Influence of sample plot size on the vegetation data analysis

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Plot sizes used for sampling in phytosociology

(an example)

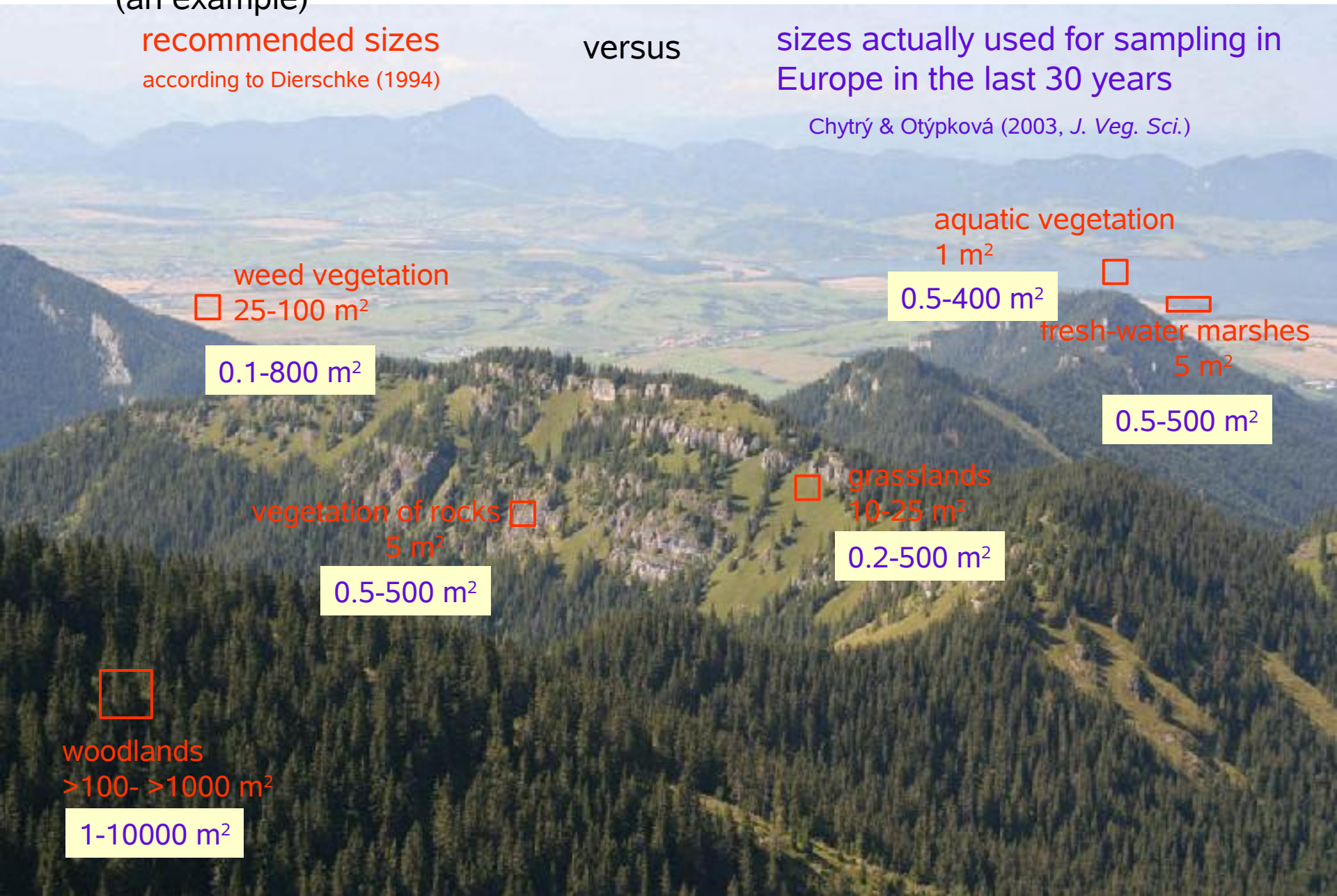
recommended sizes

according to Dierschke (1994)

versus

sizes actually used for sampling in Europe in the last 30 years

Chytrý & Otýpková (2003, *J. Veg. Sci.*)



Questions

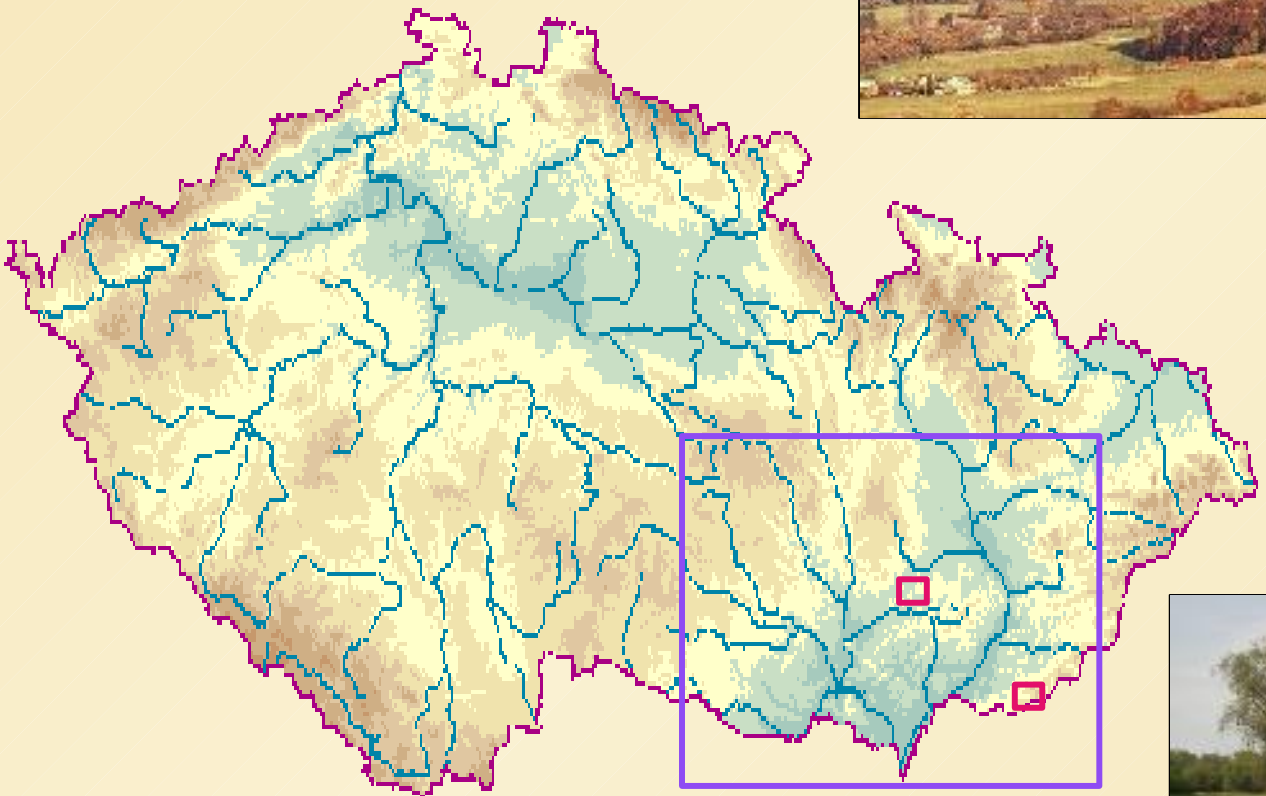
1) are ordination results affected by the plot size?

2) if so, is the effect of plot size more pronounced in homogeneous or in heterogeneous data sets?

3) is the effect of plot size consistent in grasslands and forests?

4) is it possible to combine various plot sizes in a single ordination?

Location of sites




various types of meadows covering classes *Molinio-Arrhenatheretea* and *Festuco-Brometea*


various types of forests covering classes *Querco-Fagetea* and *Quercetea robori-petraeae*

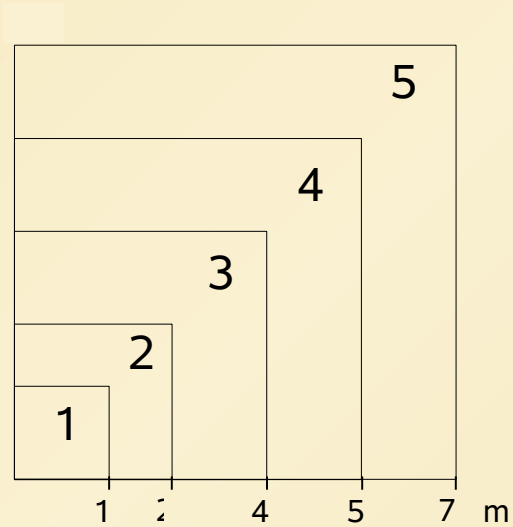

species-rich grasslands dominated
by *Carex humilis* and
Brachypodium pinnatum


beech and hornbeam forests
of alliances *Fagion sylvaticae* and
Carpinion betuli

Plot size

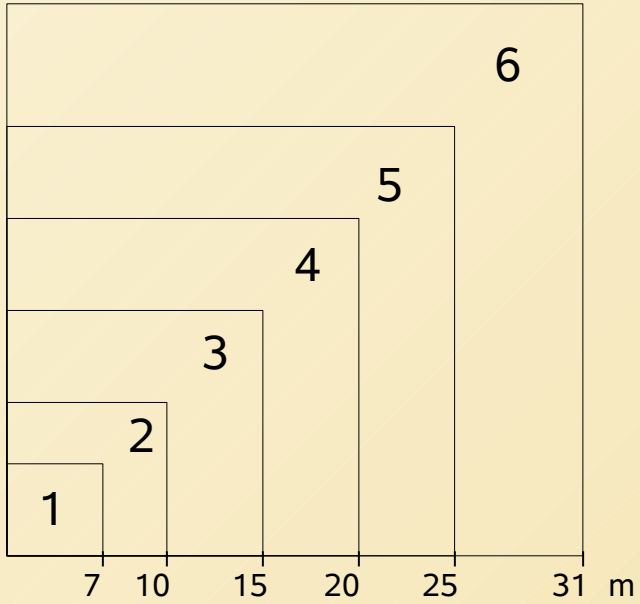
Grasslands

1 – 1 m²
2 – 4 m²
3 – 16 m²
4 – 25 m²
5 – 49 m²

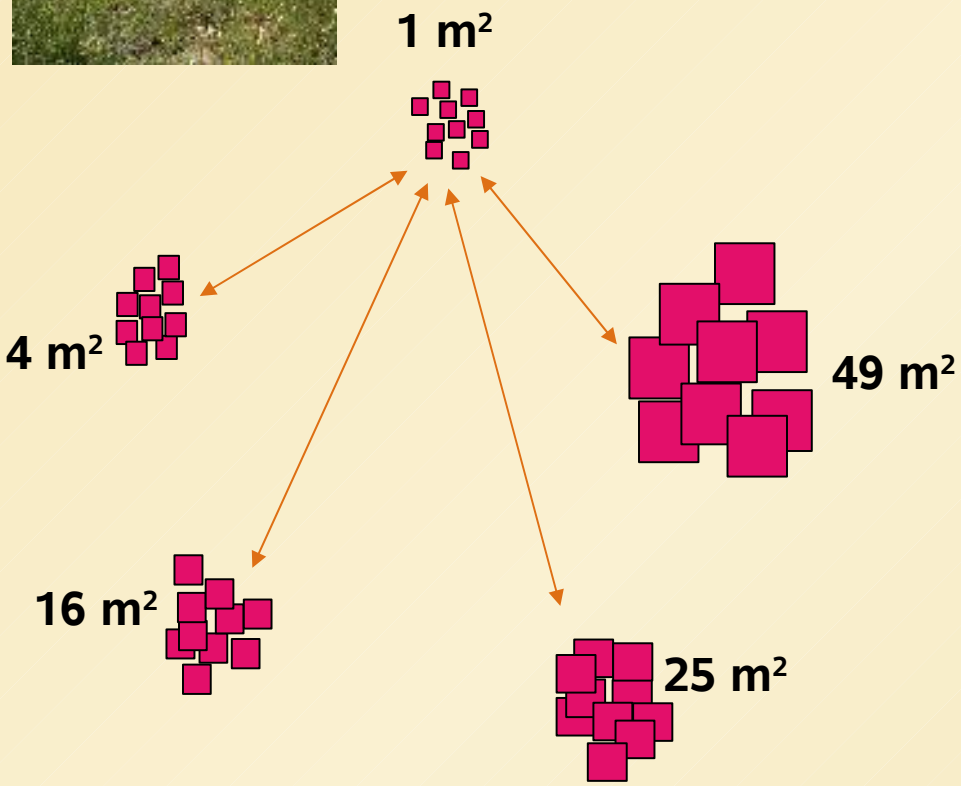


Forests

1 – 49 m²
2 – 100 m²
3 – 225 m²
4 – 400 m²
5 – 625 m²
6 – 961 m²



Combinations of plot sizes in ordinations for grasslands



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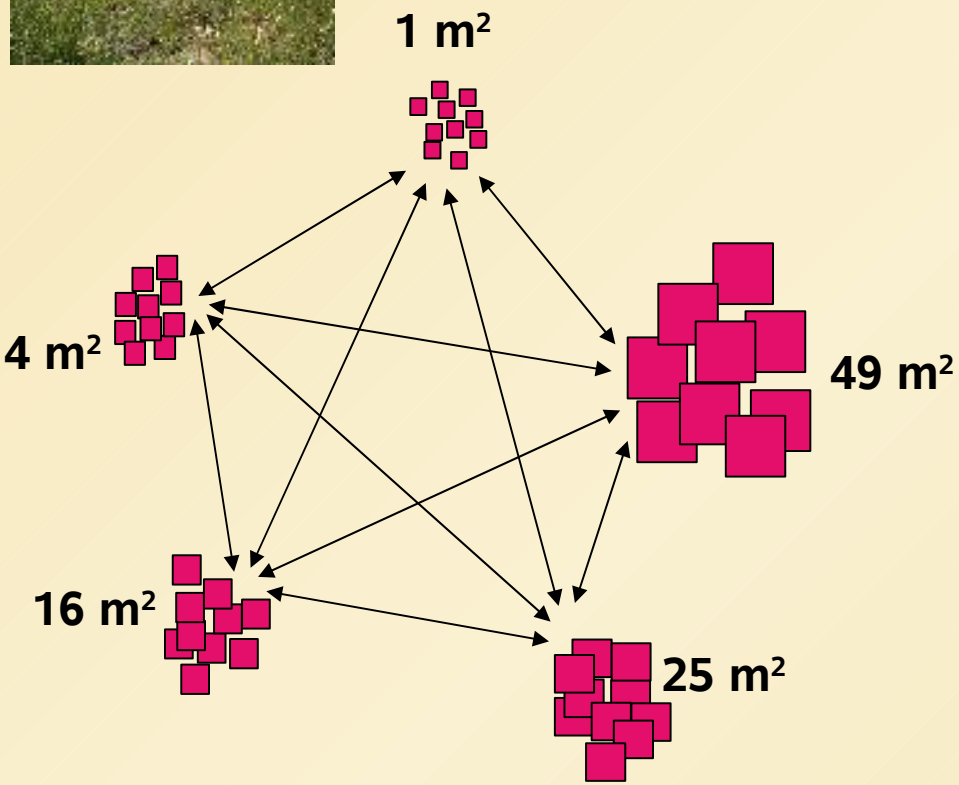
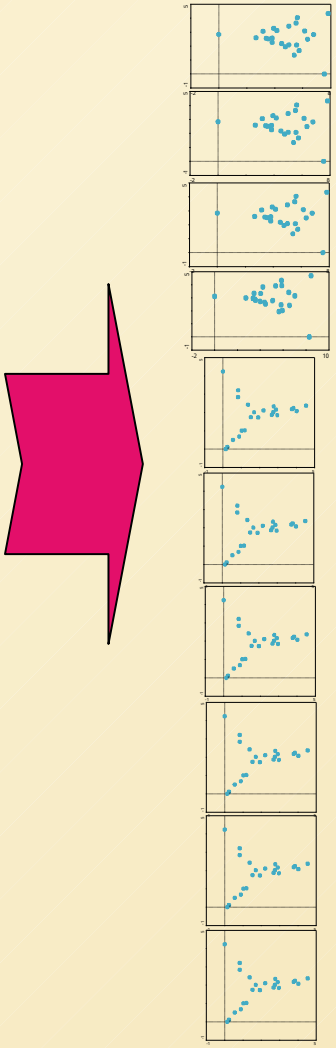
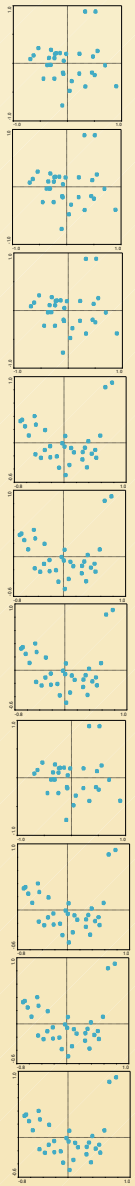


PCAs for homogeneous data sets



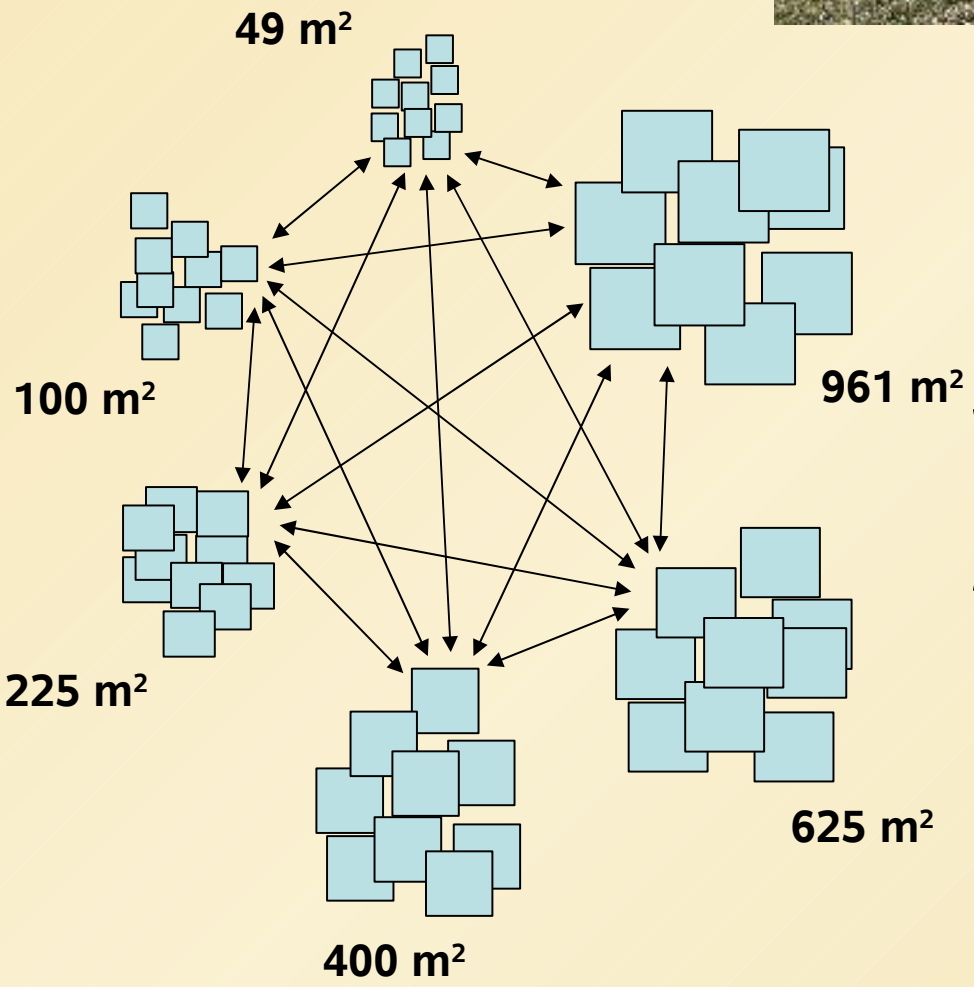
DCAs for heterogeneous data sets

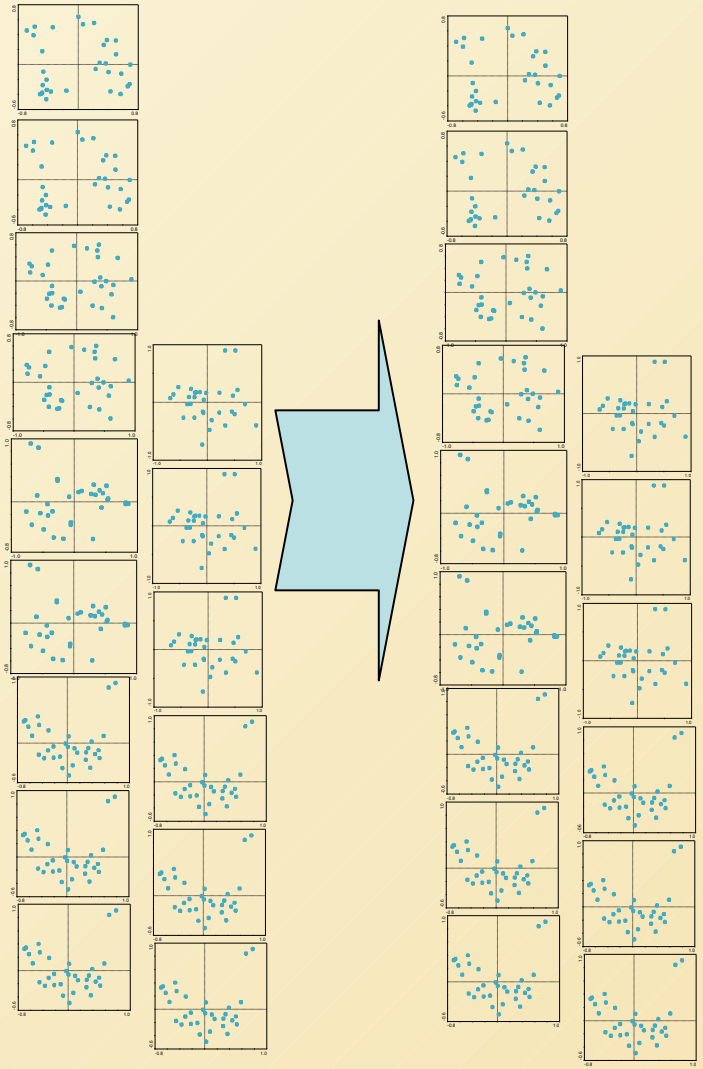


Combinations of plot sizes in ordinations for forests

PCAs for homogeneous data sets

DCAs for heterogeneous data sets



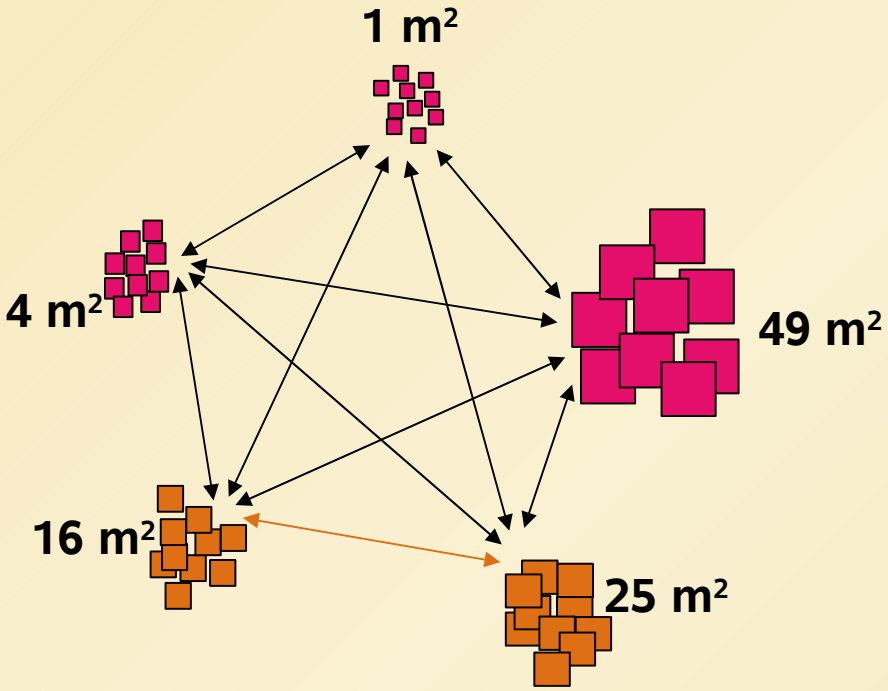


Ordinations with plots of different, but similar size (16 and 25 m²)

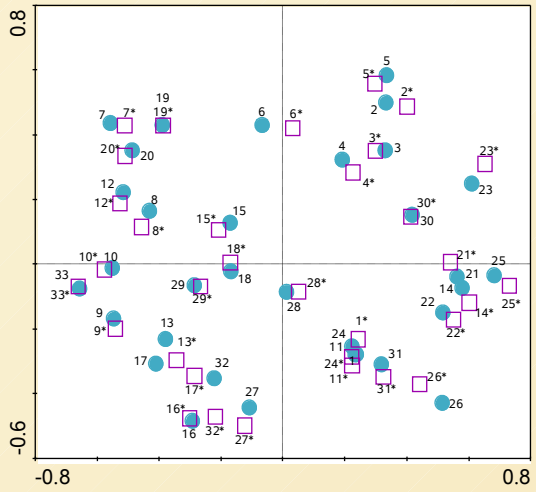
Grasslands

smaller plots

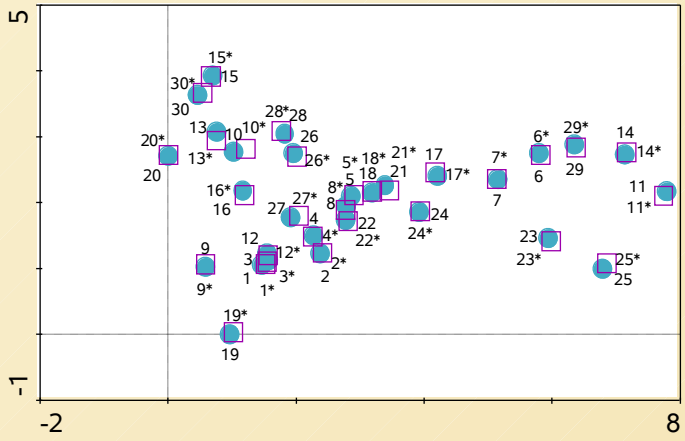
larger plots



Homogeneous data sets

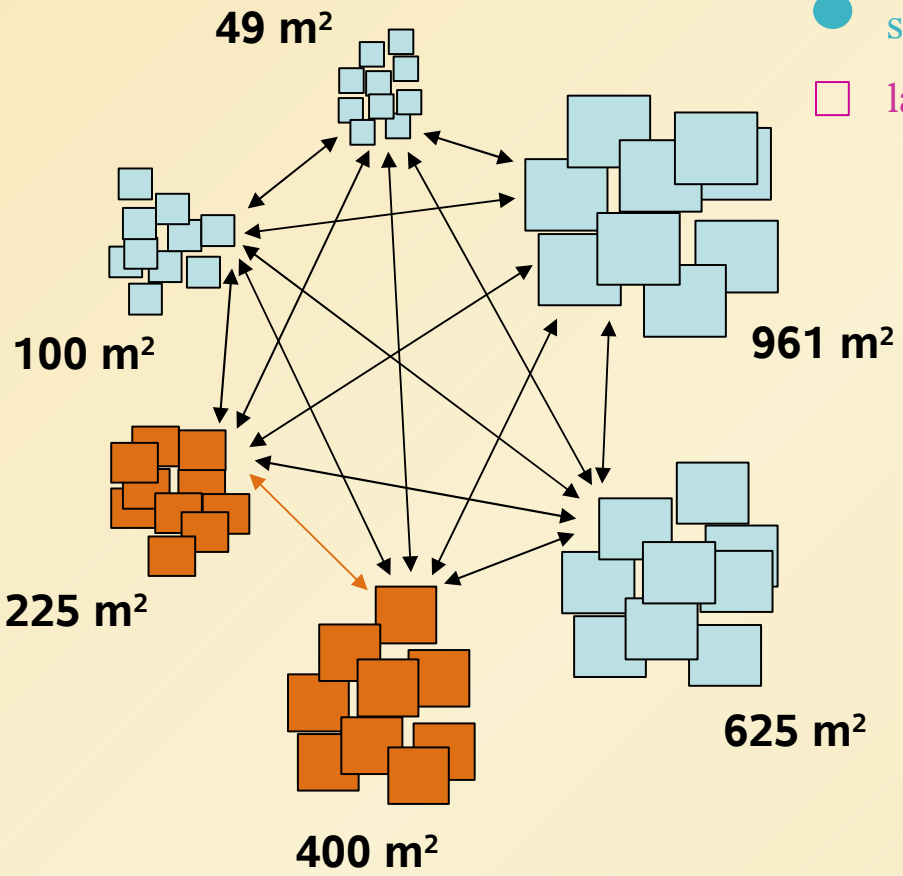


Heterogeneous data sets

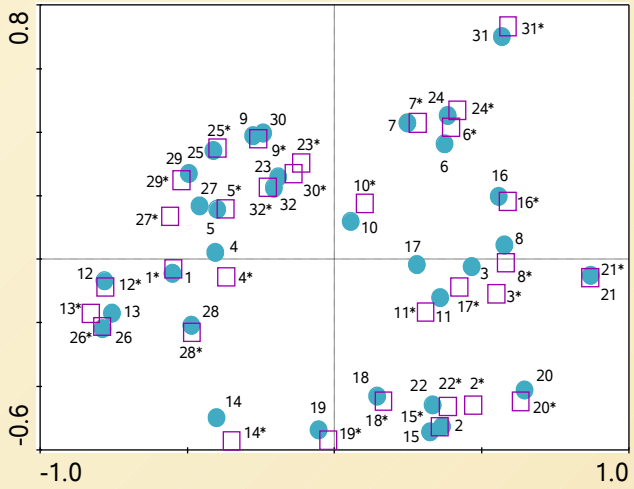


Ordinations with plots of different, but similar size (225 and 400 m²)

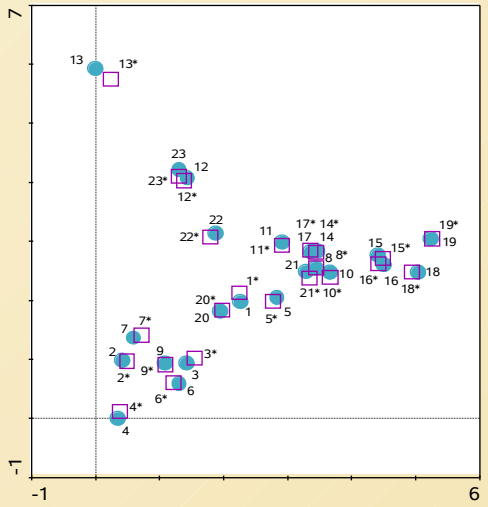
Forests



Homogeneous data sets

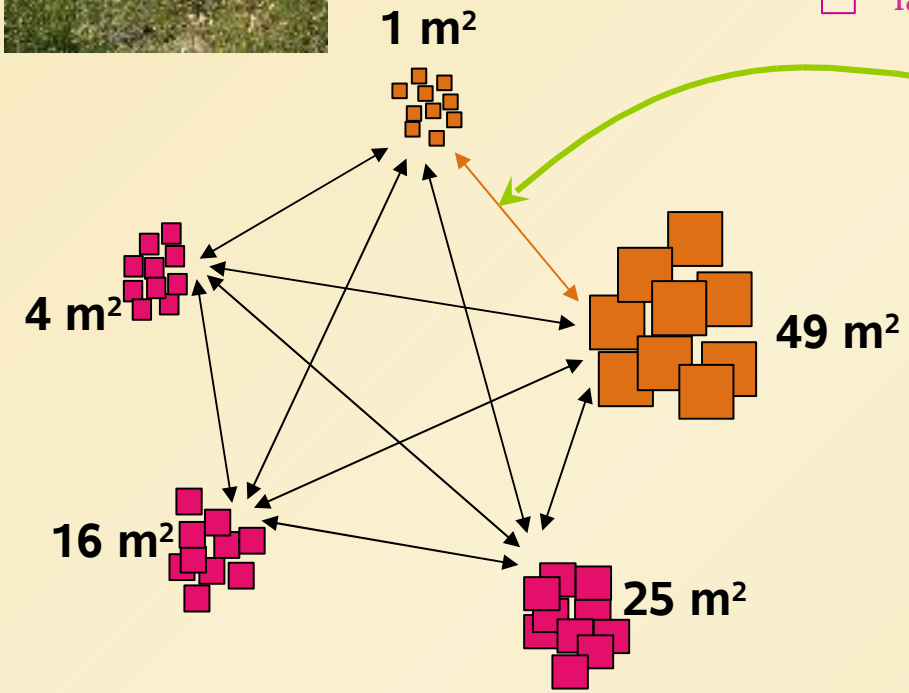


Heterogeneous data sets



Ordinations with combined plot sizes, when size differs by the order of magnitude (1 and 49 m²)

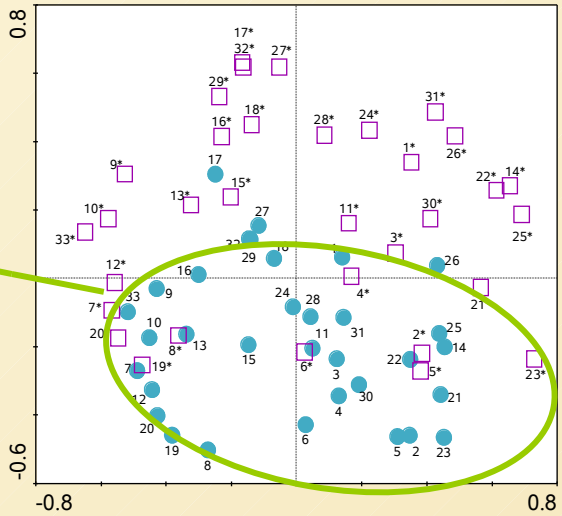
Grasslands



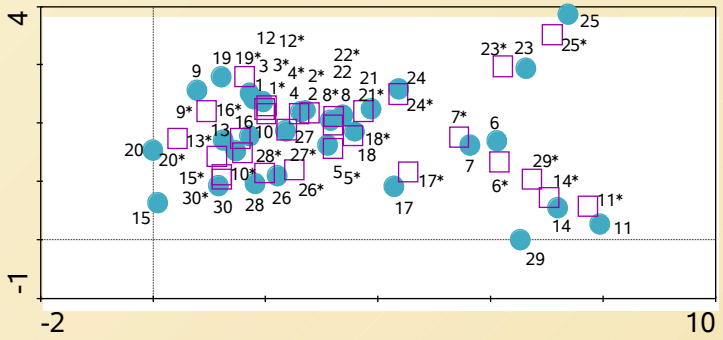
smaller plots

larger plots

Homogeneous data sets

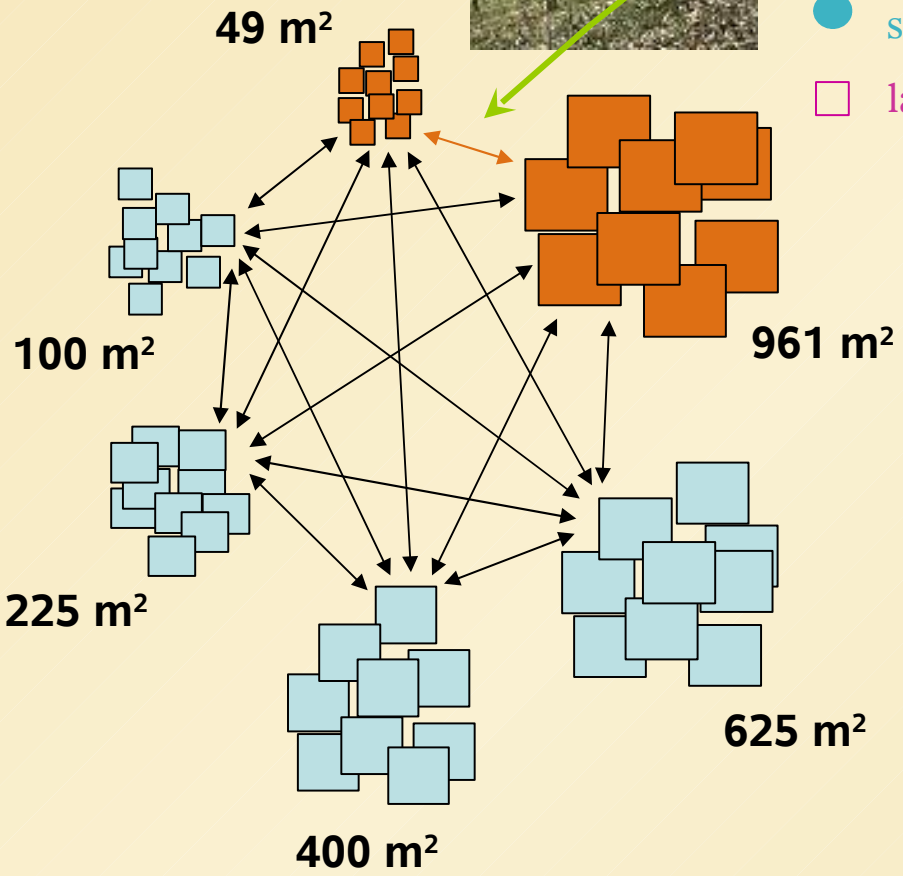


Heterogeneous data sets



Ordinations with combined plot sizes, when size differs by the order of magnitude (49 and 961 m²)

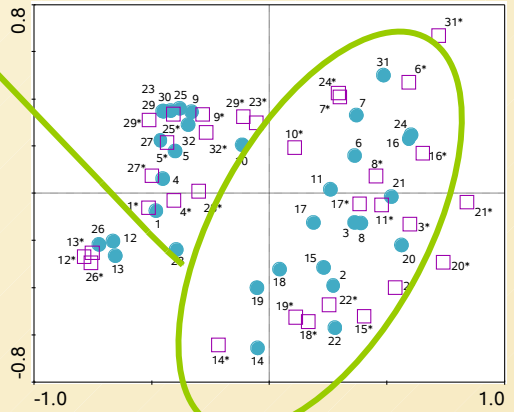
Forests



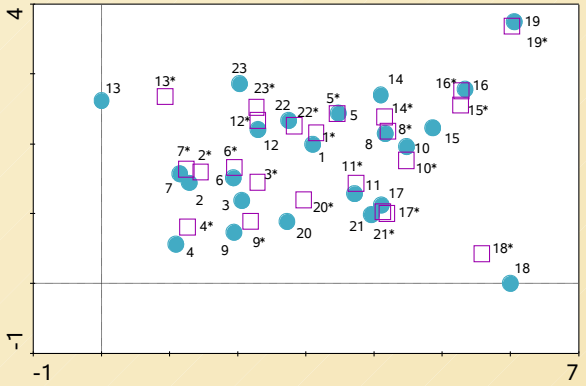
smaller plots

larger plots

Homogeneous data sets

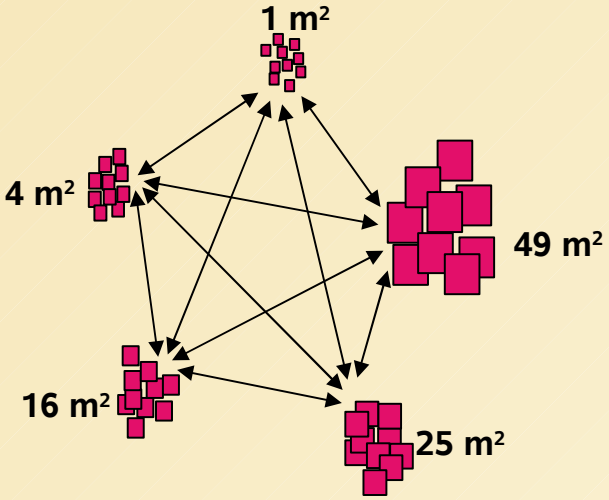


Heterogeneous data sets



Monte Carlo test

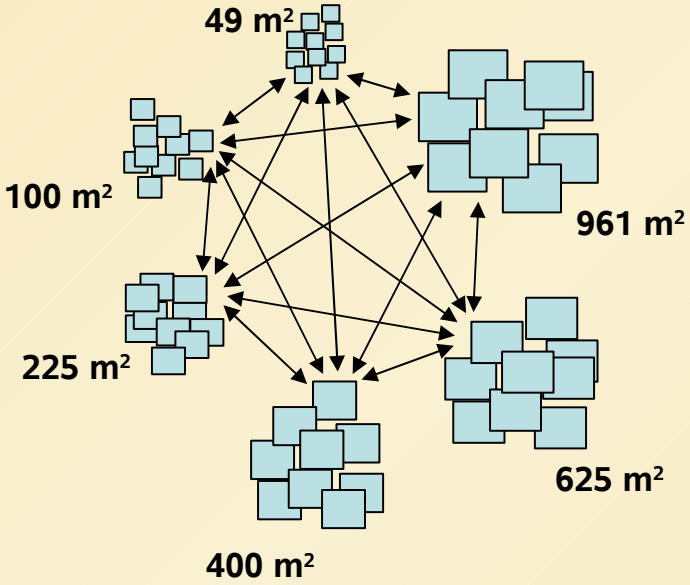
in grasslands



Heterogeneous data sets

non significant

in forests

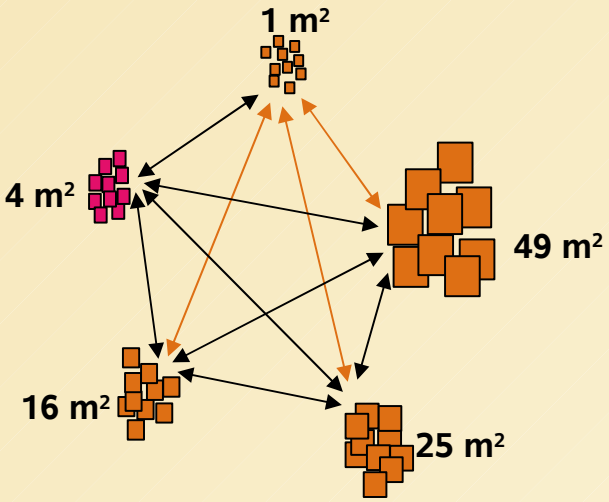


Heterogeneous data sets

non significant

Monte Carlo test

in grasslands



Homogeneous data sets

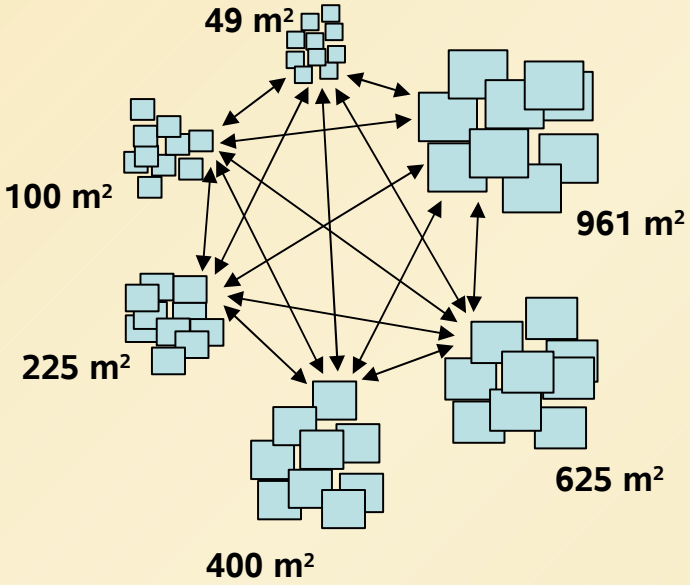
1 vs. 16 m²	F=3.04**
1 vs. 25 m²	F=3.99**
1 vs. 49 m²	F=5.59**

the other pairs non significant

Heterogeneous data sets

non significant

in forests

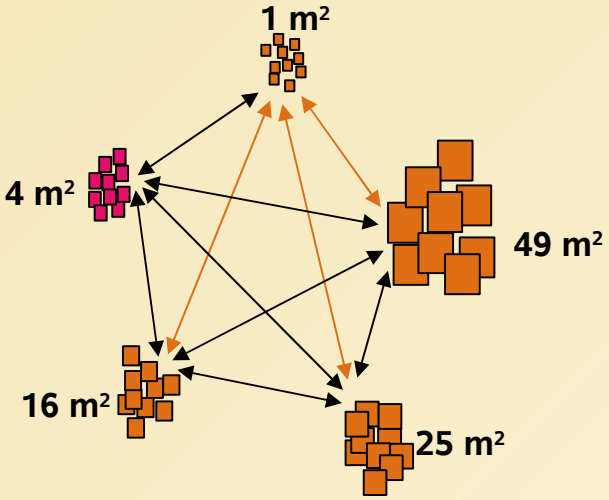


Heterogeneous data sets

non significant

Monte Carlo test

in grasslands



Homogeneous data sets

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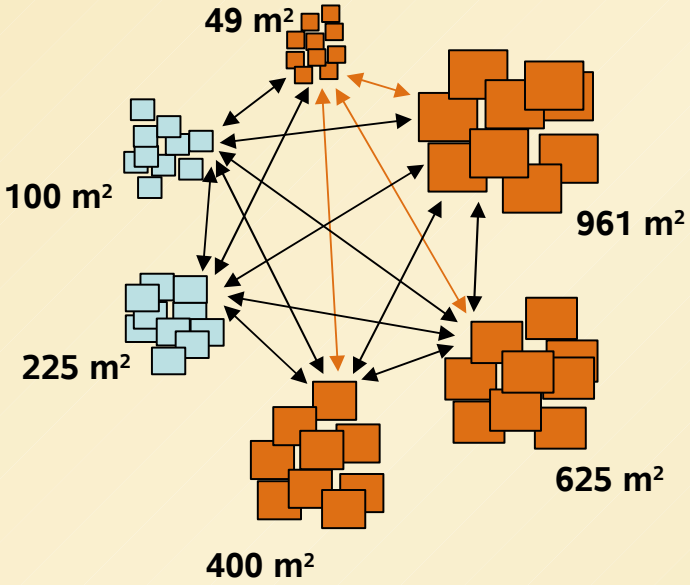
the other pairs non significant

Heterogeneous data sets

non significant

in forests



Homogeneous data sets

49 vs. 400 m²	F=2.37*
49 vs. 625 m²	F=3.51**
49 vs. 961 m²	F=4.74**

the other pairs non significant

Heterogeneous data sets

non significant

Conclusions

Plot size

- affects ordinations, especialy when small plot size is used
- affects ordinations more strongly in homogeneous data sets
- consistently affects ordinations in grasslands and forests

Combination of different plot sizes

- is possible in heterogeneous data sets
- but never in homogeneous data sets when range of plot sizes is too broad!

Recommendations

- do not use too small plots, if possible
- use similar ranges of plot sizes
- in homogeneous data sets, never combine plot sizes that differ in size by an order of magnitude

Thank you for your attention!

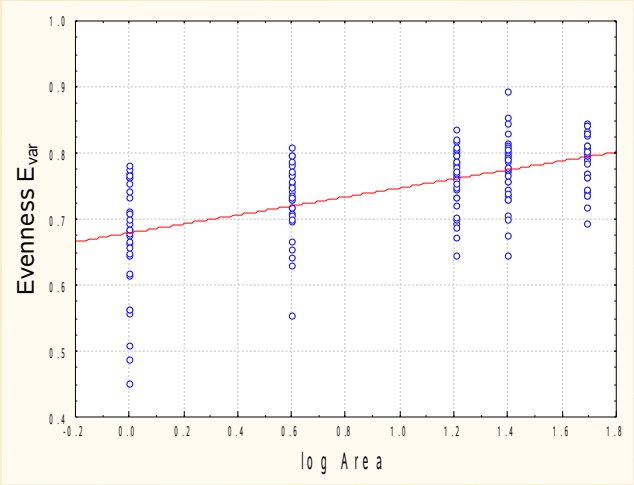
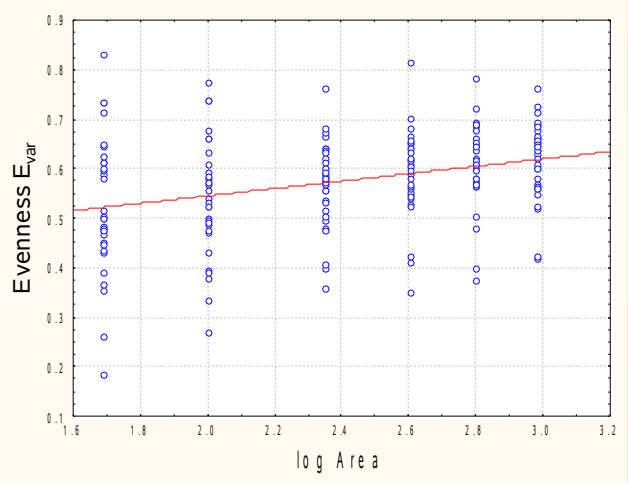
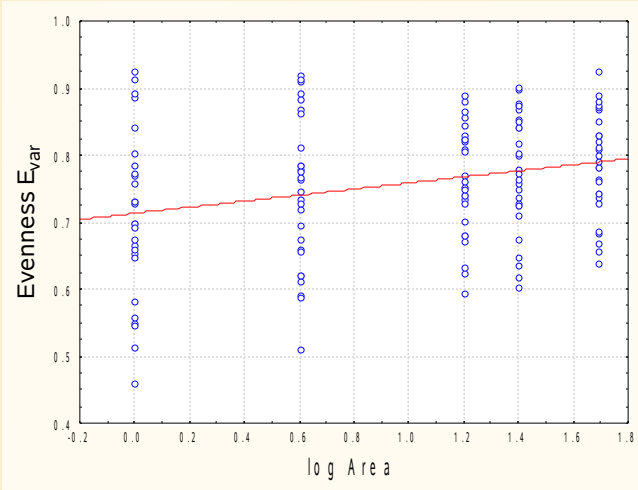
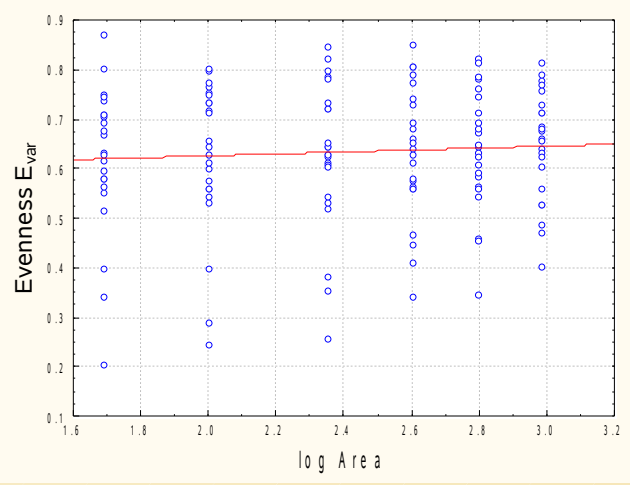
What about other analysis….?

….evenness

….β-diversity

Evenness

……increases with increasing plot size

	Grasslands	Forests
Homogeneous data set		
	R=0.5849**, *z*=0.07	*R*=0.3187**, *z*=0.07
Heterogeneous data set		
	R=0.2747*, *z*=0.05	*R*=0.0648, n.s., *z*=0.02

β-diversity

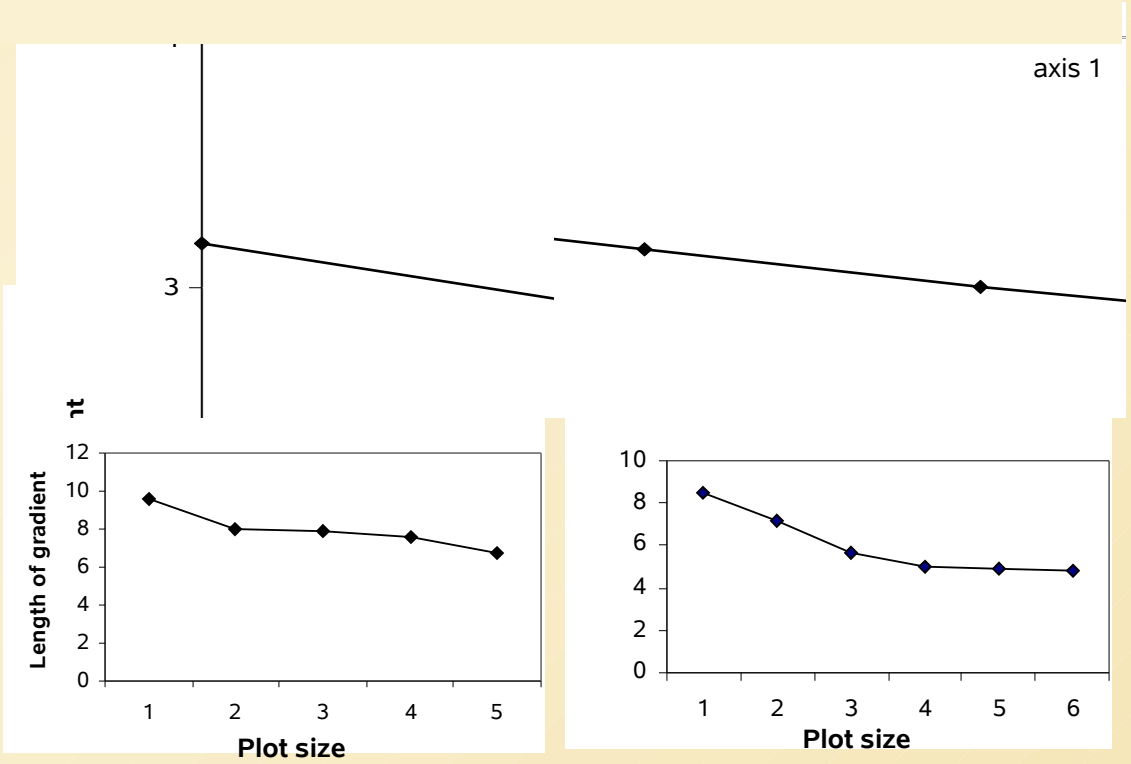
…..decreases with increasing plot size

Grasslands

Forests

Homogeneous data set

Heterogeneous data set



Because of…..

low evenness at smaller plots

- ➟ species composition is more uneven
- ➟ dominant species are predominantly recorded

higher heterogeneity at smaller plots

- ➟ small-scale heterogeneity is more offen recorded

…… ordinations of small plots result in unstable patterns