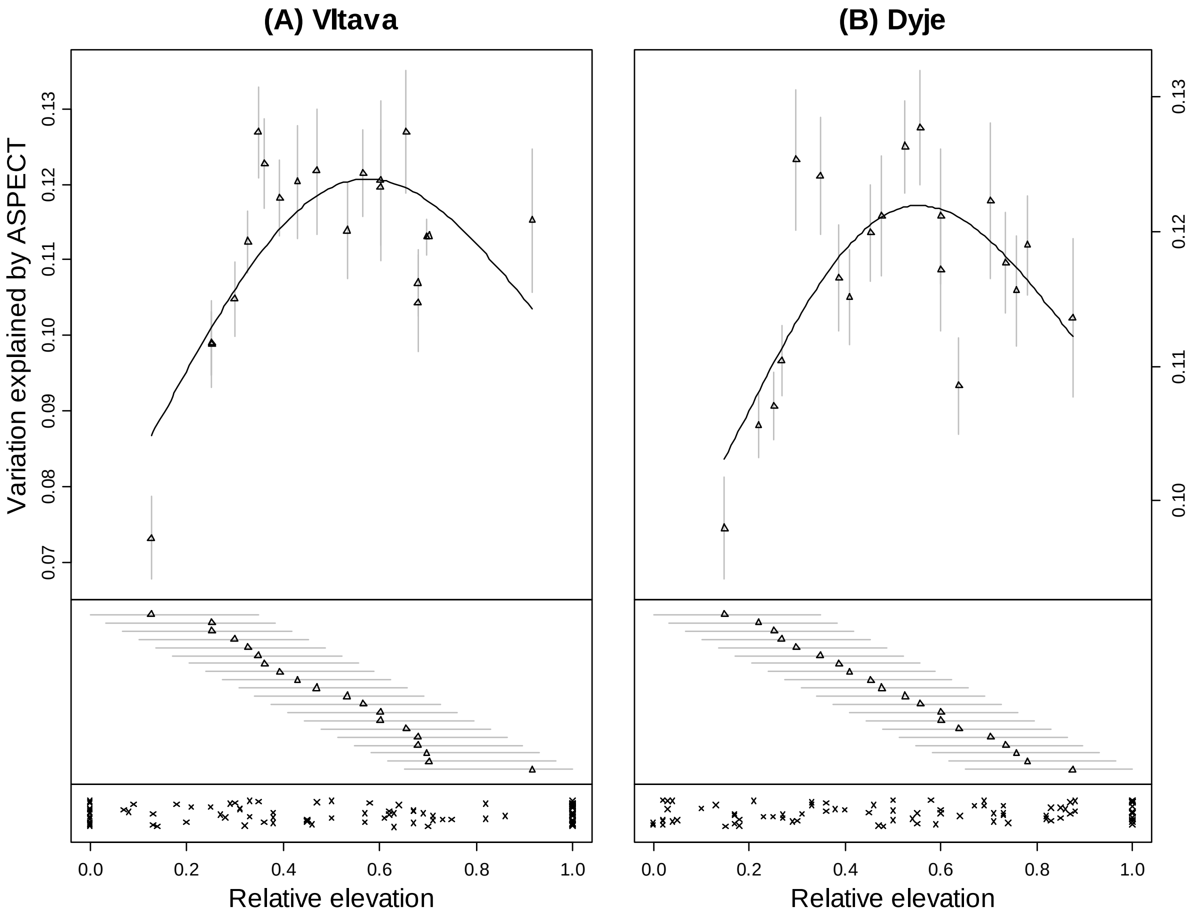
Moving window CCA



Zelený D. & Chytrý M. (2007): Environmental control of the vegetation pattern in deep river valleys of the Bohemian Massif. – *Preslia* 79: 205-222.

Paper 1: Conclusions

1. vegetation in deep river valleys is structured along two main complex ecological gradients: the moisture-nutrients-soil pH and the light-temperature-continentality gradient; the first one is related to the elevation above valley bottom, the second one to aspect;
2. the effect of aspect is mostly pronounced in the middle parts of the valley slopes, while being lowest at the shaded valley bottoms;
3. soil variables are slightly better predictors of vegetation composition than topographical variables;
4. the results of all analyses are similar in both valleys – and probably may be generalized also into other deep river valleys of mid-altitudes of the Bohemian Massif.

Zelený D. & Chytrý M. (2007): Environmental control of the vegetation pattern in deep river valleys of the Bohemian Massif. – *Preslia* 79: 205-222.

Zelený D. & Chytrý M.:

Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif

manuscript

Question: Which environmental factors are the best predictors of the local species richness in deep river valleys and how can be diversity-environment relationship influenced by differences in regional species pool?

Study area: Vltava valley (DZ) and Dyje valley (MCh).

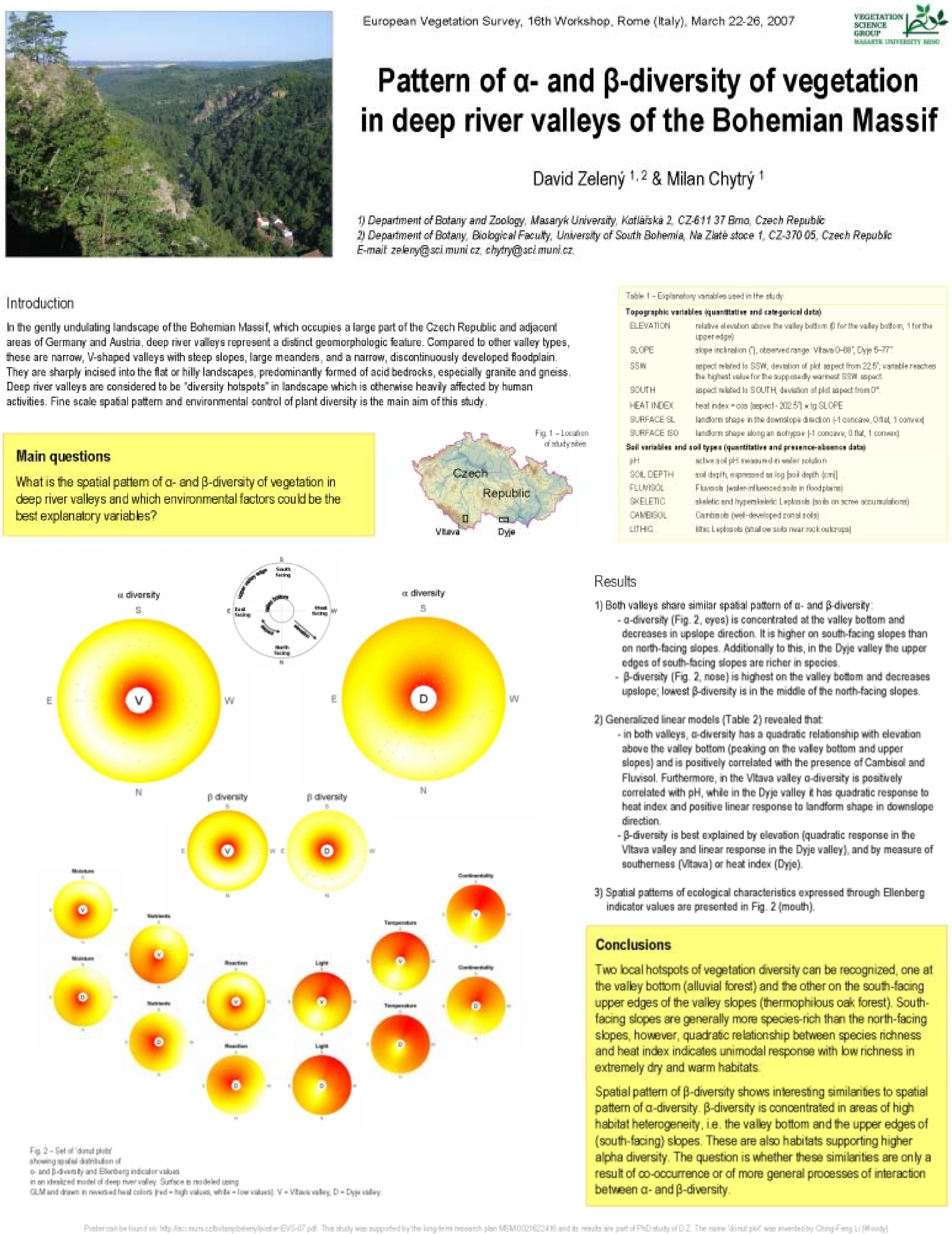
Data: the same as in previous study.

Analyses: Generalized linear models

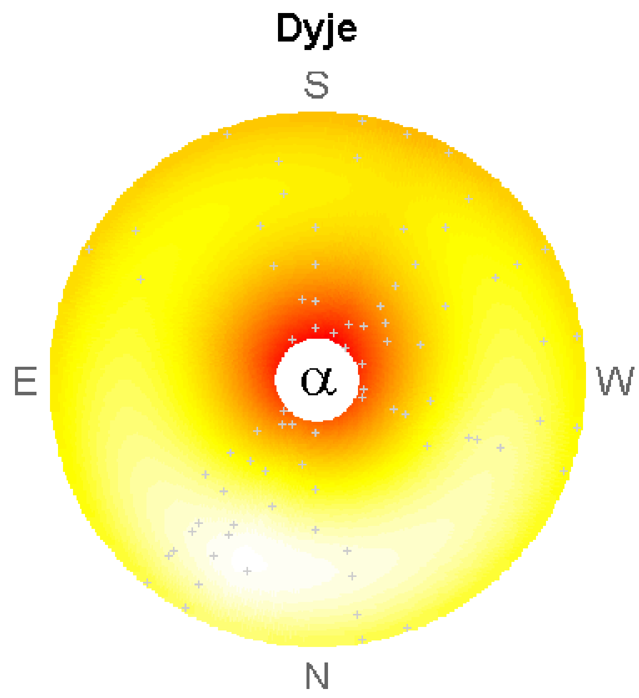
Poster presentation

16th Workshop of European Vegetation Survey

Rome, spring 2007



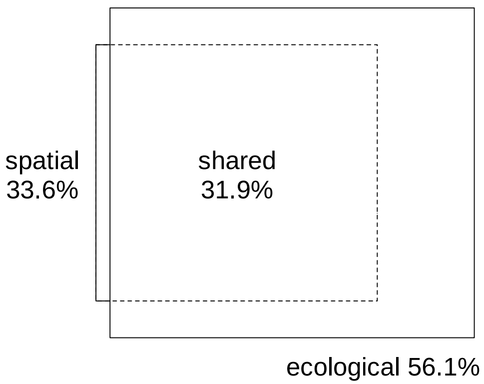
Spatial distribution of alpha diversity (herb layer species only) in deep river valley – donut plot



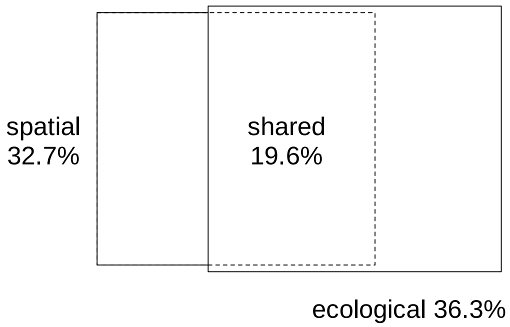
Zelený D. & Chytrý M. (manuscript): Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif

Variance in species richness explained by spatial and ecological variables

Vltava



Dyje



spatial: elevation (^{2}) + aspect

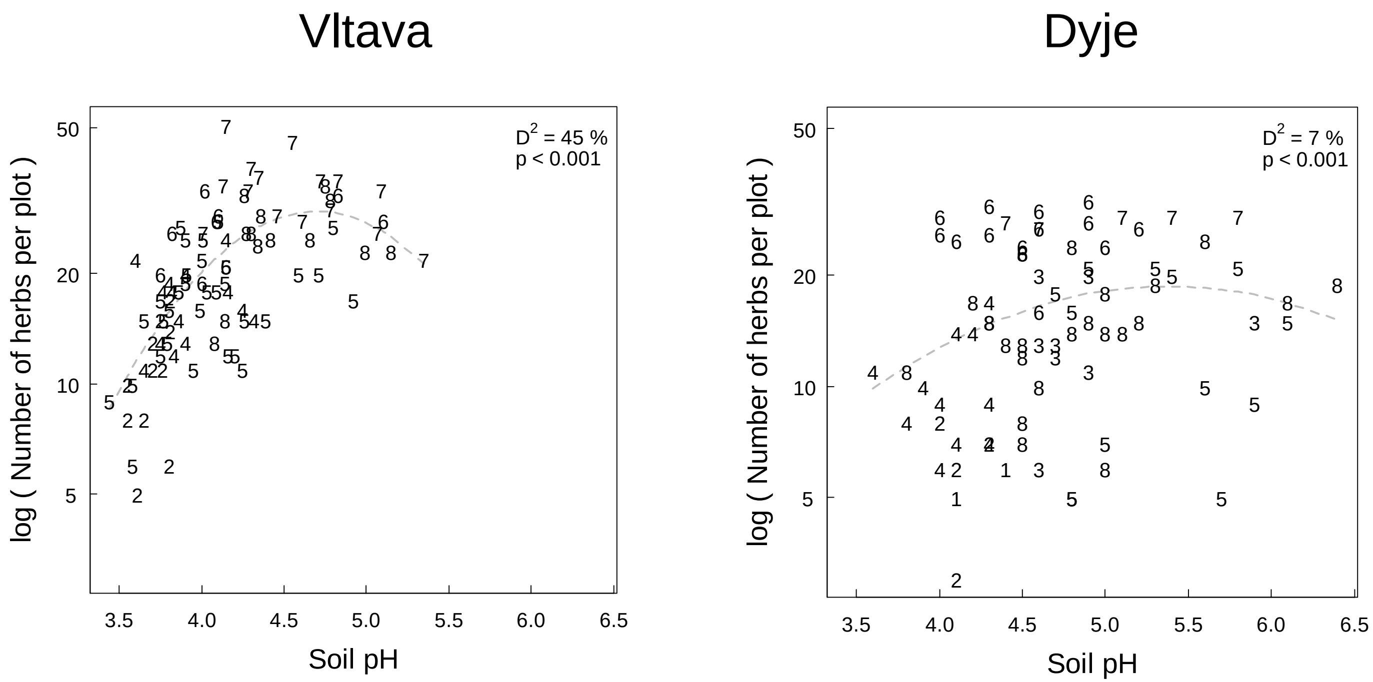
ecological: pH (^{2}) + Fluvisol + Heat load

spatial: elevation (^{2}) + aspect

ecological: pH (^{2}) + Fluvisol + Heat load + Cambisol + Lithic

Zelený D. & Chytrý M. (manuscript): Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif

Relationship between species richness (herb layer species) and measured soil pH

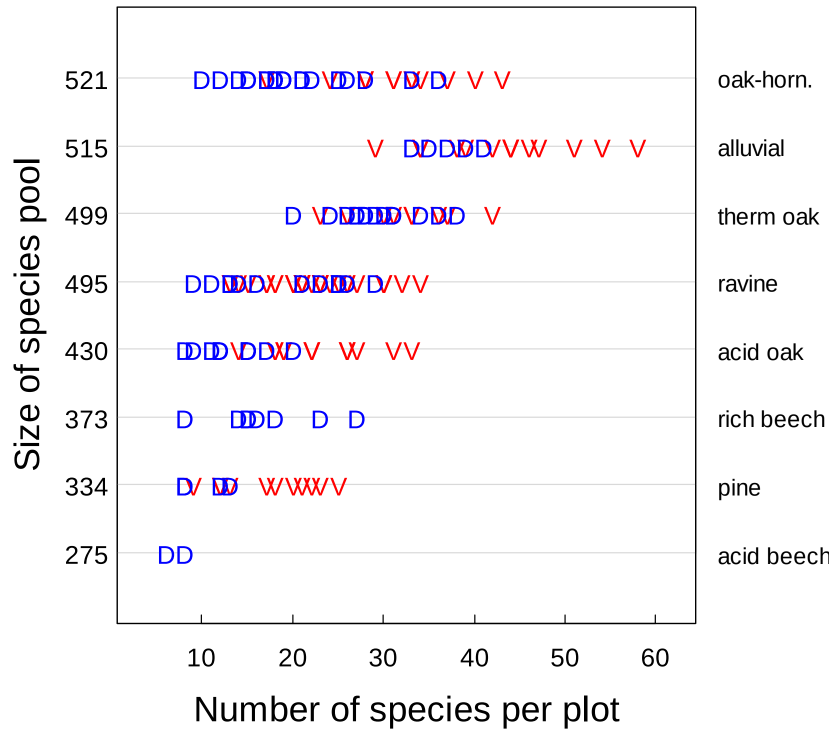


Numbers refer to classification of plots into habitat types, following Sádlo et al. (2007):

1 – acidophilous beech forests, 2 – boreo-continental pine forests, 3 – herb-rich beech forests, 4 – acidophilous oak forests, 5 – ravine forests, 6 – thermophilous oak forests, 7 – alluvial forests and 8 – oak-hornbeam forests.

Zelený D. & Chytrý M. (manuscript): Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif

Relationship between species richness (herb layer species) and estimated habitat species pools (Sádlo et al. 2008)



Zelený D. & Chytrý M. (manuscript): Pattern of species richness in the topographically complex landscape of deep river valleys in the Bohemian Massif

Paper 2: Conclusions

1. the highest local species richness within the valley is located at the valley bottom and at the south and west facing upper edges of the valley slopes;
2. soil pH is a strong predictor of species richness, but only in case of Vltava river valley with predominating acid soils with values of pH < 4.5;
3. in case of Dyje valley, important factor related to high local species richness is continentality, resulting probably from the higher proportion of continental species in regional species pool of Dyje valley;
4. local species richness is positively correlated with the size of regional species pool estimated for particular habitat types; this indicates that estimates of species pool size itself may be a good predictor of real local species richness.

Zelený D. & Chytrý M. (2007): Environmental control of the vegetation pattern in deep river valleys of the Bohemian Massif. – *Preslia* 79: 205-222.

David Zelený, Ching-Feng Li & Milan Chytrý

Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

submitted manuscript

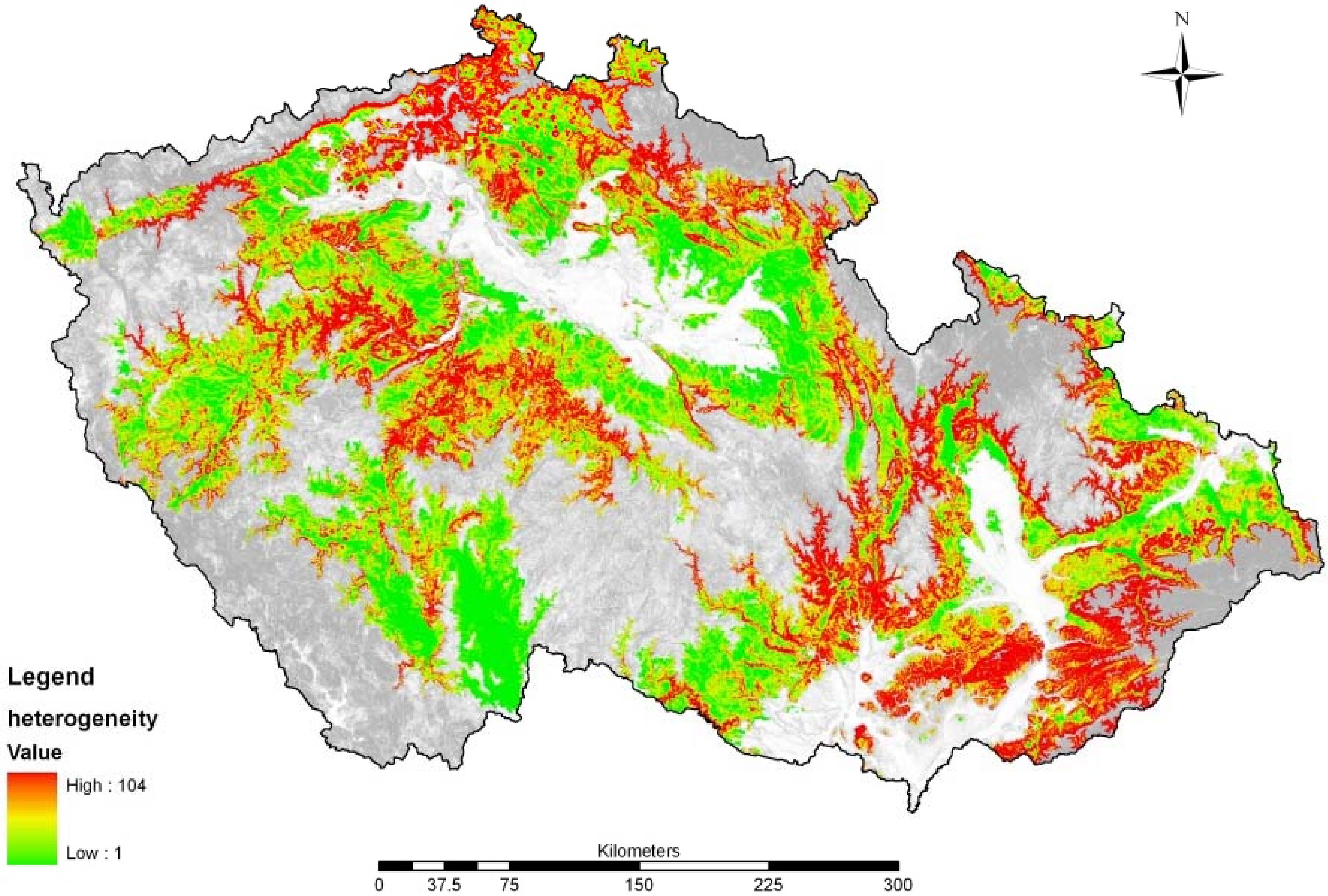
Main question: How is the species richness of microsite correlated with the heterogeneity of surrounding landscape?

Study area: Czech Republic, 250-480 m a.s.l.

Data: Forest vegetation, phytosociological relevés from the Czech National Vegetation Database, 250-480 m a.s.l.

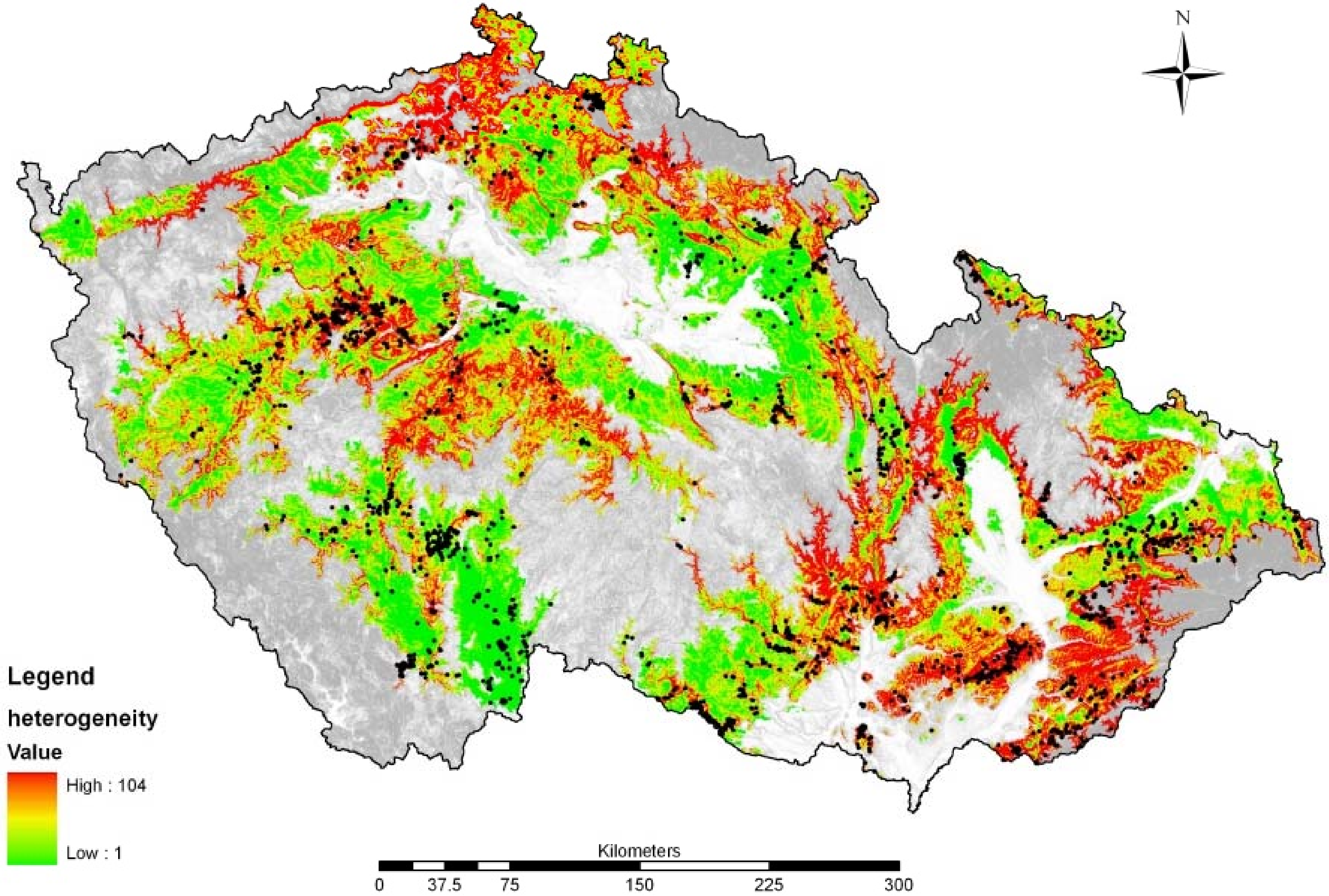
Analyses: ‘repeated-correlation analysis’, NMDS, GIS

Topographic heterogeneity within the Czech Republic (250-480 m a.s.l.)



Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

2551 forest vegetation relevés from Czech National Vegetation Database



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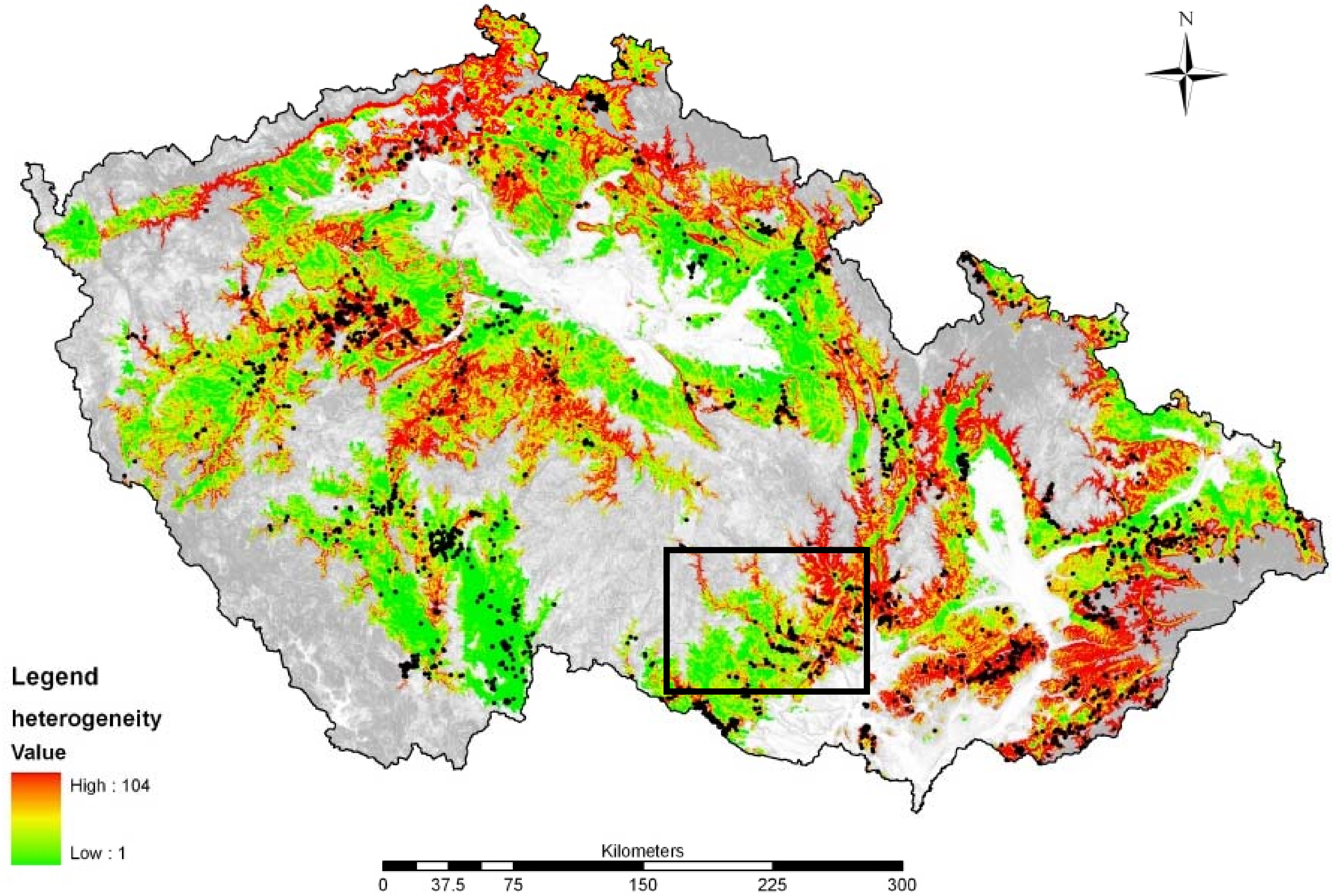

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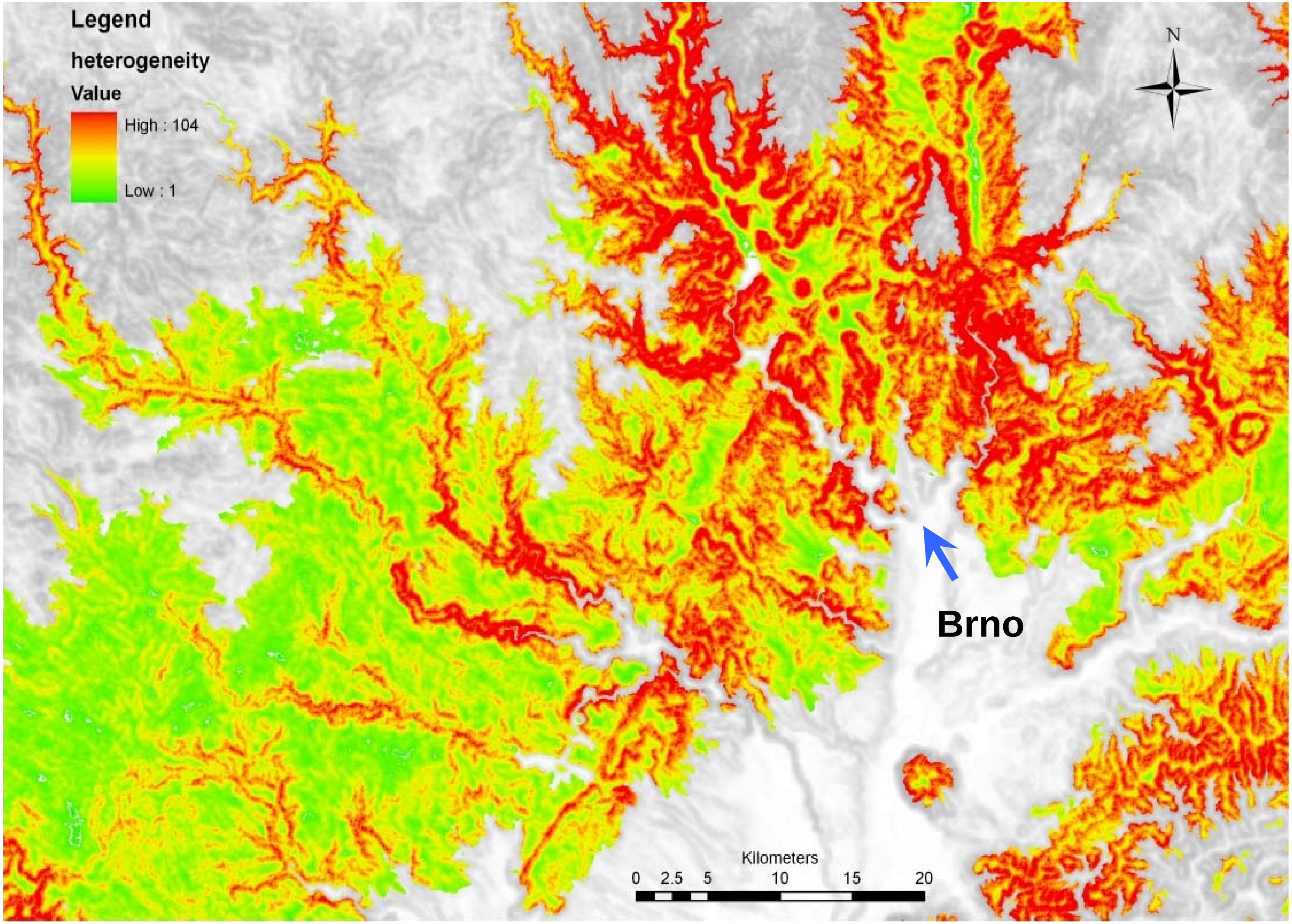
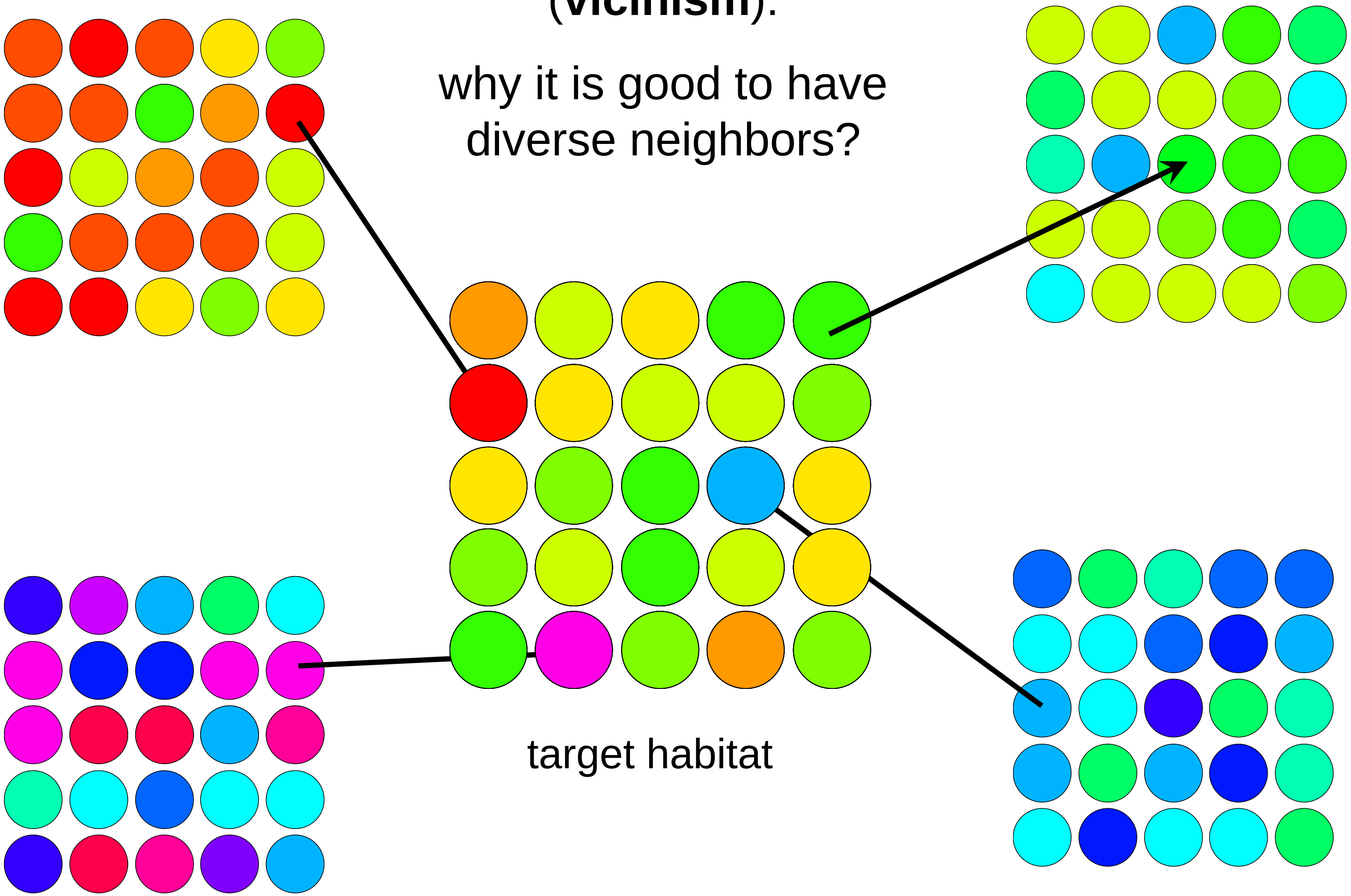


Legend
heterogeneity
Value
High : 104
Low : 1
N
Brno
Kilometers
0 2.5 5 10 15 20

Spatial mass effect
(**vicinism**):

why it is good to have diverse neighbors?



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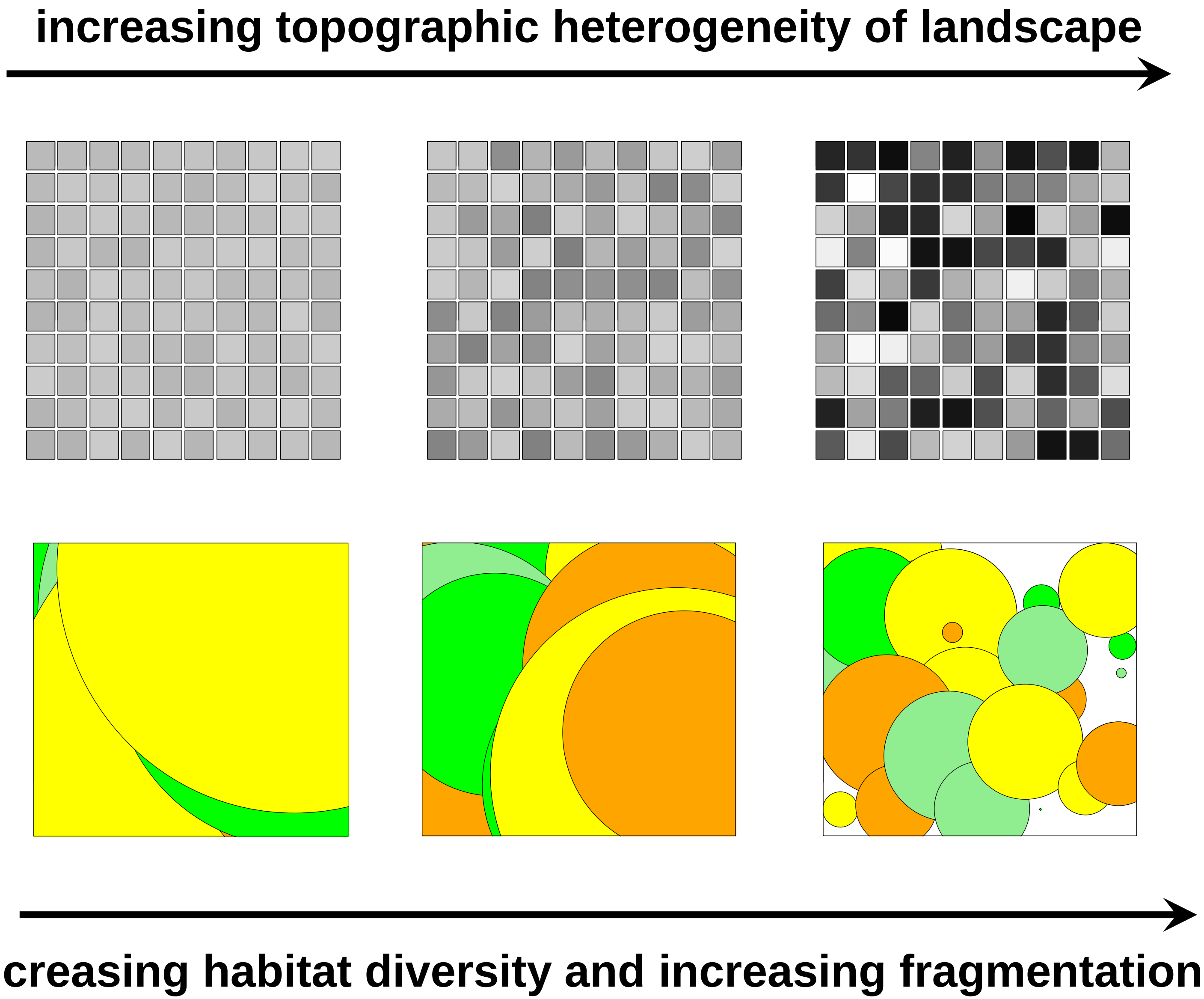

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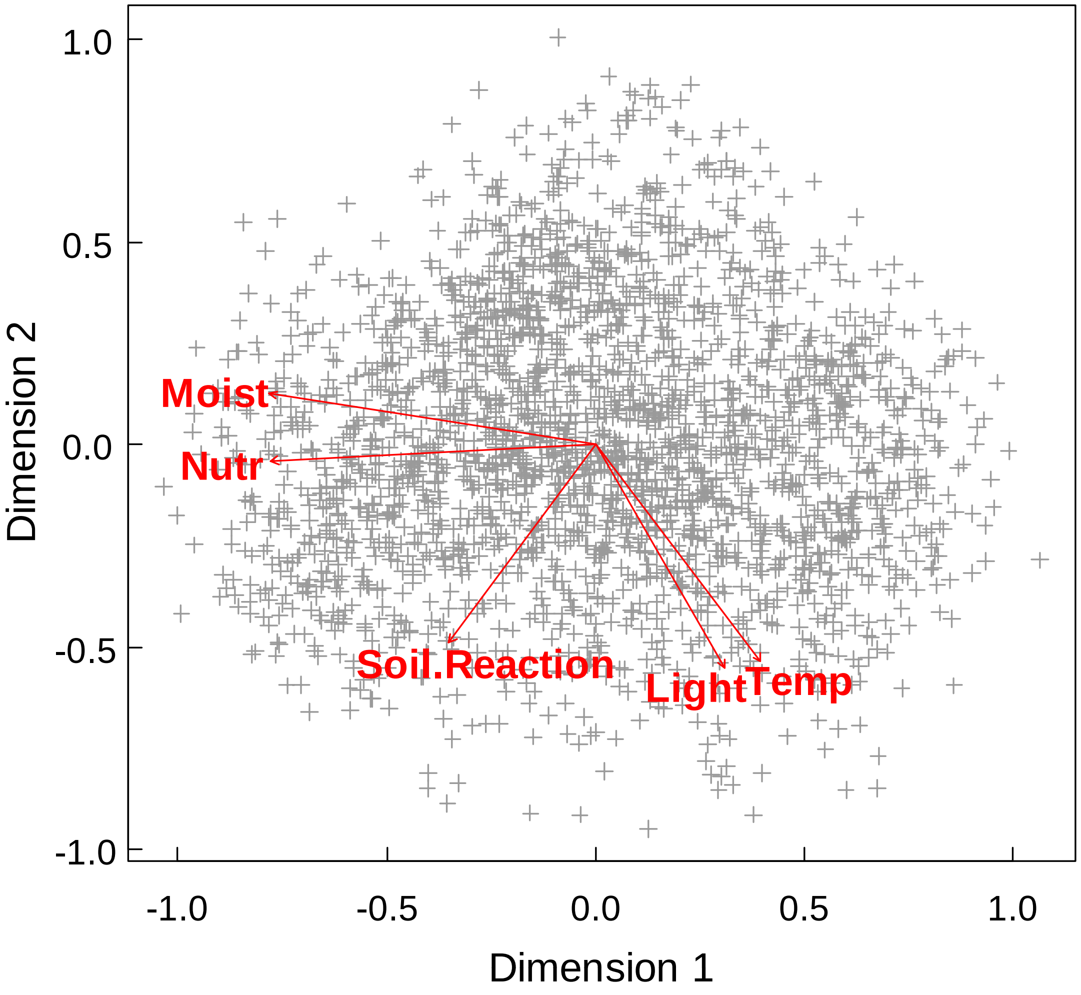
NMDS of 2551 forest relevés



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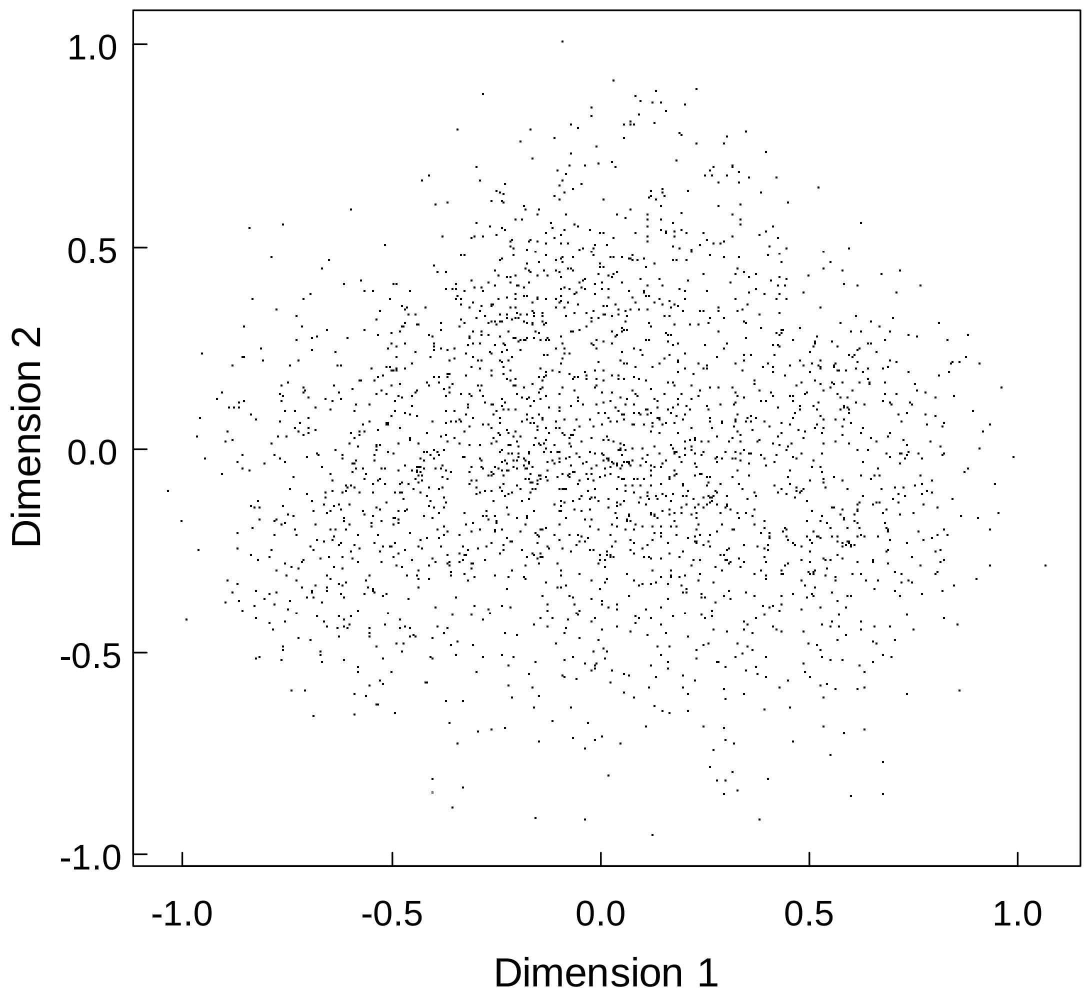
Species richness vs. heterogeneity



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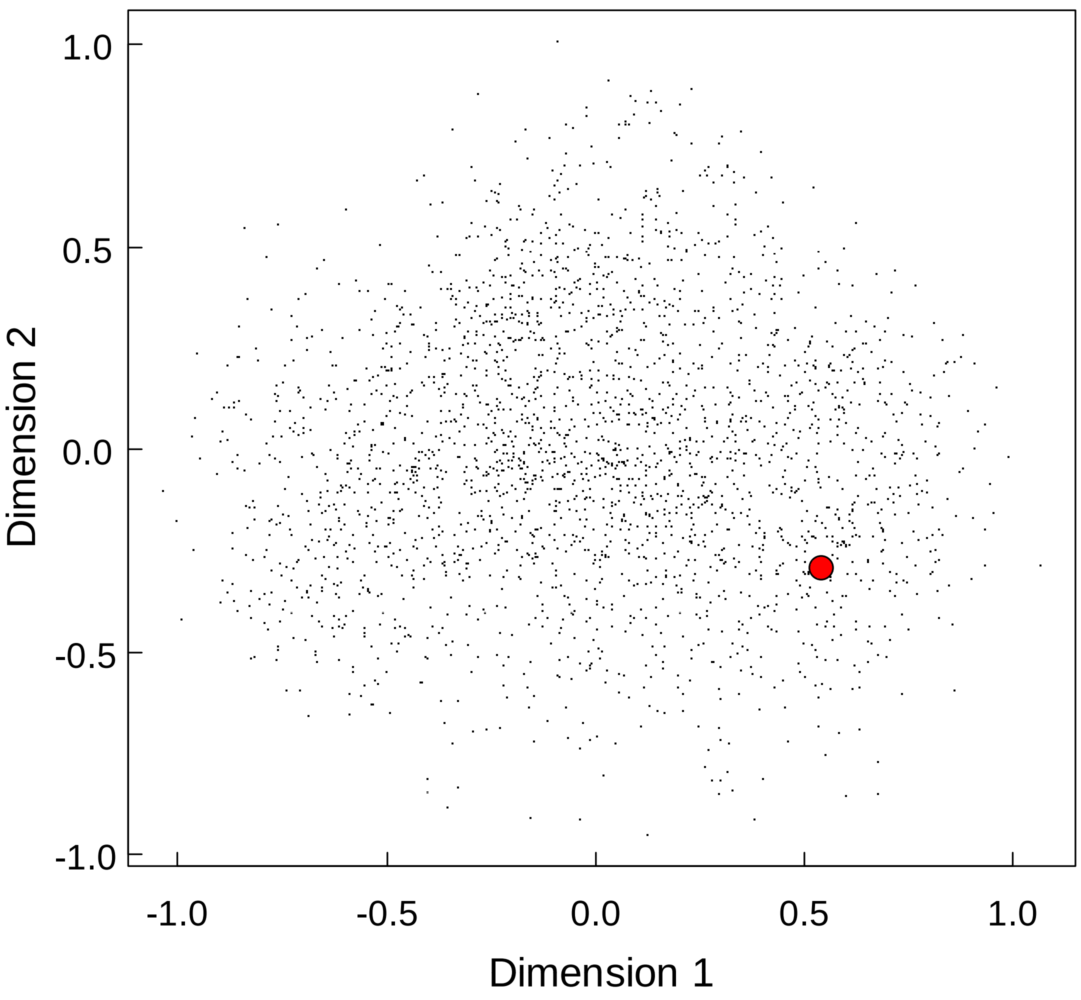

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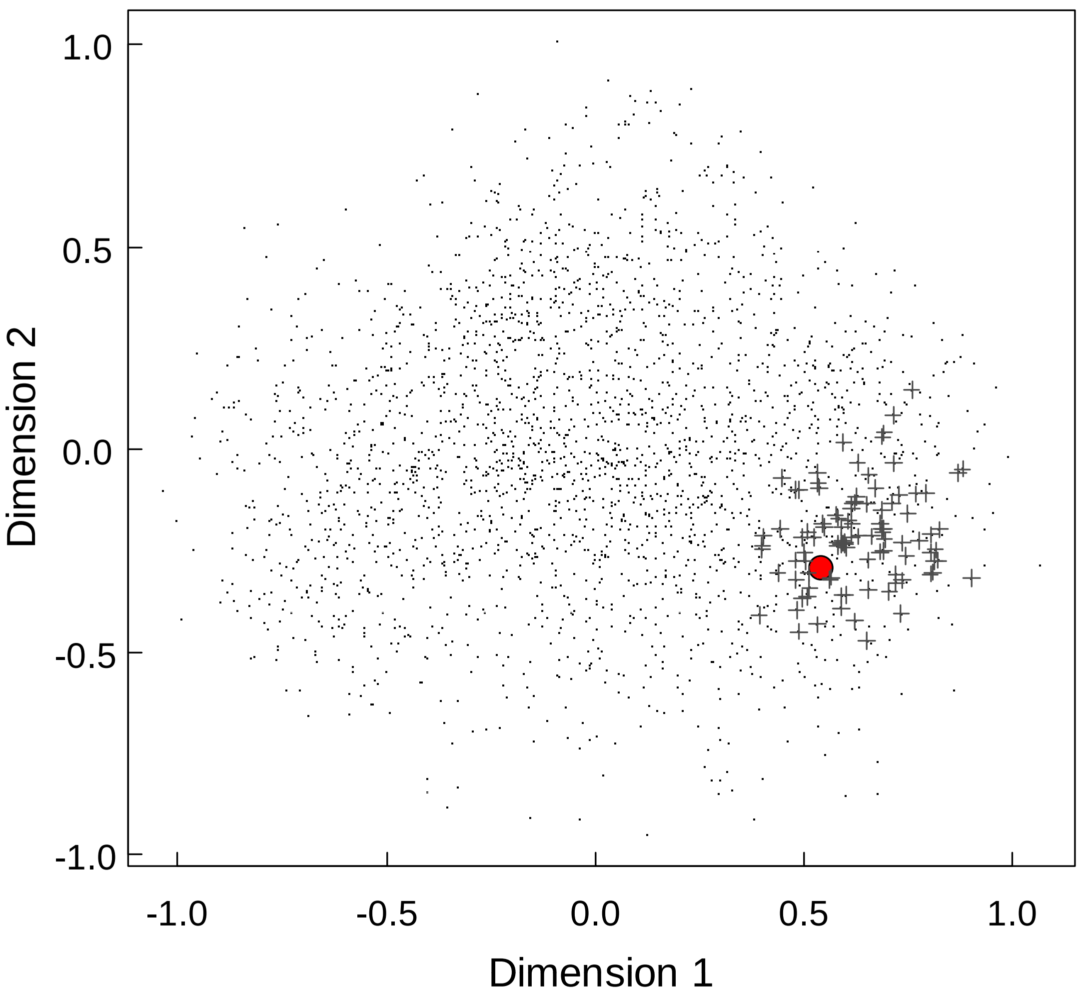

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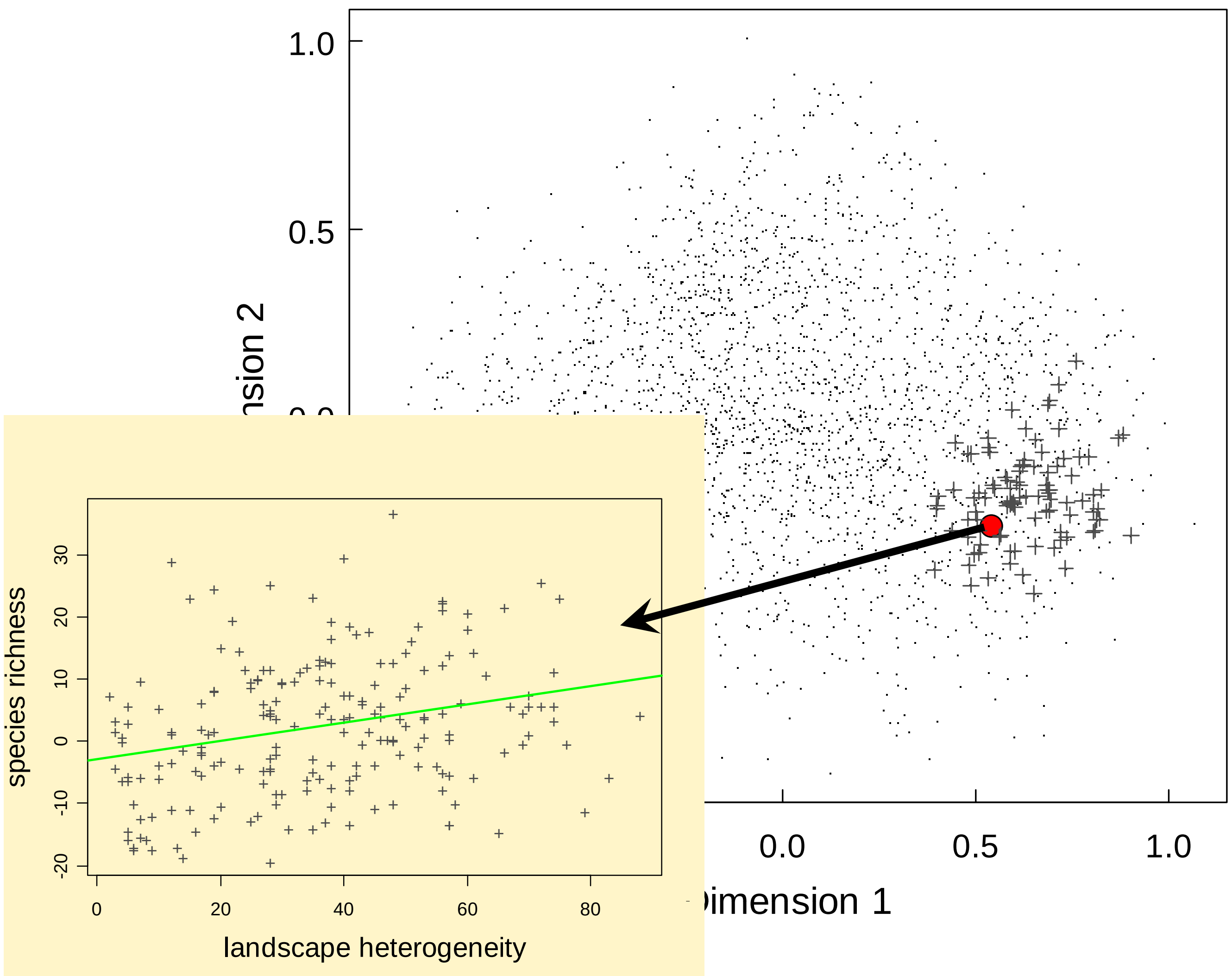

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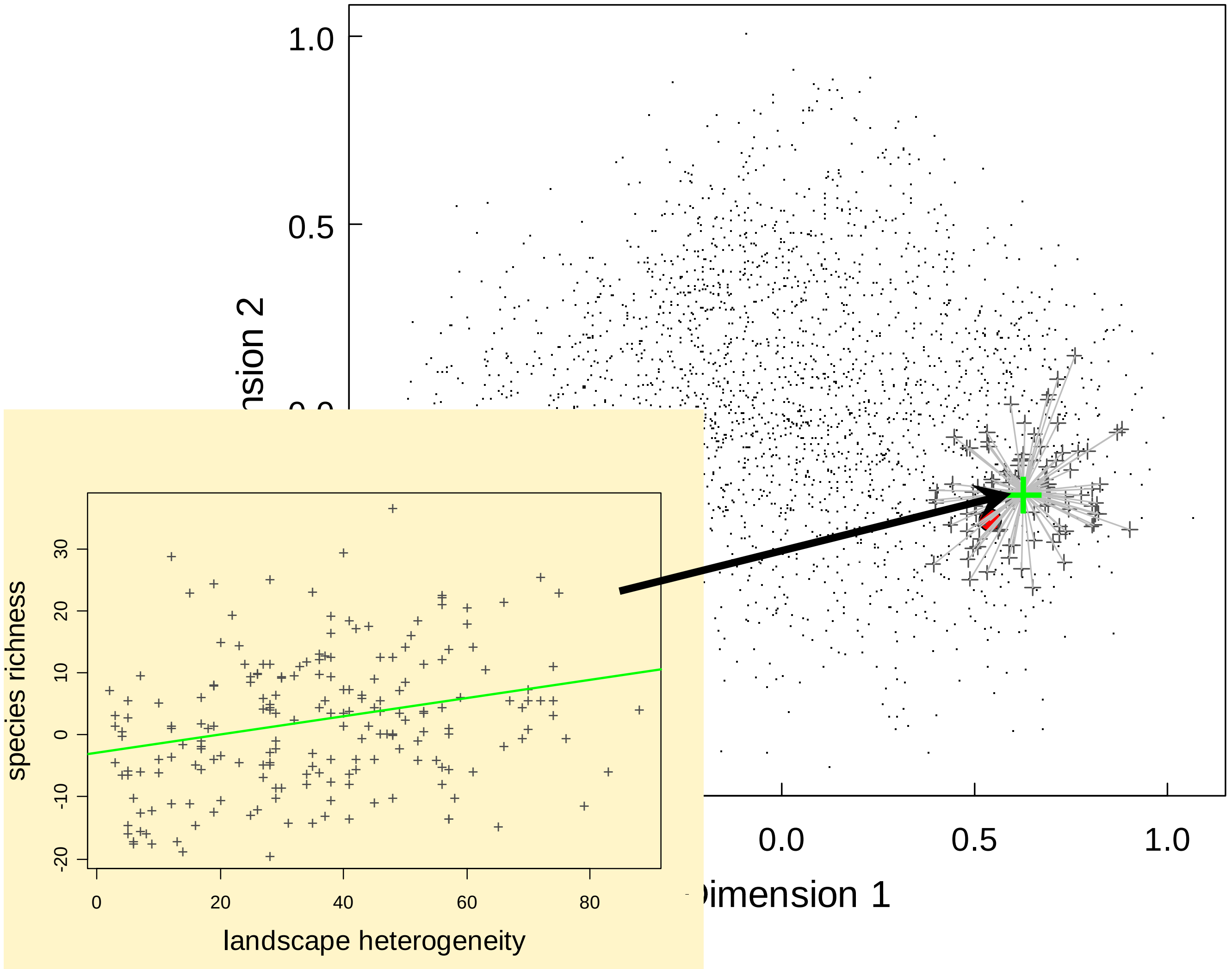

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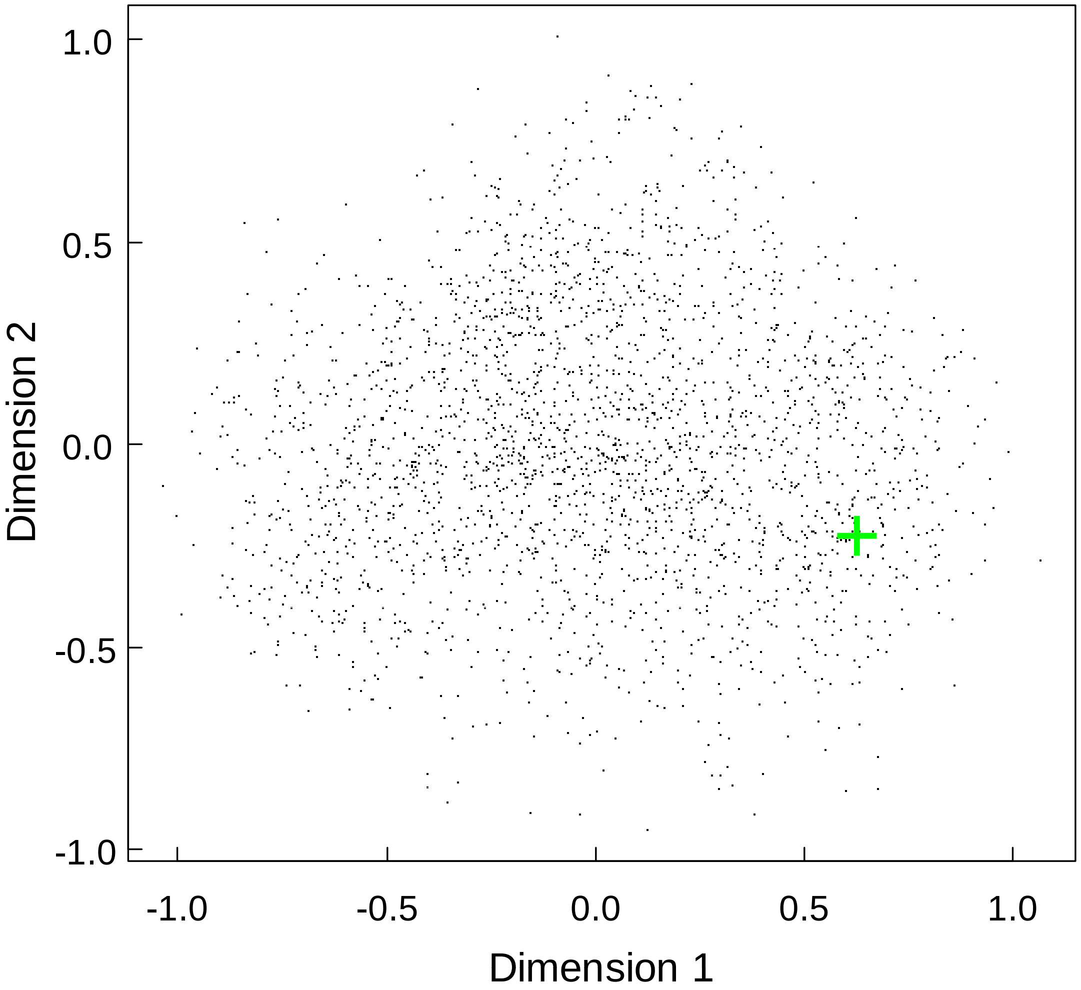
Species richness vs. heterogeneity



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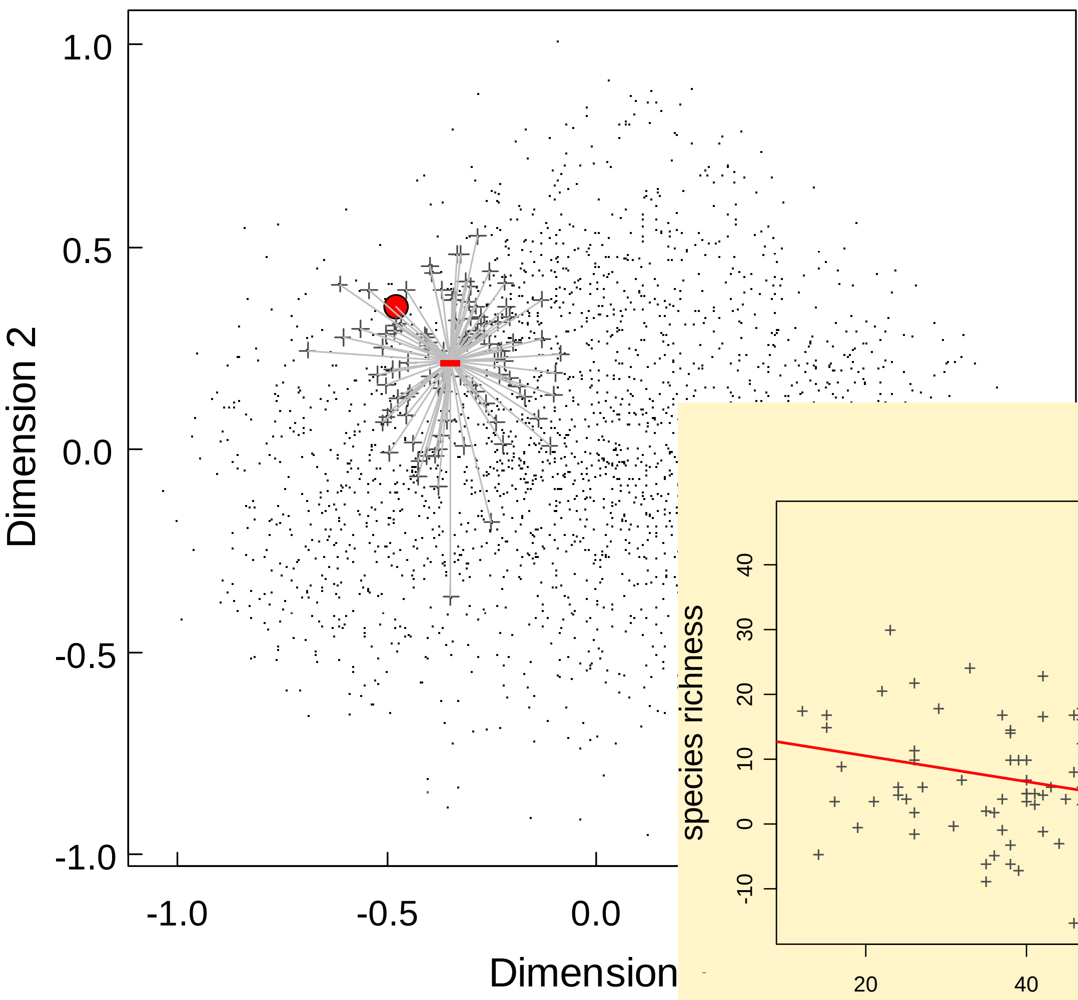

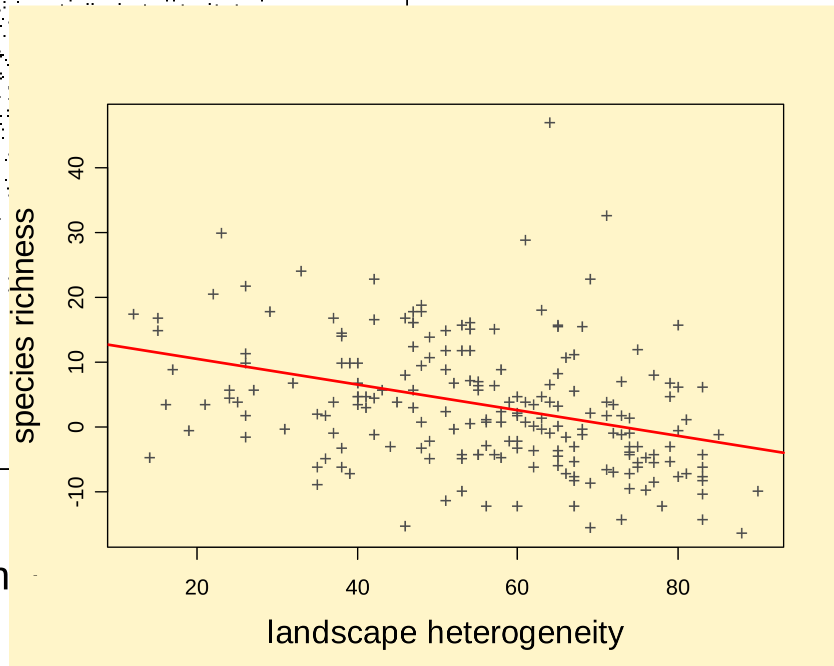

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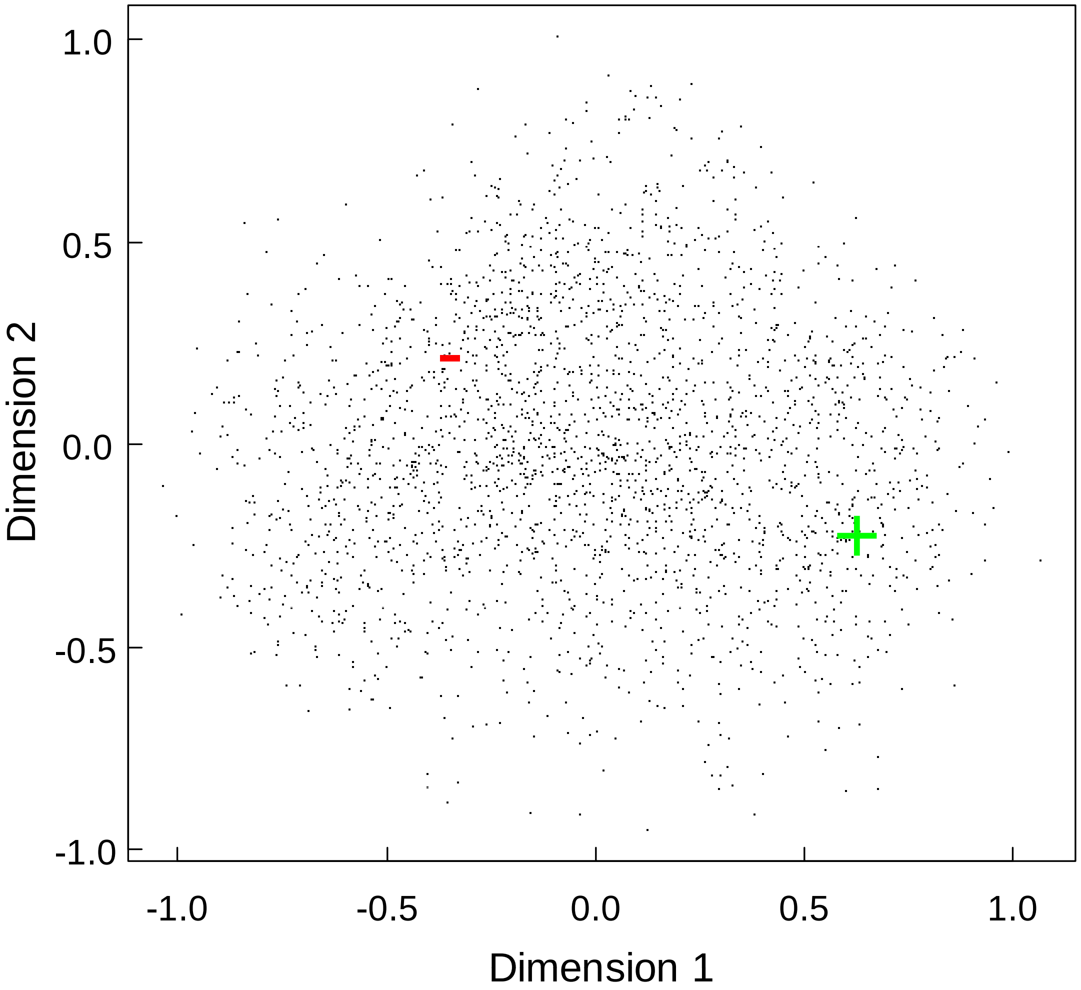

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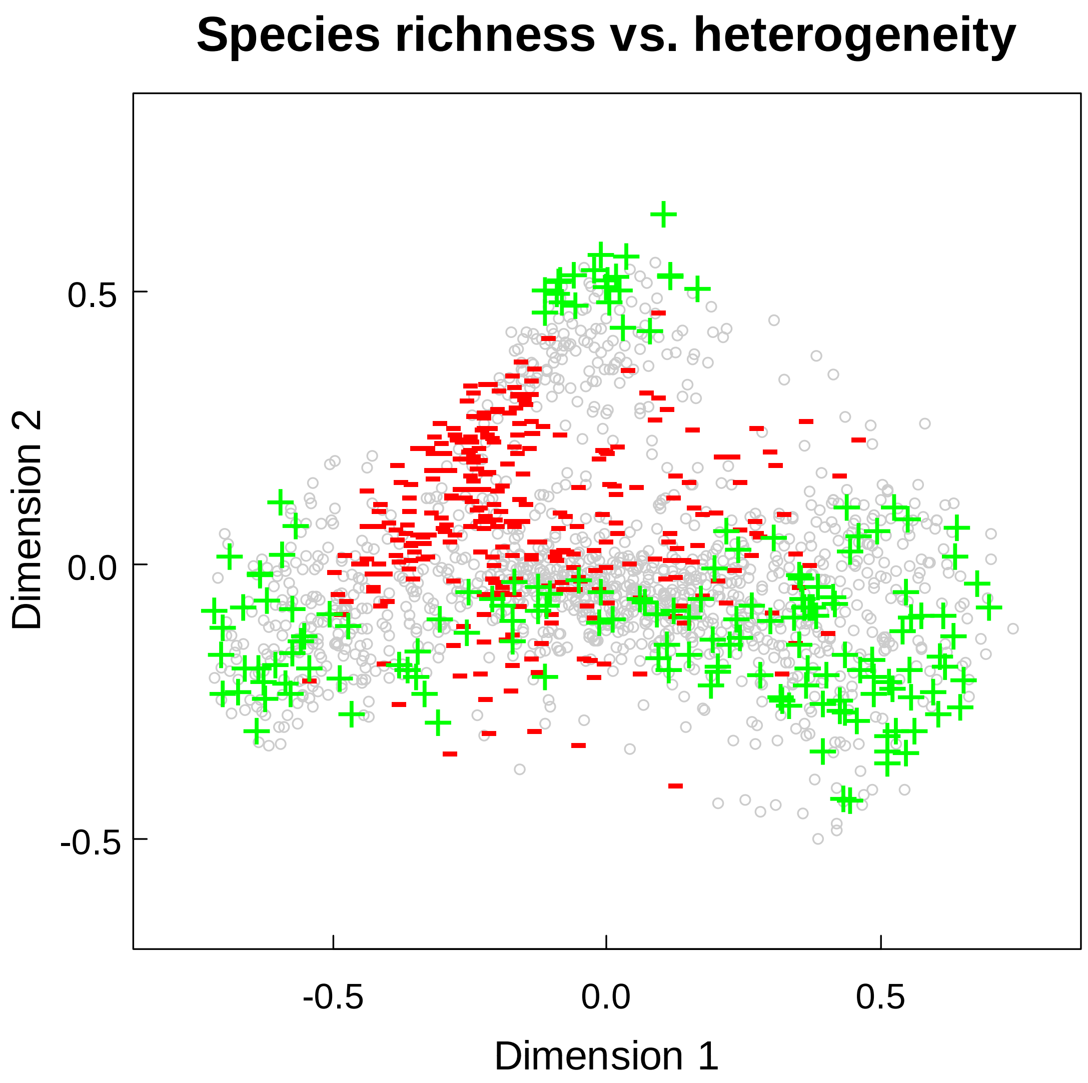

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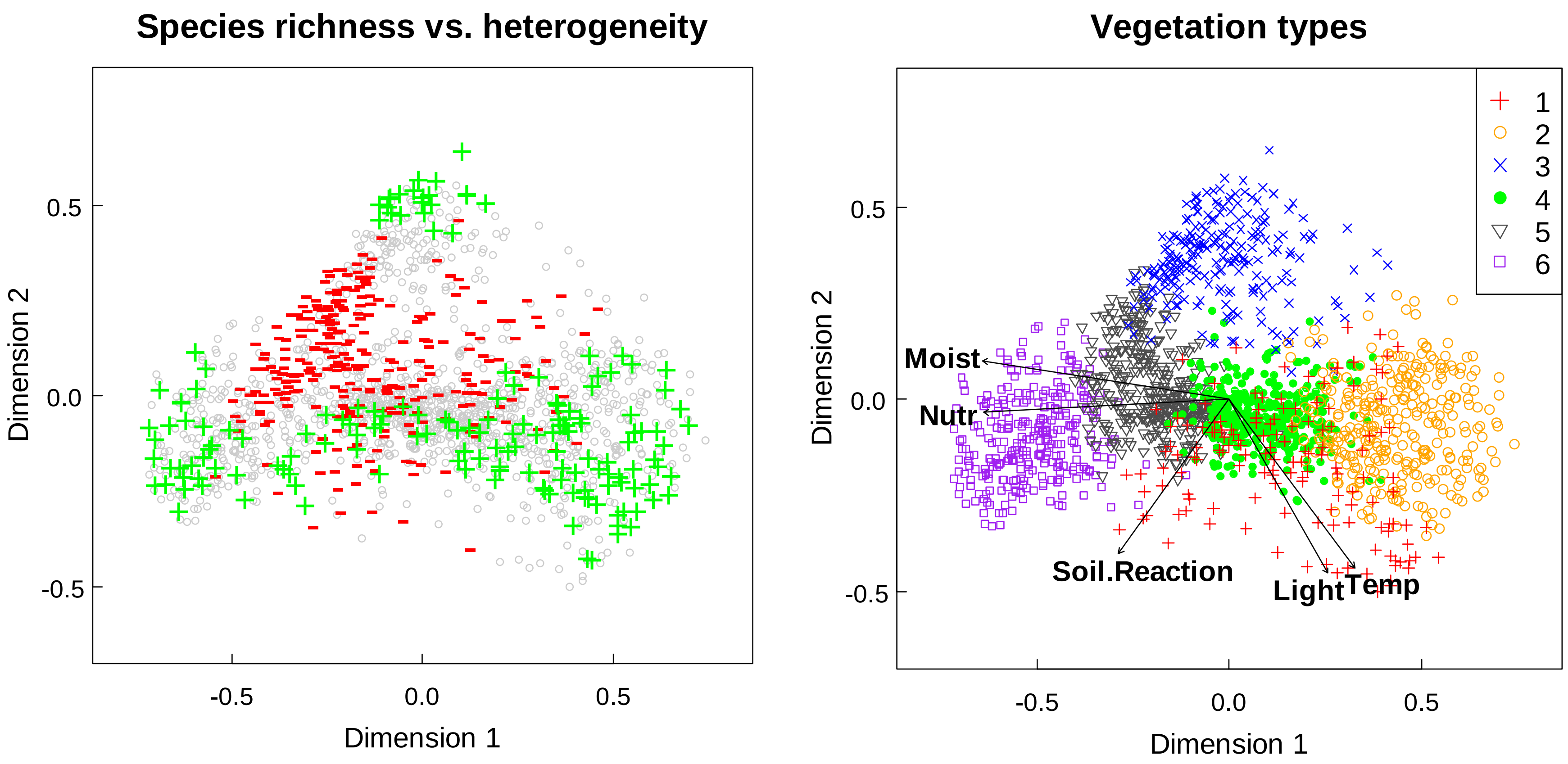

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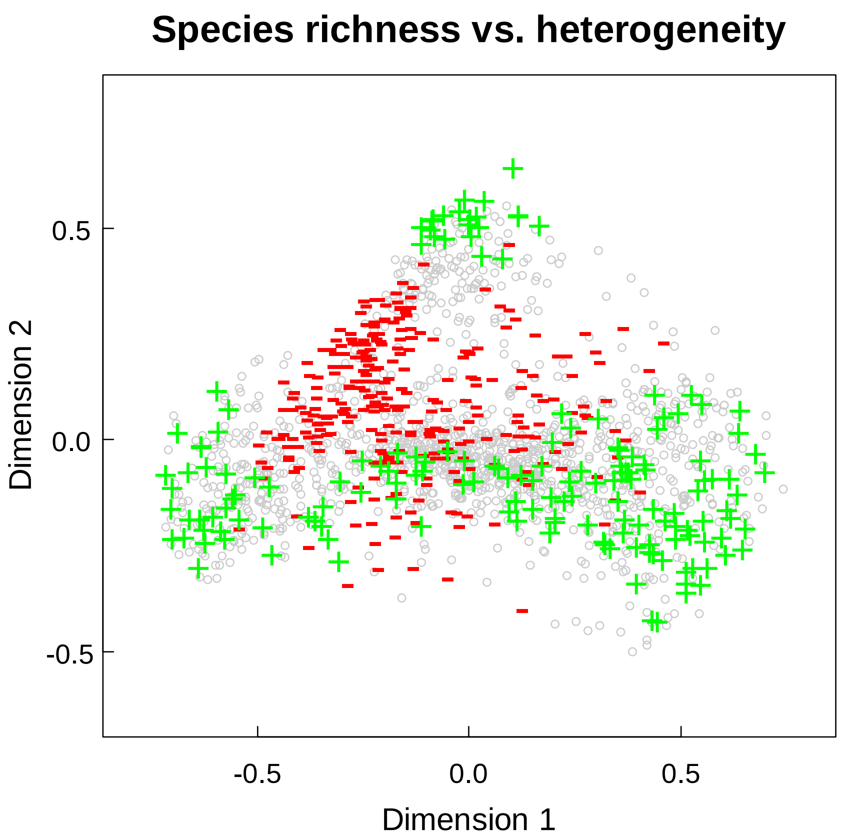
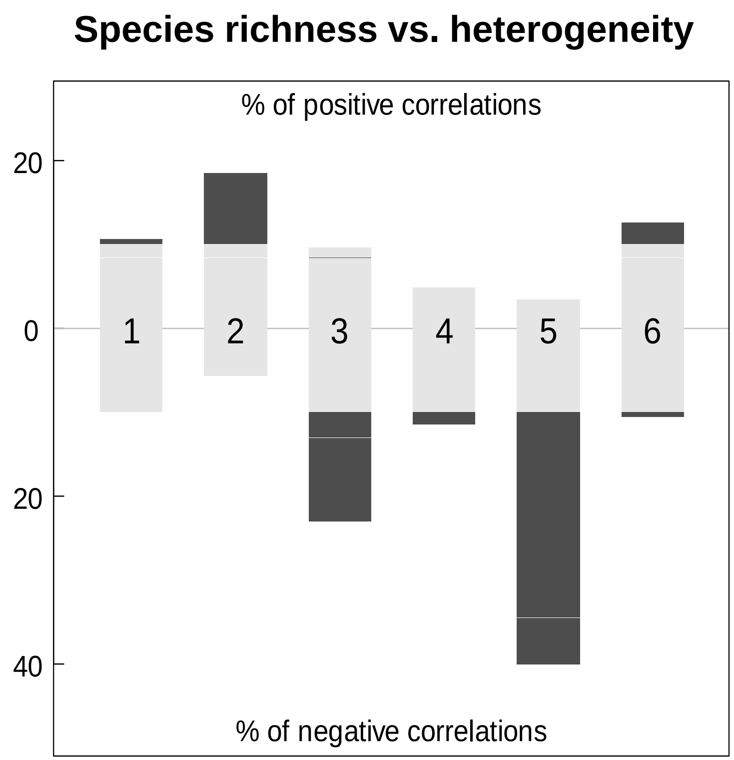
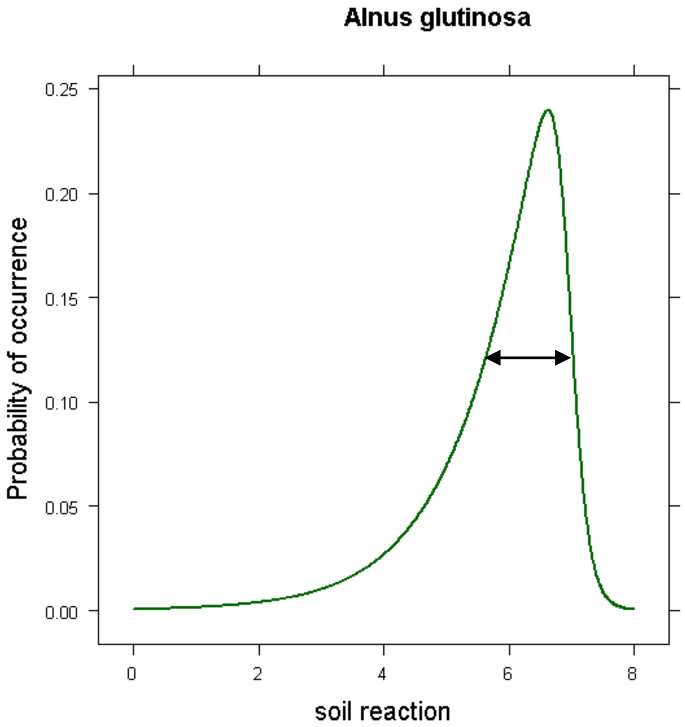




Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

Species habitat specialization based on the species niche width along environmental gradient

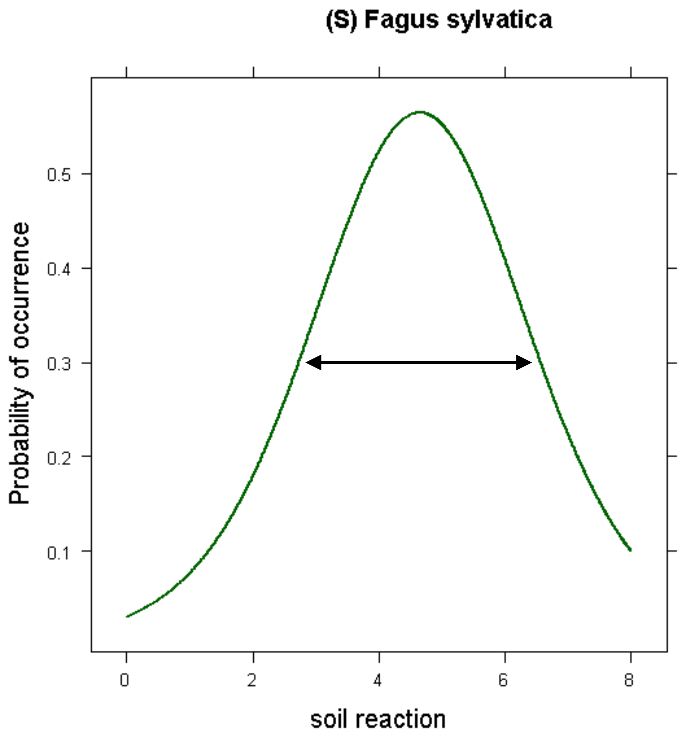


specialist

=

species with

narrow niche



generalist

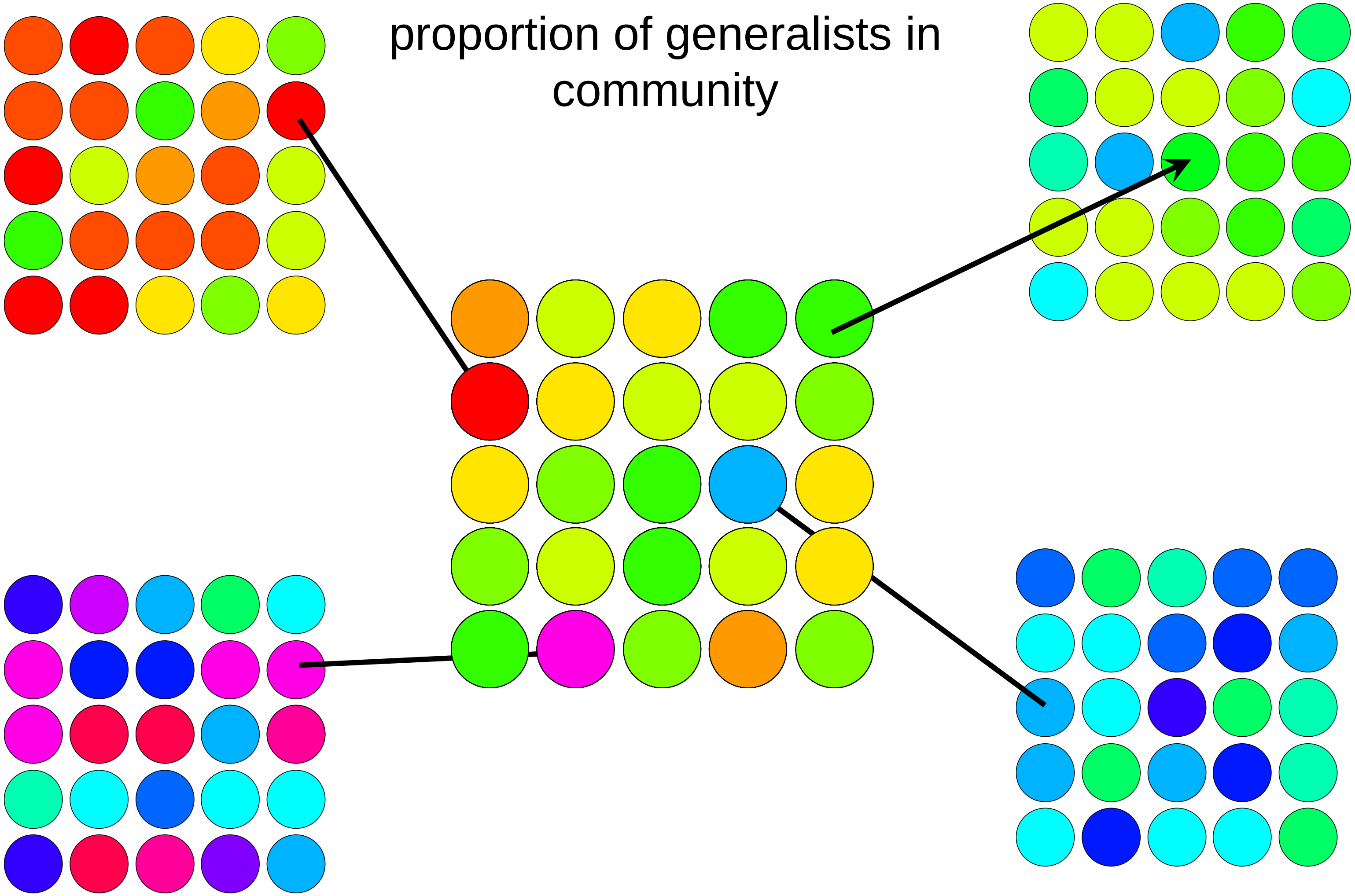
=

species with

wide niche

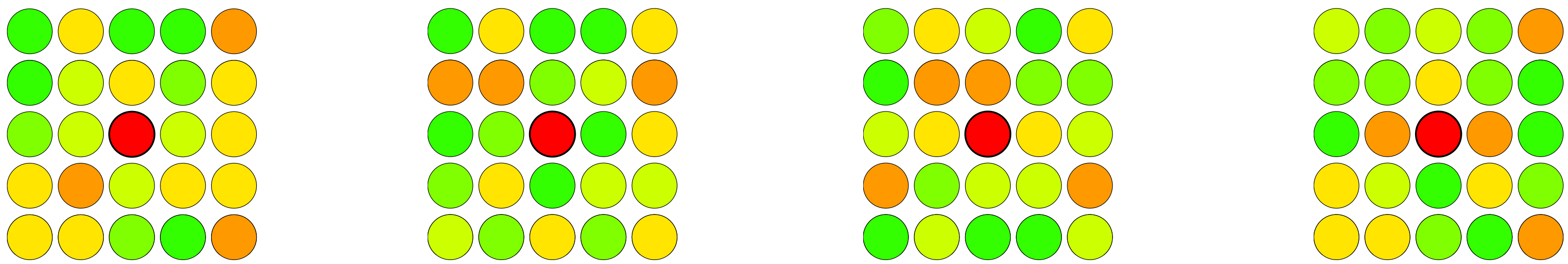
Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

Steiner & Köhler (2003) – spatial mass effect increases with increased proportion of generalists in community

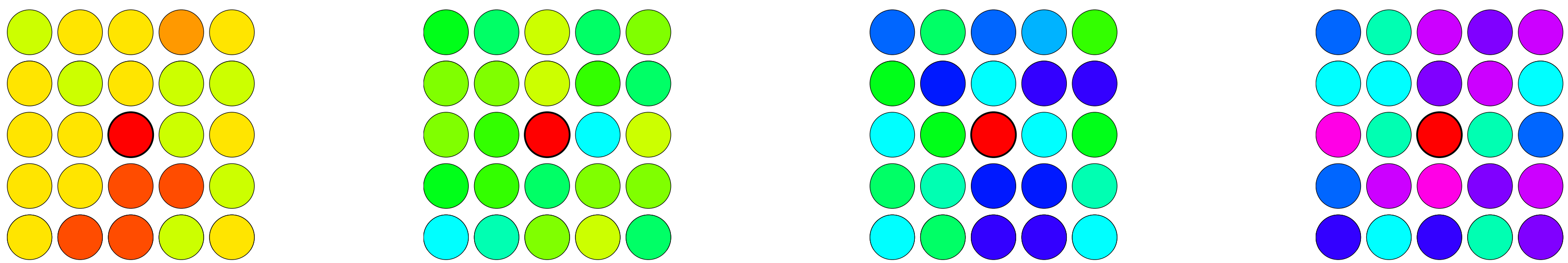


Steiner & Köhler (2003): Effects of landscape patterns on species richness – a modelling appoach. – *Agriculture, Ecosystems and Environment*, 98: 353-361.

Species habitat specialization based on the compositional differences among occupied habitats



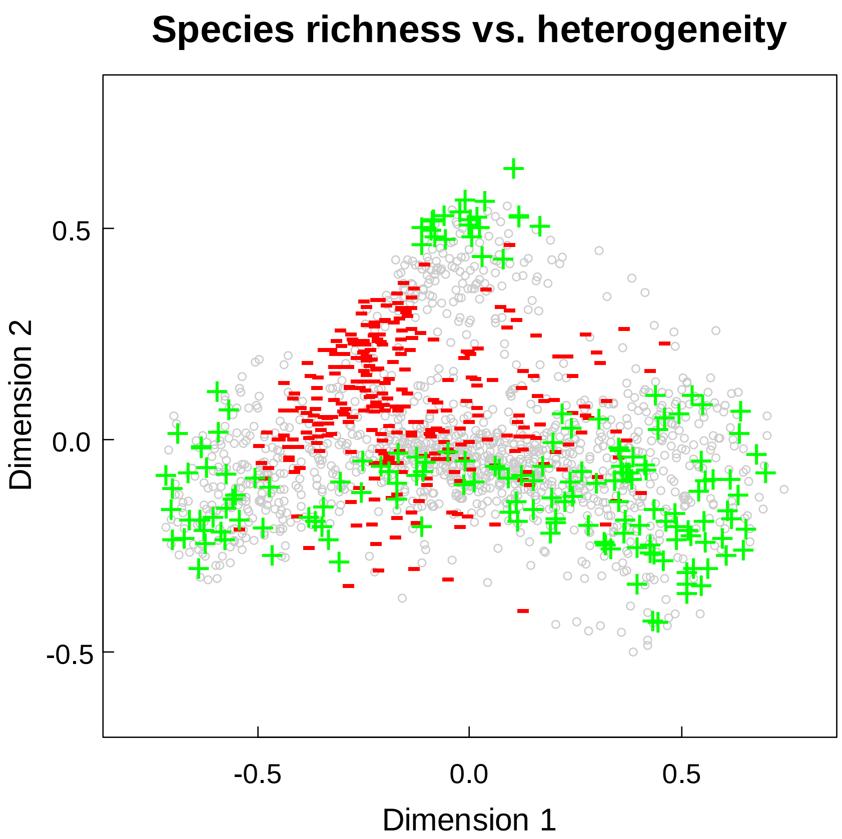
specialist – occurs in **similar** habitats with **similar** species composition

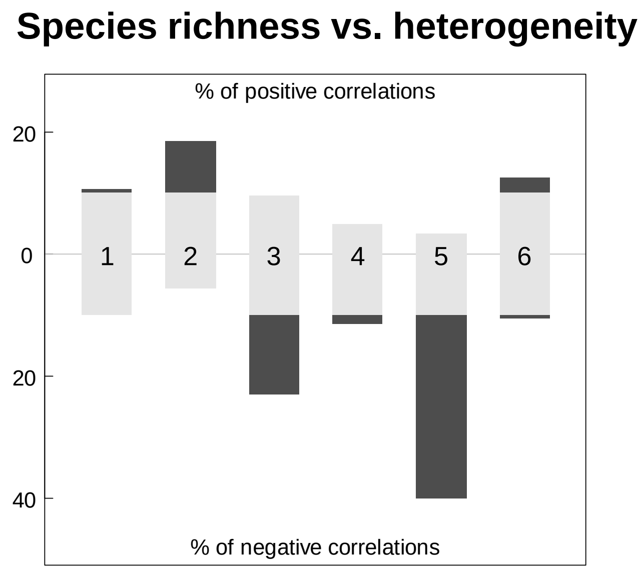


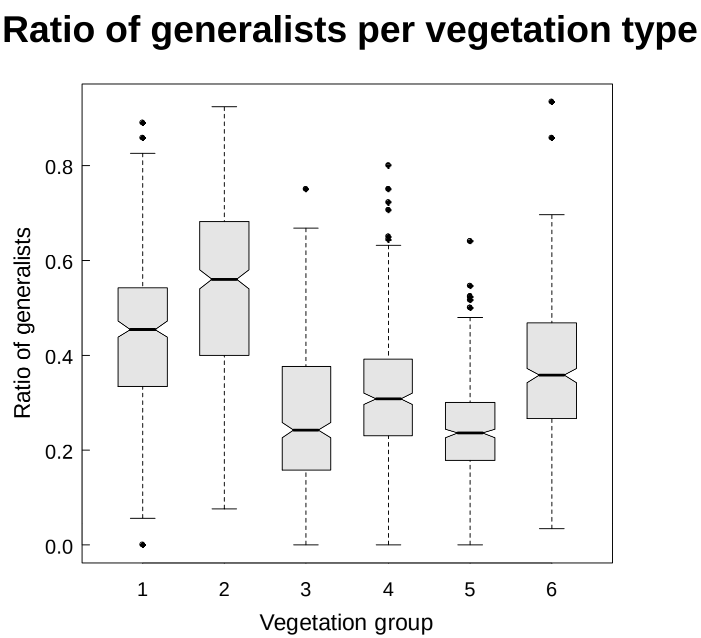
generalist – occurs in **various** habitats with **diverse** species composition

Fridley et al. (2007): Co-occurrence based assessment of habitat generalists and specialists: a new approach for the measurement of niche width. *Journal of Ecology,* **95,** 707-722.

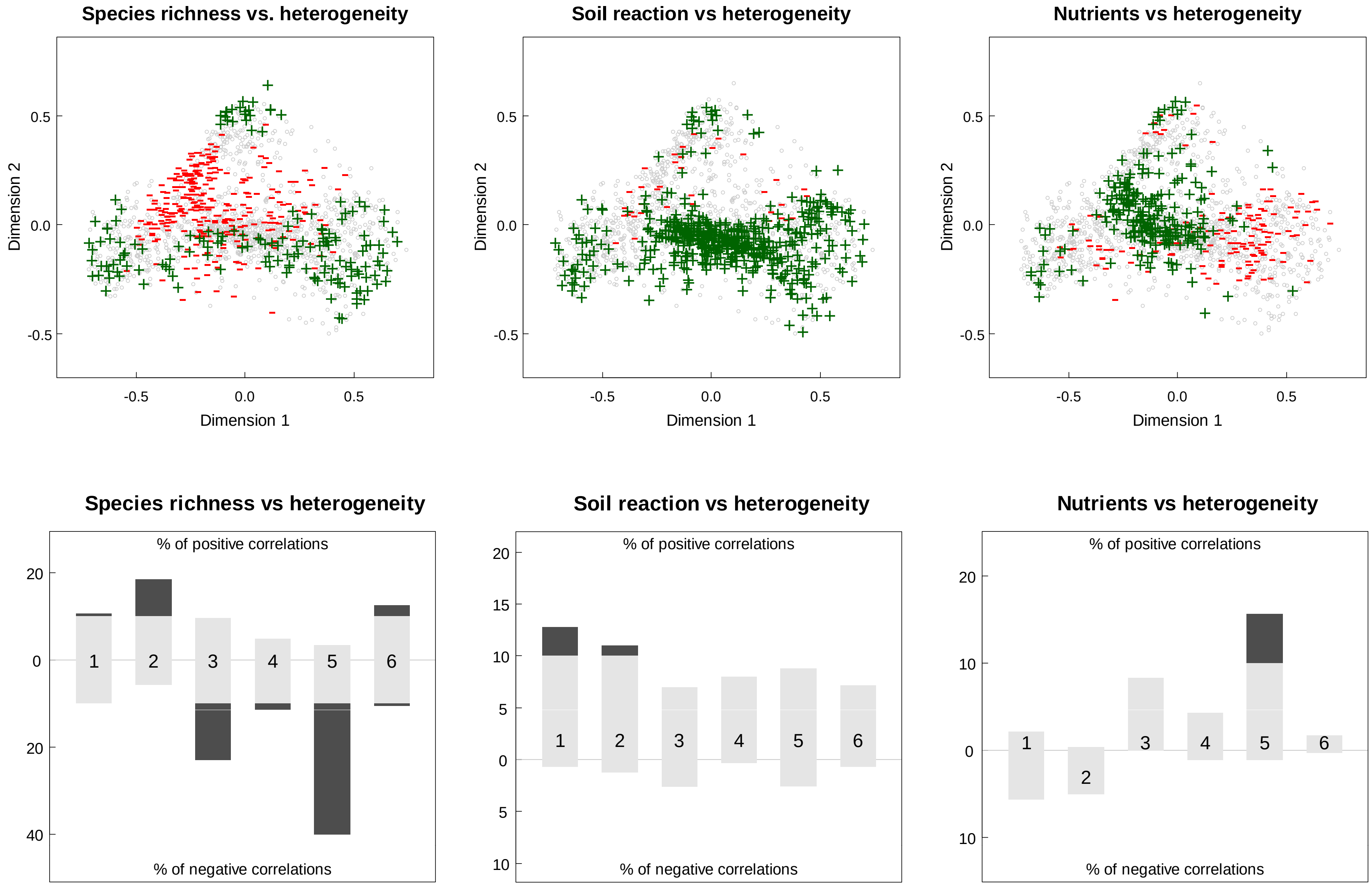
Species richness vs. heterogeneity





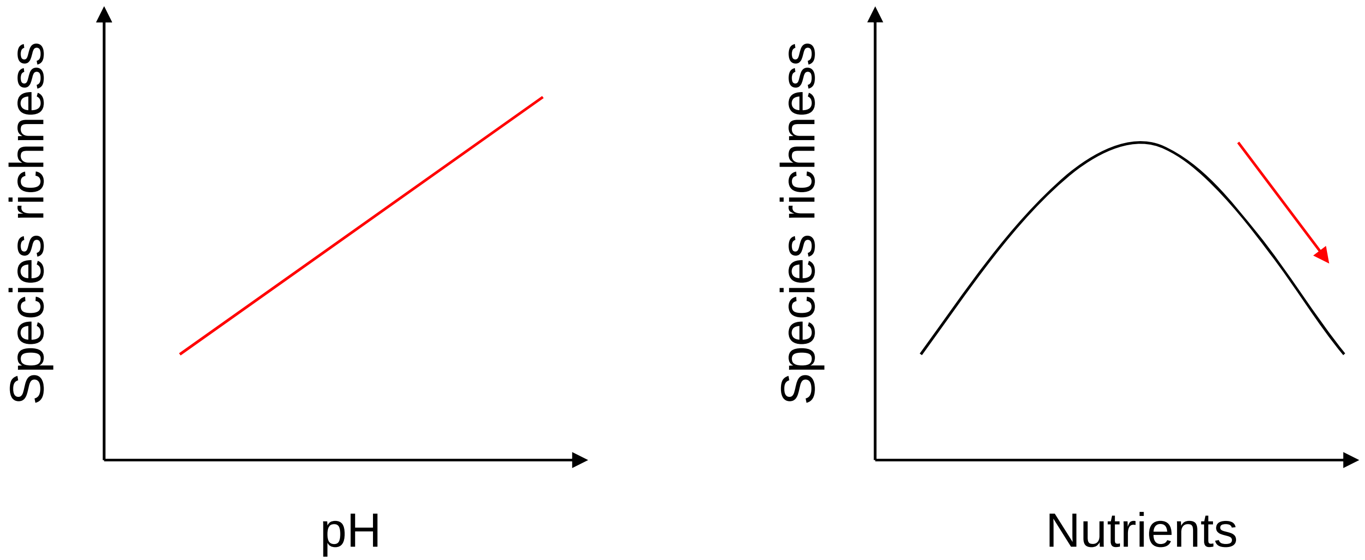


Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?



Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

Empirical models of species richness along gradients of soil reaction and nutrients



Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

Paper 3: Conclusions

1. Generally, nutrient-poor vegetation types are more species rich in topographically heterogeneous landscape, while the opposite is true for nutrient-rich vegetation types;
2. nutrient-poor vegetation types (e.g. oak forests) have high proportion of habitat generalists, indicating that their higher species richness in heterogeneous landscape may be result of pronounced spatial mass effect;
3. the pattern of local species richness along the gradient of landscape topographical heterogeneity may be also explained by the shifts in stand ecological conditions: at heterogeneous landscape, the stands have higher soil reaction (valid for almost all vegetation types), and also higher productivity (valid only for nutrient-rich vegetation types).

Zelený D. , Li Ch.-F. & Chytrý M. (submitted): Pattern of plant species richness along the gradient of landscape topographic heterogeneity: result of spatial mass effect or environmental shift?

David Zelený

Co-occurrence-based assessment of species habitat specialization is affected by the size of species pool: reply to Fridley *et al*. (2007).

Journal of Ecology, in press

Main aim: methodological paper, which points up the problem of the method for estimation of species habitat specialization, as originally published by Fridley et al. (2007); corrected version is proposed.

Thank you for your attention!