

Direct multiscale ordination

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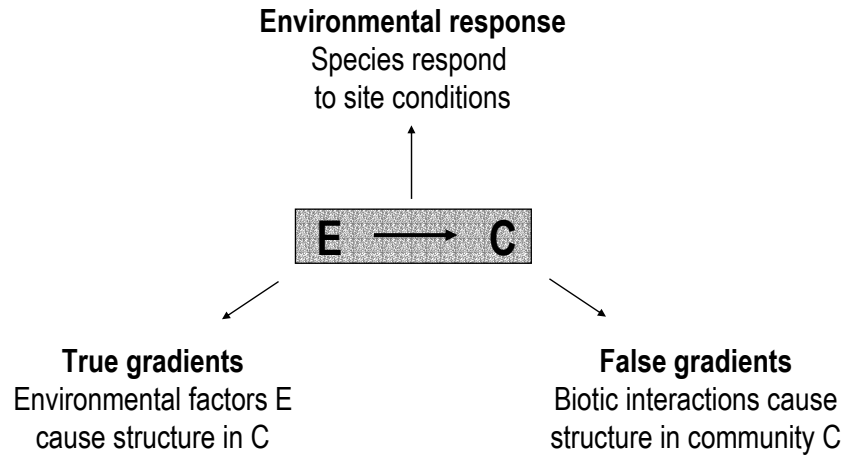


Overview

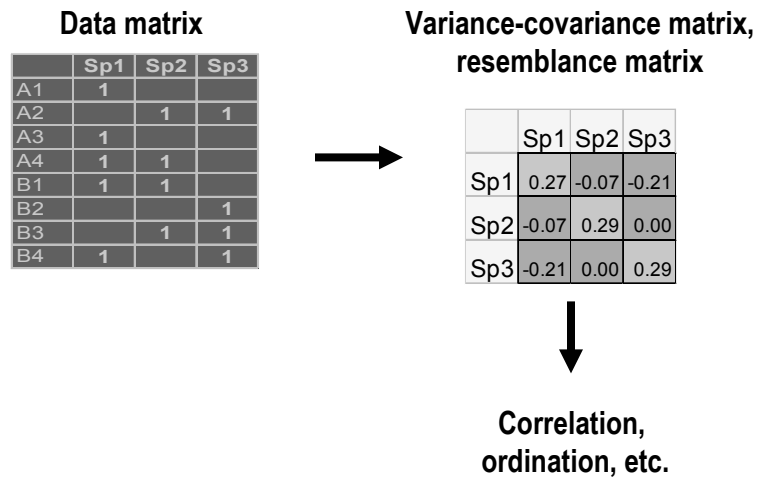
- Spatial effects in gradient analysis
- Direct multiscale ordination
- Application to oribatid mite data

Photo: Ray Norton (<http://www.fcps.k12.va.us>)

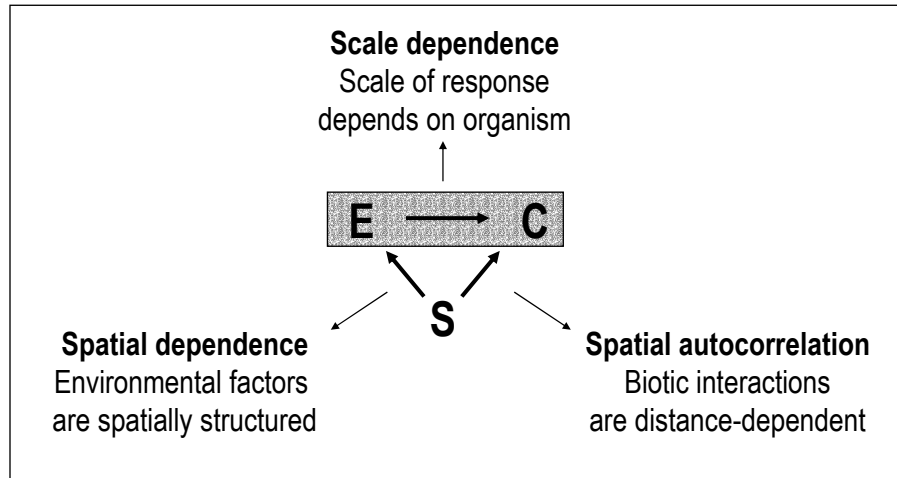
Gradient analysis



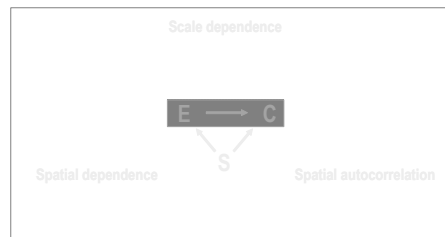
Non-spatial data analysis



Gradient analysis in a spatial paradigm



In short ...

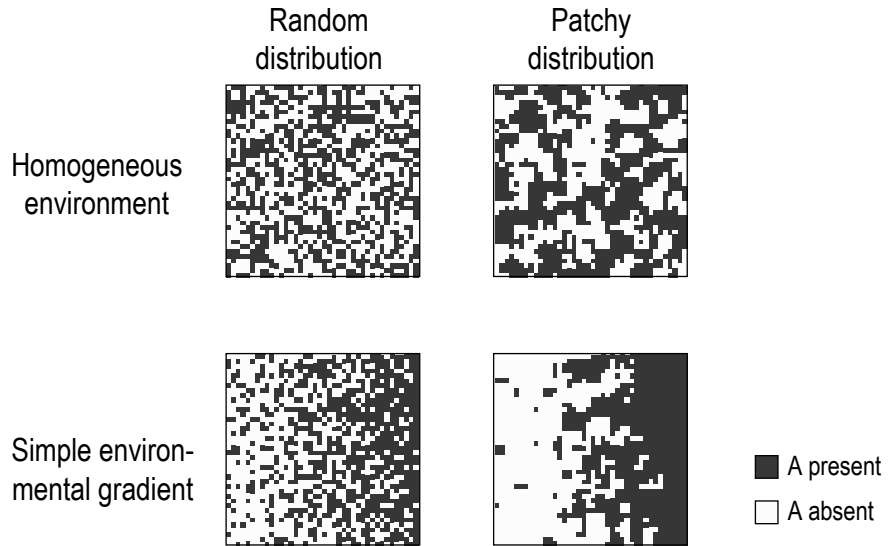


Three causes of spatial structure:

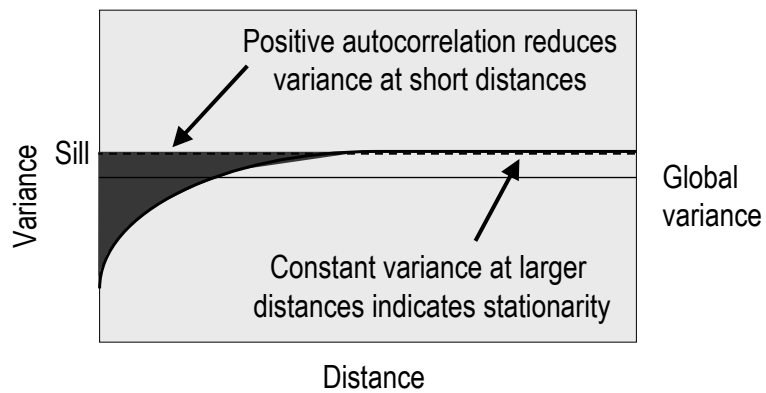
- How to distinguish between them?
- How to account for them?

➔ Direct multiscale ordination

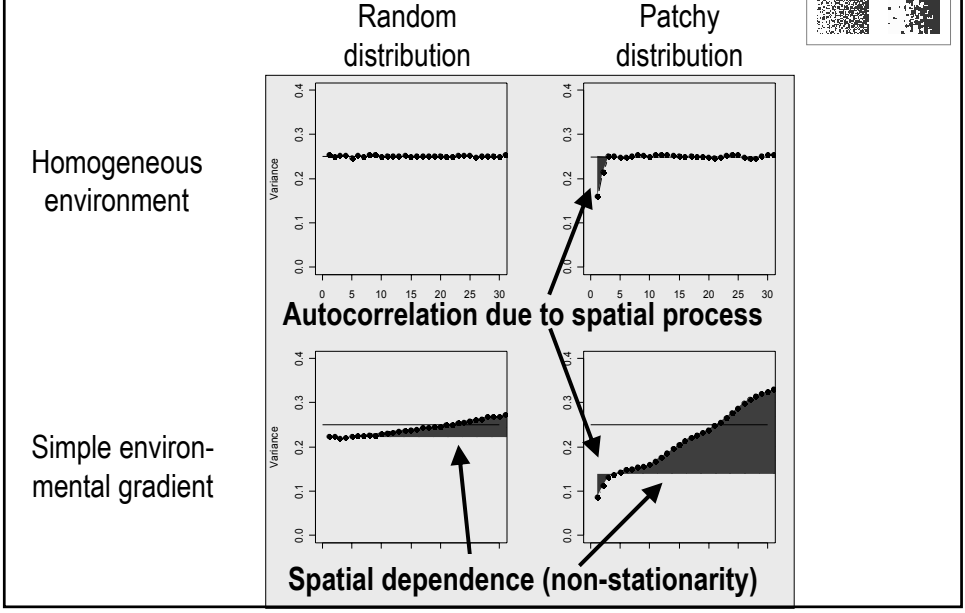
Simulated species distribution



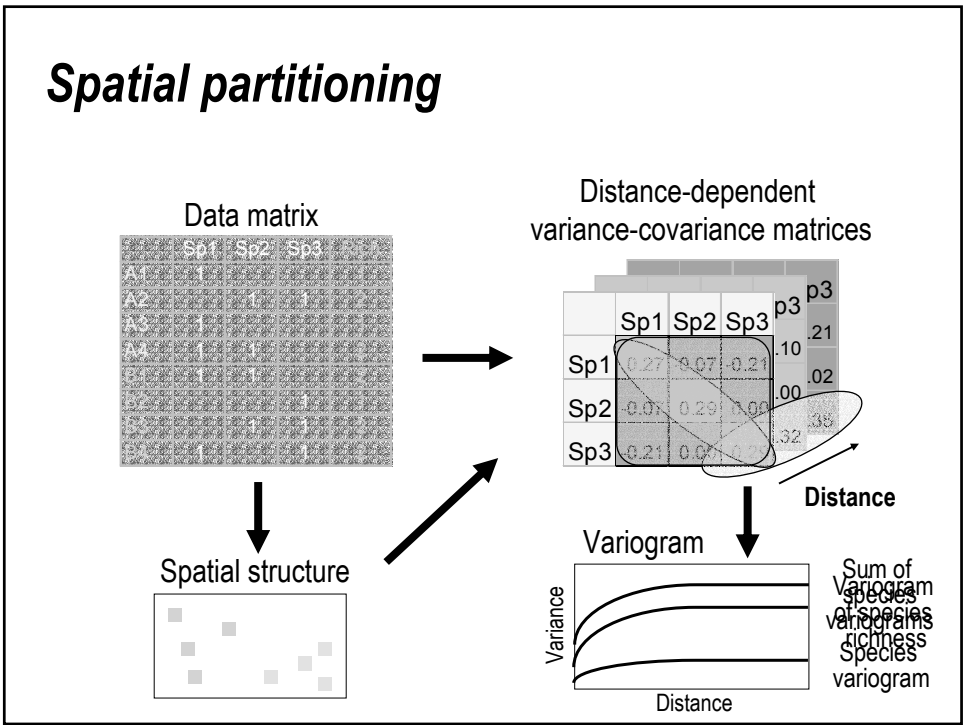
Variogram interpretation



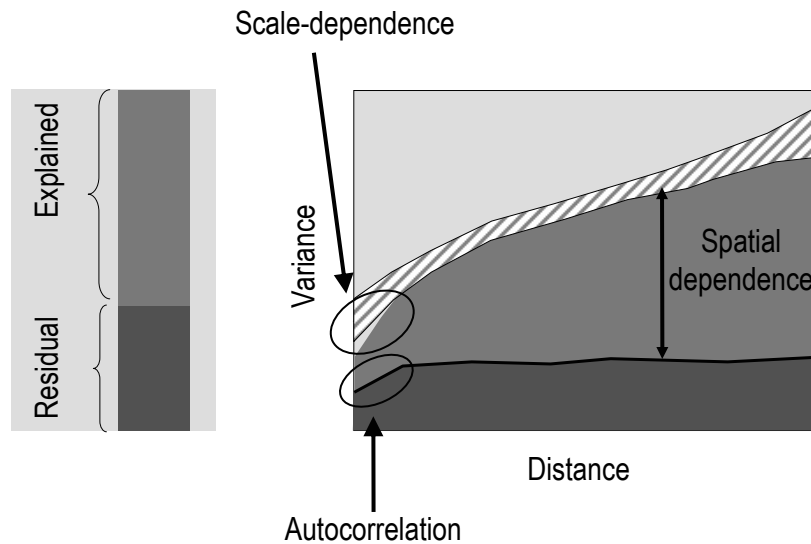
Variograms of simulated species



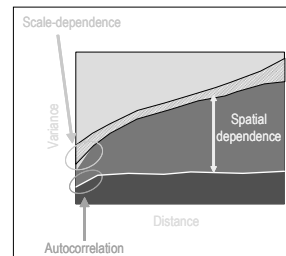
Spatial partitioning



Direct multiscale ordination



In short ...



Direct multiscale ordination provides:

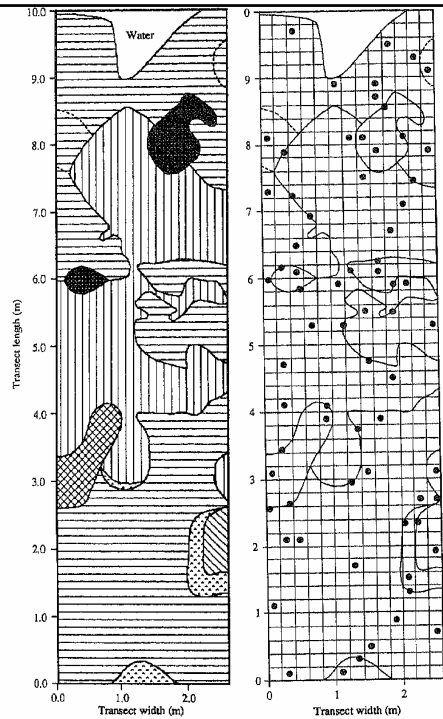
- A simple test for residual autocorrelation
- A simple test for a mismatch of the scales of observation and response
- Separation of spatial dependence, spatial autocorrelation, and scale dependence

➔ Application to Oribatid mite data

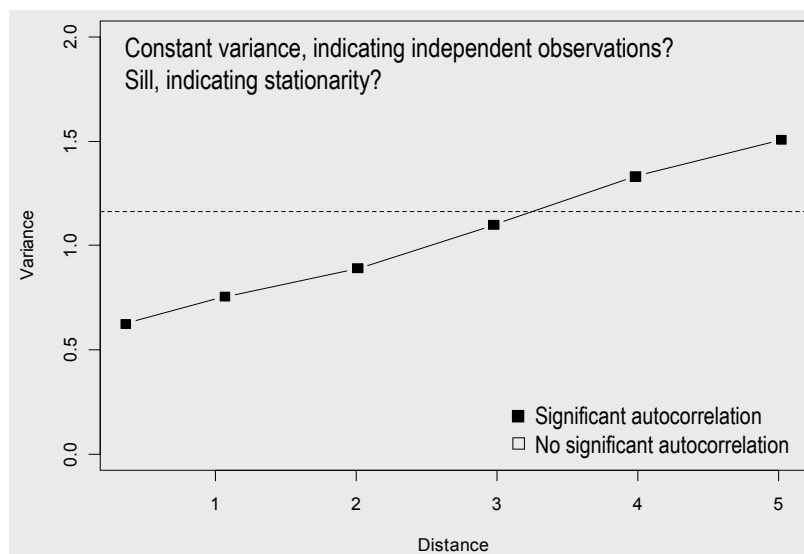
Oribatid mite data

(Borcard et al. 1992, Borcard & Legendre 1994)

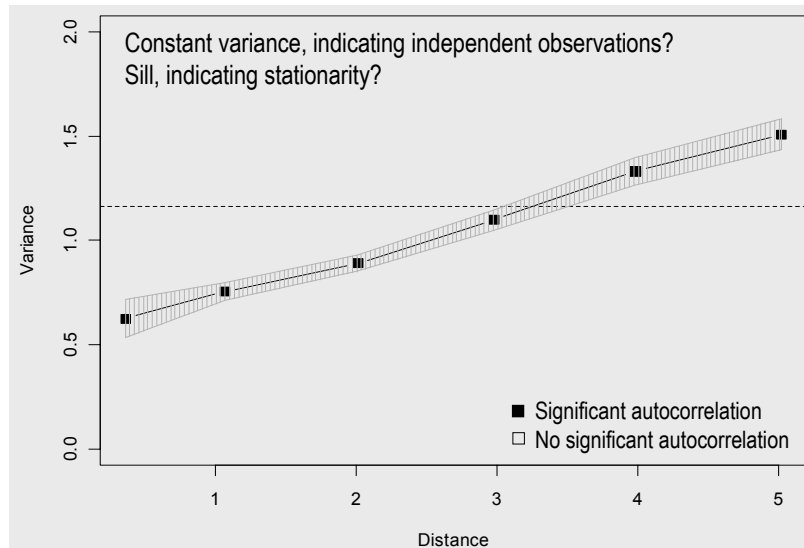
- Grain: 0.2 m grid
- Extent: 10 m x 2.6 m
- Samples: 70 cores
- Response:
 - 35 mite species
- Predictors:
 - Substratum (7),
 - shrub cover (3),
 - microtopography (2),
 - substratum density,
 - water content



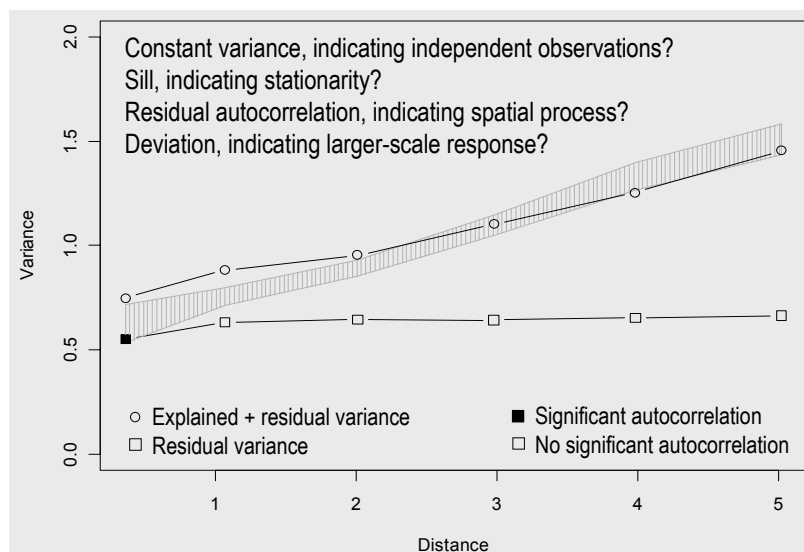
Original data (CA)



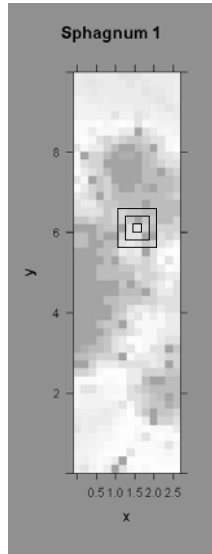
Original data (CA)



Accounting for environment (CCA)

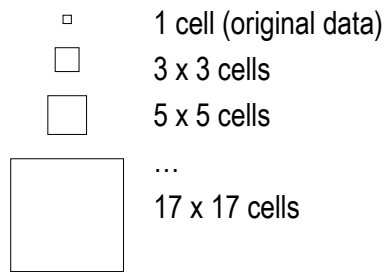


Aggregation of environmental data

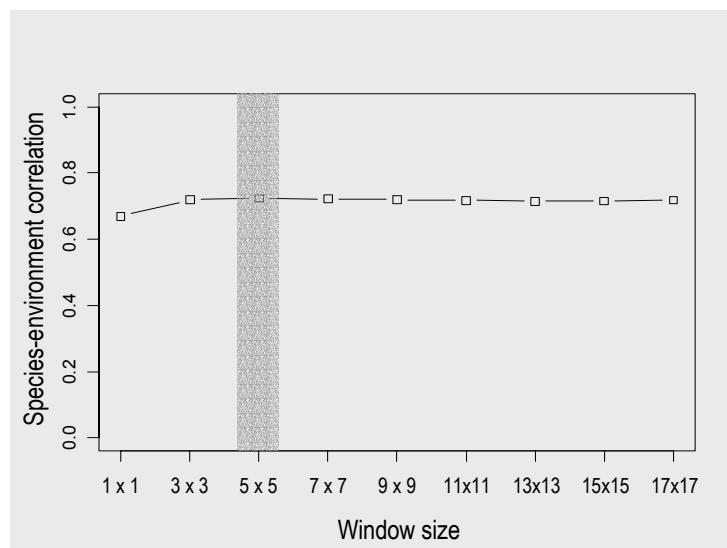


For each predictor variable:

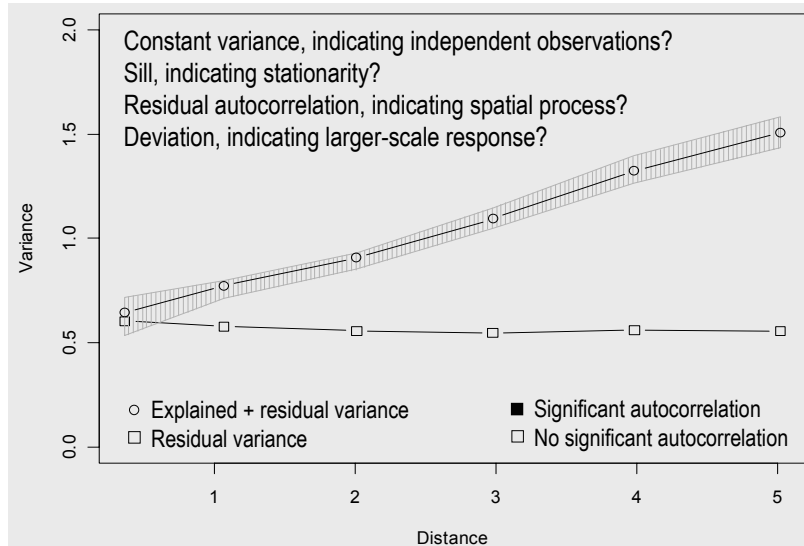
- Linear interpolation
- Mean within windows:



Identifying scale of response



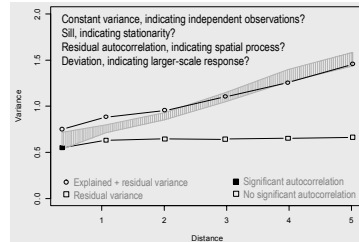
Accounting for larger-scale response



Model comparison

	Local response model	Larger-scale response model
Scale of response	1 cell (0.2 m)	5 x 5 cells (1 m)
Rsquare	0.45	0.52
Residual autocorrelation	< 1 m	none

In short ...



- Natural communities are likely to contain spatial structure due to several processes
 - The components of spatial structure cannot be estimated independently
 - Failing to account for one component is likely to lead to wrong conclusions
- ➔ Direct ordination requires residual analysis, as provided by MSO.

More details?

Spatial partitioning of variance:

Wagner (2003), *Ecology* 84: 1045-1057.

Direct multiscale ordination (incl. R library):

Wagner (2004), *Ecology* 85: 342-351.

Multiscale response:

Wagner et al. (submitted), *Journal of Animal Ecology*.

Generalized multiscale ordination (incl. R library):

Couteron and Ollier (2005), *Ecology* 86: 828-834.

Spatial analysis of landscapes:

Wagner and Fortin (2005), *Ecology* 86: 1975-1987.

Acknowledgments

VIP

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