

Andrey Zaitsev

A.N. Severtsov Institute of Ecology and Evolution,
Russian Academy of Sciences, Moscow, Russia

Justus-Liebig-University Giessen, Germany



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Background

Ecological and geographic drivers are different by nature, but may overlap in space.

- Ecological drivers – any environmental or biotic factor influencing a community. They are spatially disparate.
- Geographic drivers are solely associated with the heat and moisture exchange between the atmosphere, hydrosphere and lithosphere and always act at a certain scale in space.



Background

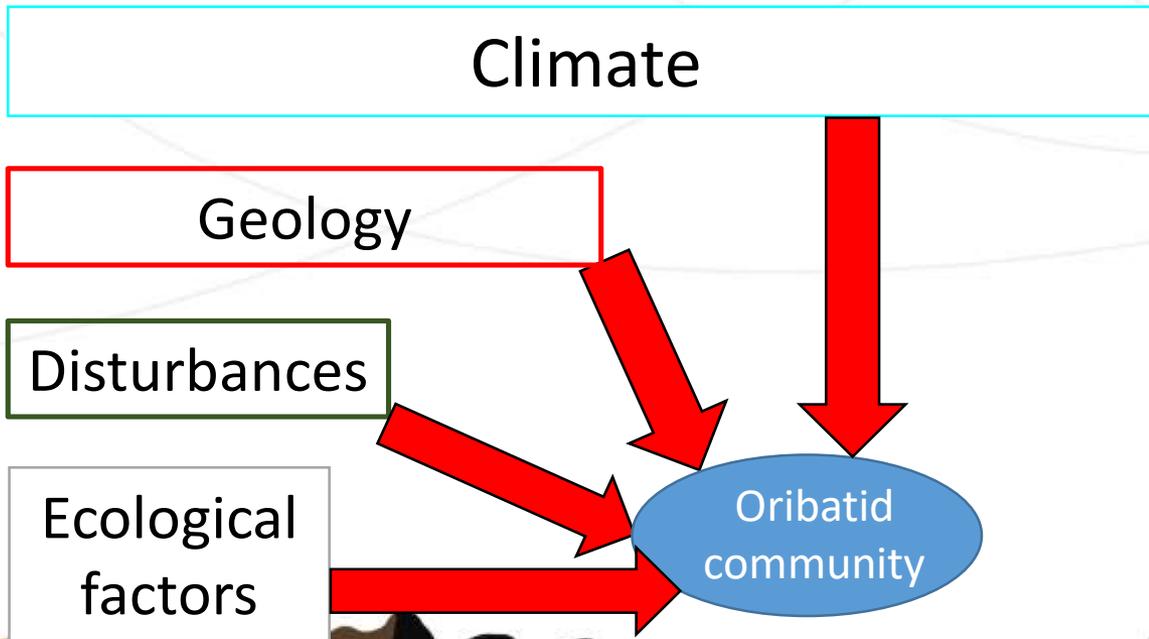
Soil biodiversity:

- The impact of macrogeographic gradients received some attention over the past few decades.
- Ecological factors are clearly better studied at local scale.
- Interactions of global environmental drivers (climate, geology, etc.) and locally acting ecological factors - **still rarely addressed**.
- Disturbances and intensive management however may have additional impacts on the habitat structure and edaphic parameters across vast areas with the unknown modification of the effect of geographic factors.



Background

- Diversity of soil communities is driven by climate, geology, disturbances and local ecological factors at different scales.



Geographic distance at which gradients become best visible

$\sim 10^6$ m

$\sim 10^5$ m

$\sim 10^2$ m

$\sim 10^{-1}$ m



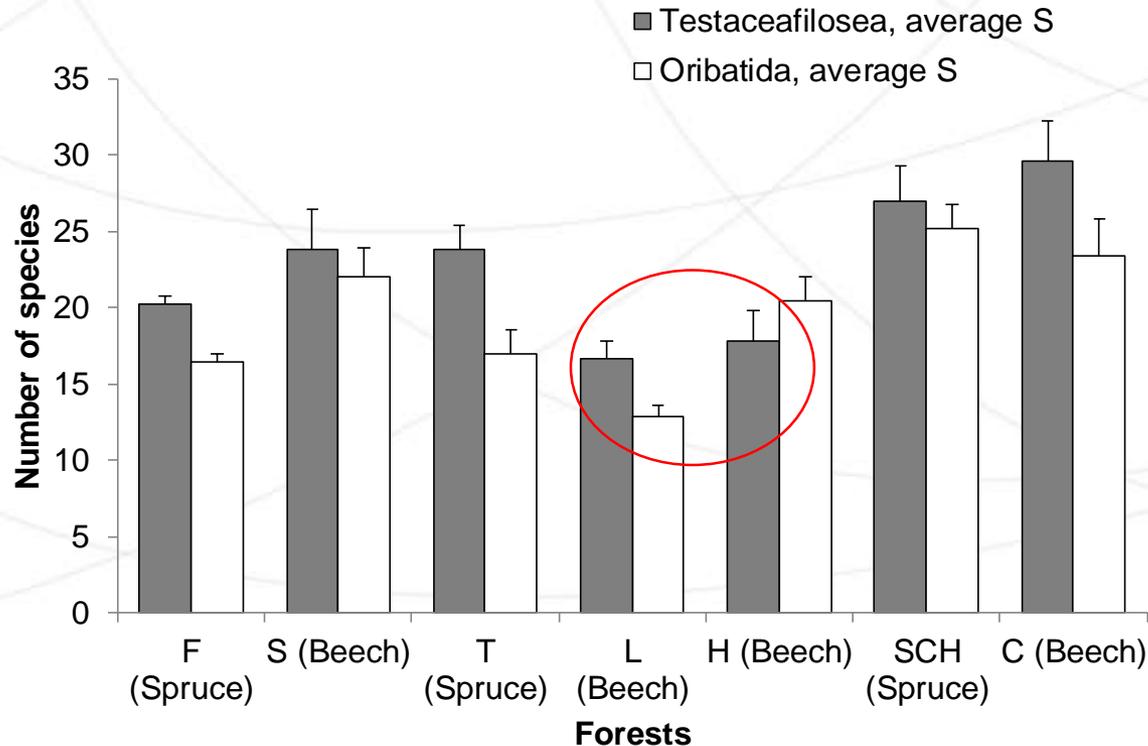
Macrogeography vs local ecological variance



European transect

- 7 regions:
 - 3 – spruce (F, T, SCH, WS, PZ, CL)
 - 4 – broadleaved (S, L, H, C, VZ, UT)
- 4-5 locations at each plot (replicates)
- Over 20 environmental parameters measured

Species richness

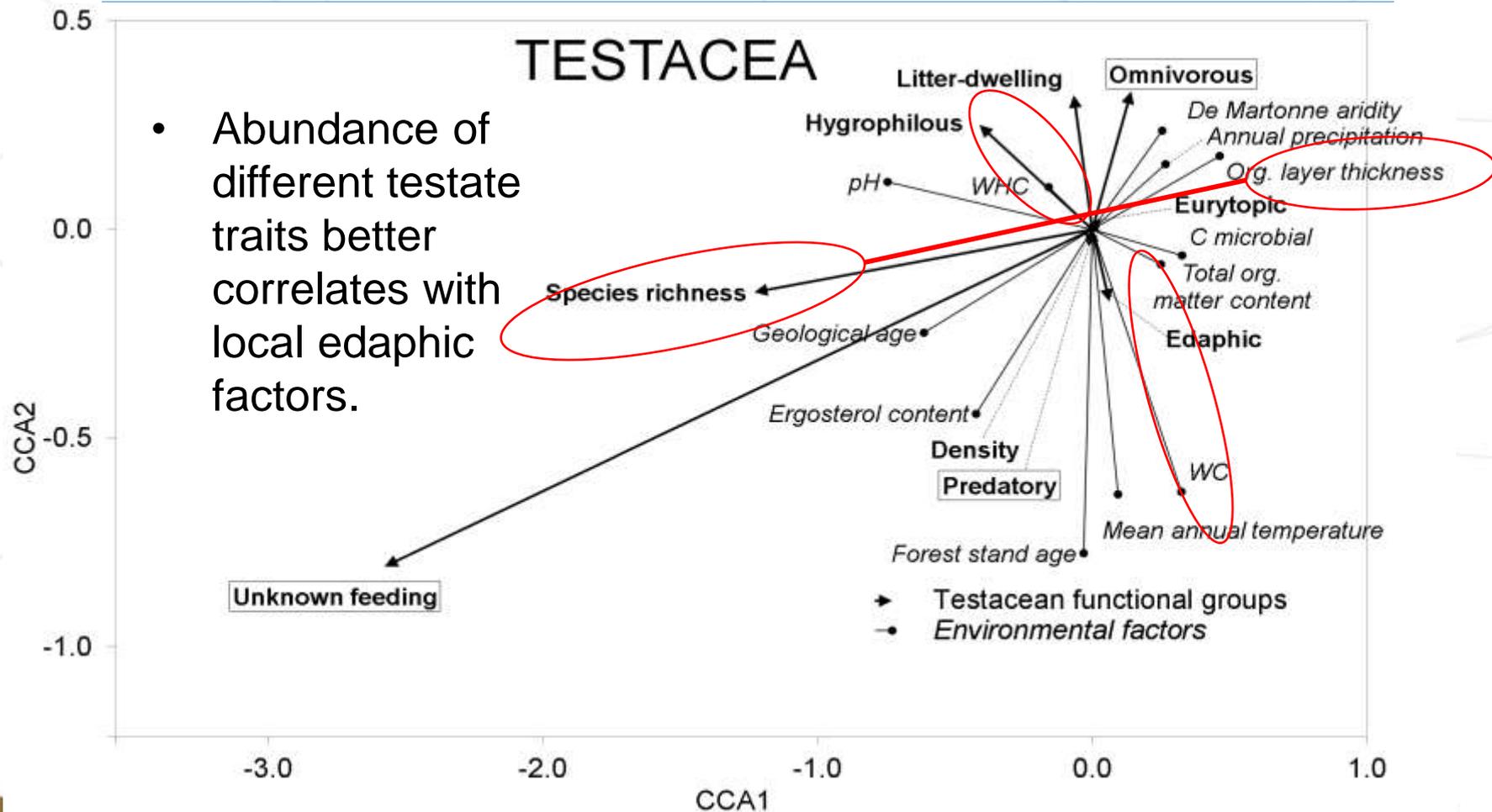


- 108+ testacean species and 158+ oribatid species, lowest species number in L.
- High correlation between richness of the two studied groups.
- No impact of forest type (GLM, n.s.).

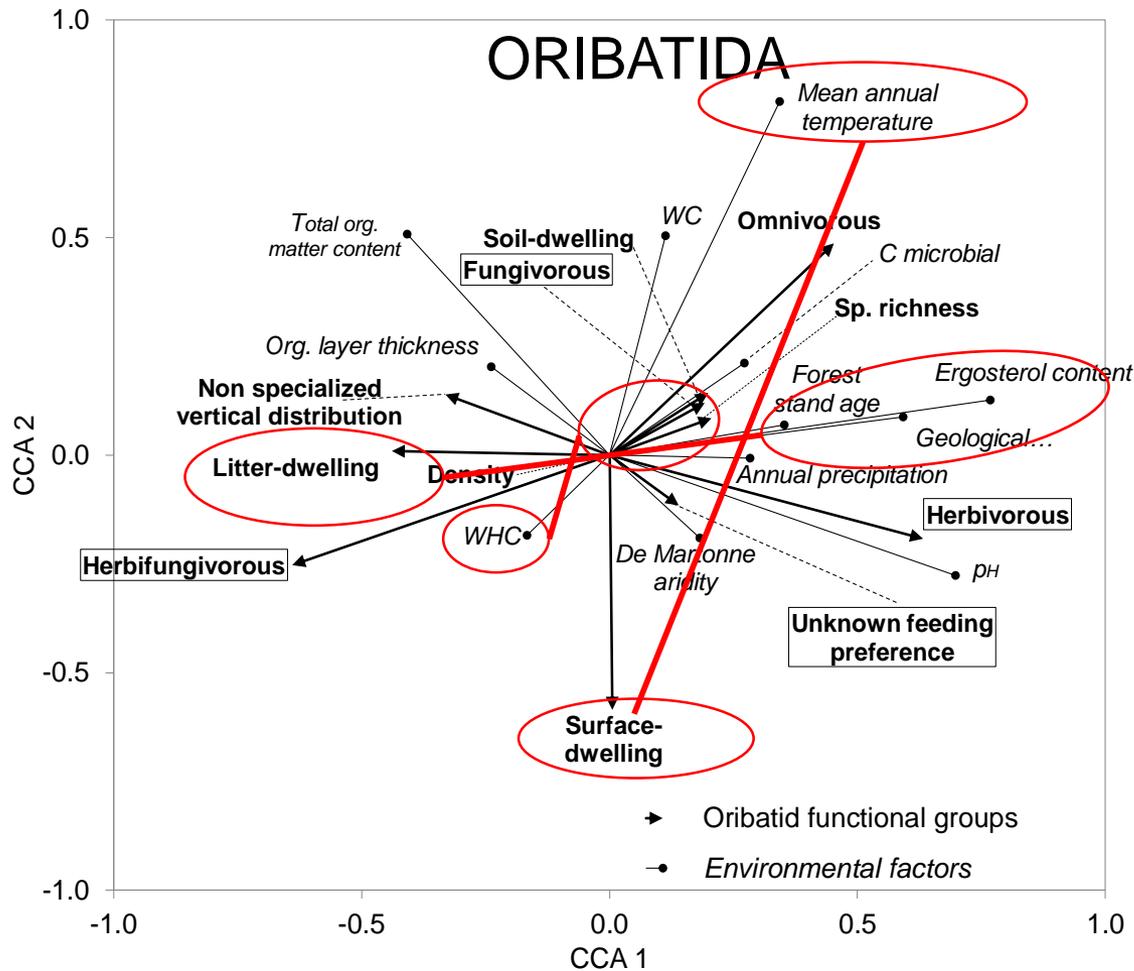


Environmental drivers effects

- Abundance of different testate traits better correlates with local edaphic factors.



Environmental drivers effects



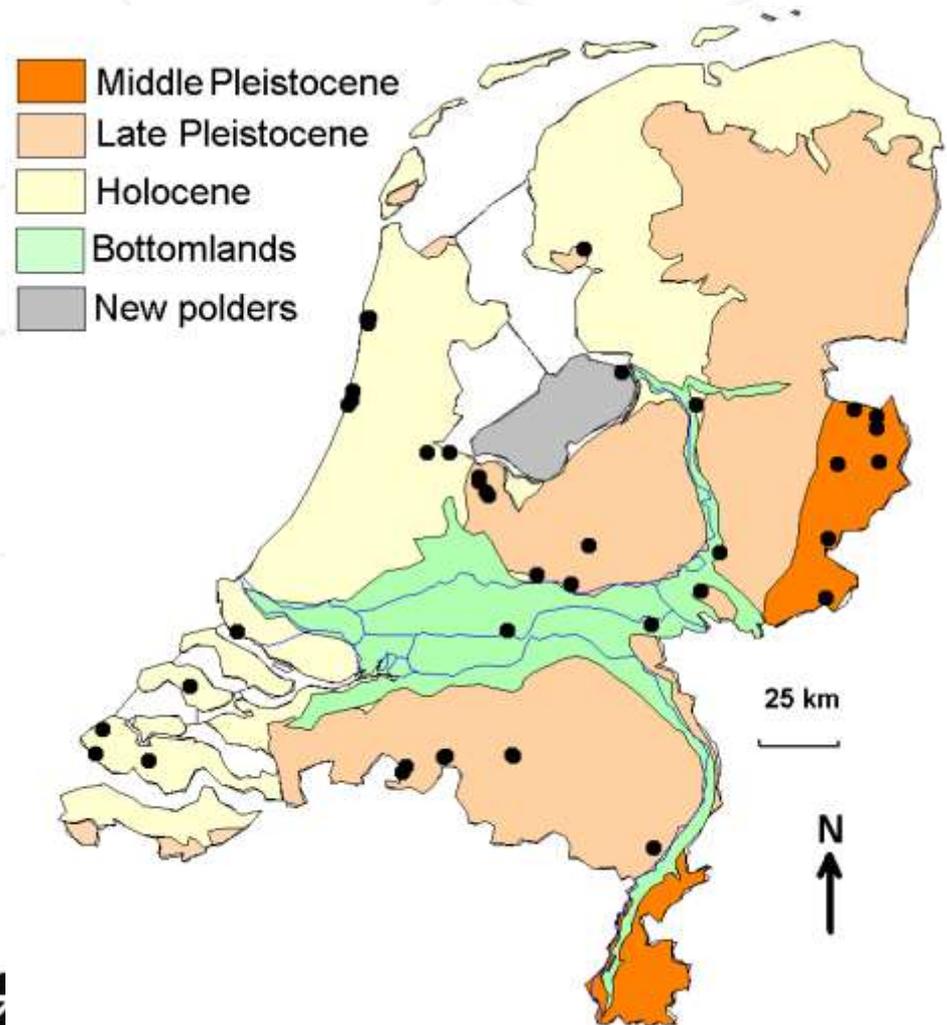
- Abundance of oribatid traits correlates with landscape and macrogeographic gradients + edaphic conditions.



Geology

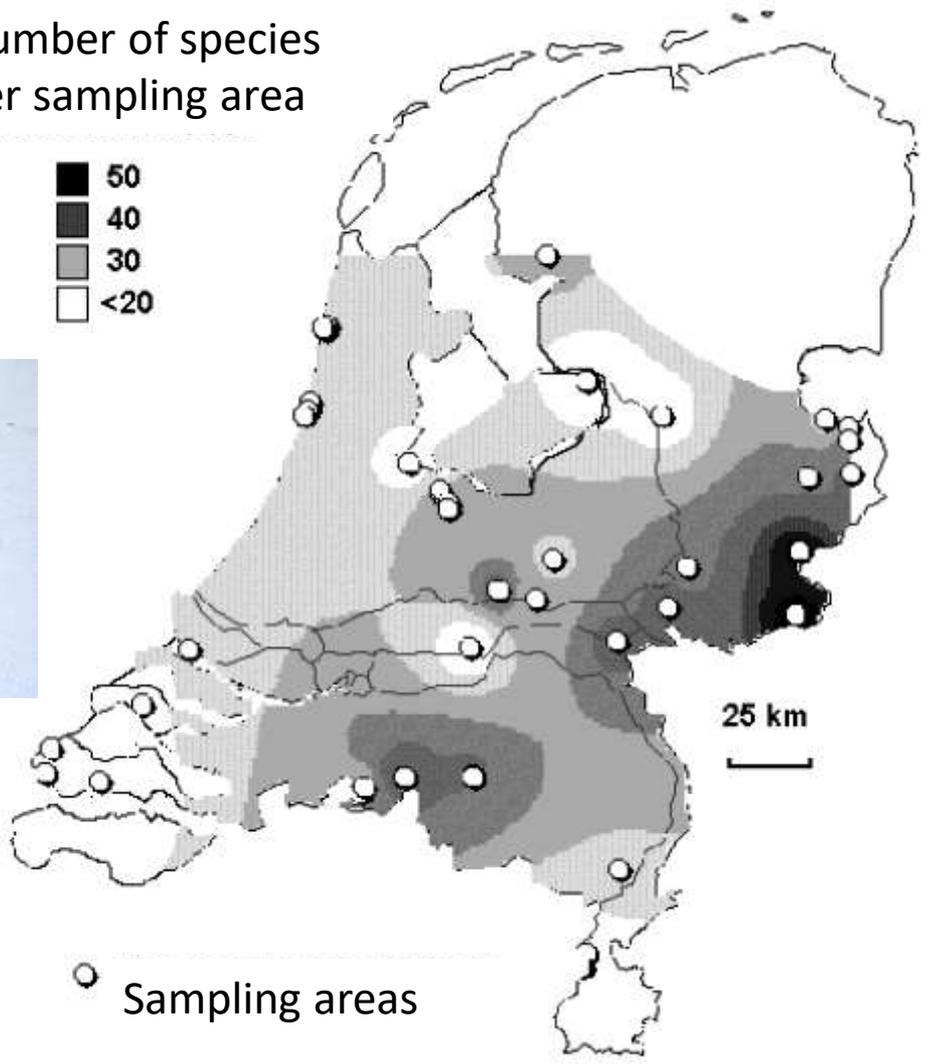
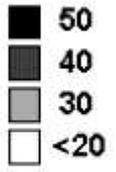
Impact of soil type and geologic age on Oribatida

- clear geologic gradient
- two soil types
- 41 forest sites
- Site area – 0.1 – 1km²
- 152 species found
- ca 50% of the total Dutch fauna found (Siepel et al., 2009)

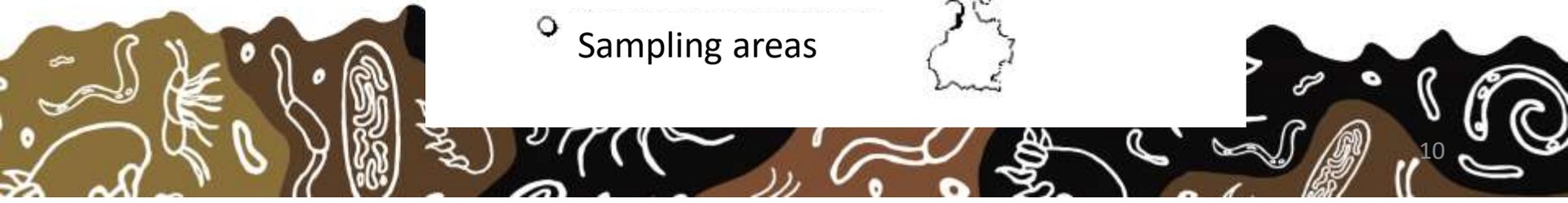


Diversity distribution

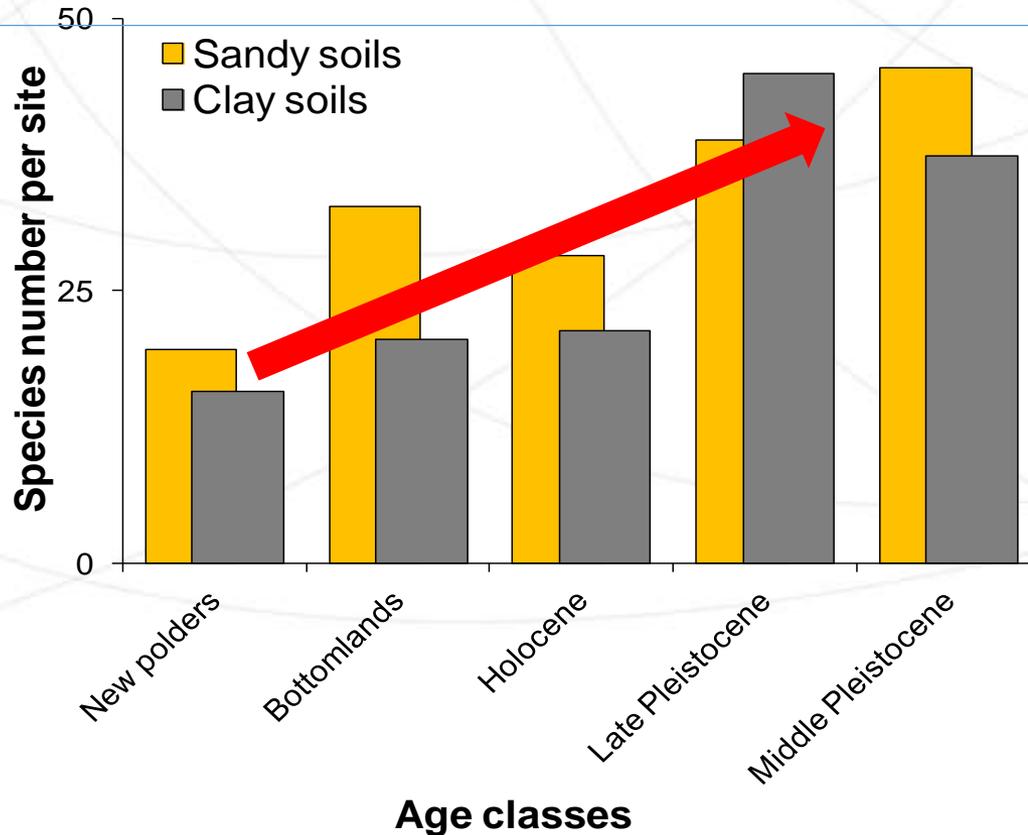
Number of species per sampling area



○ Sampling areas



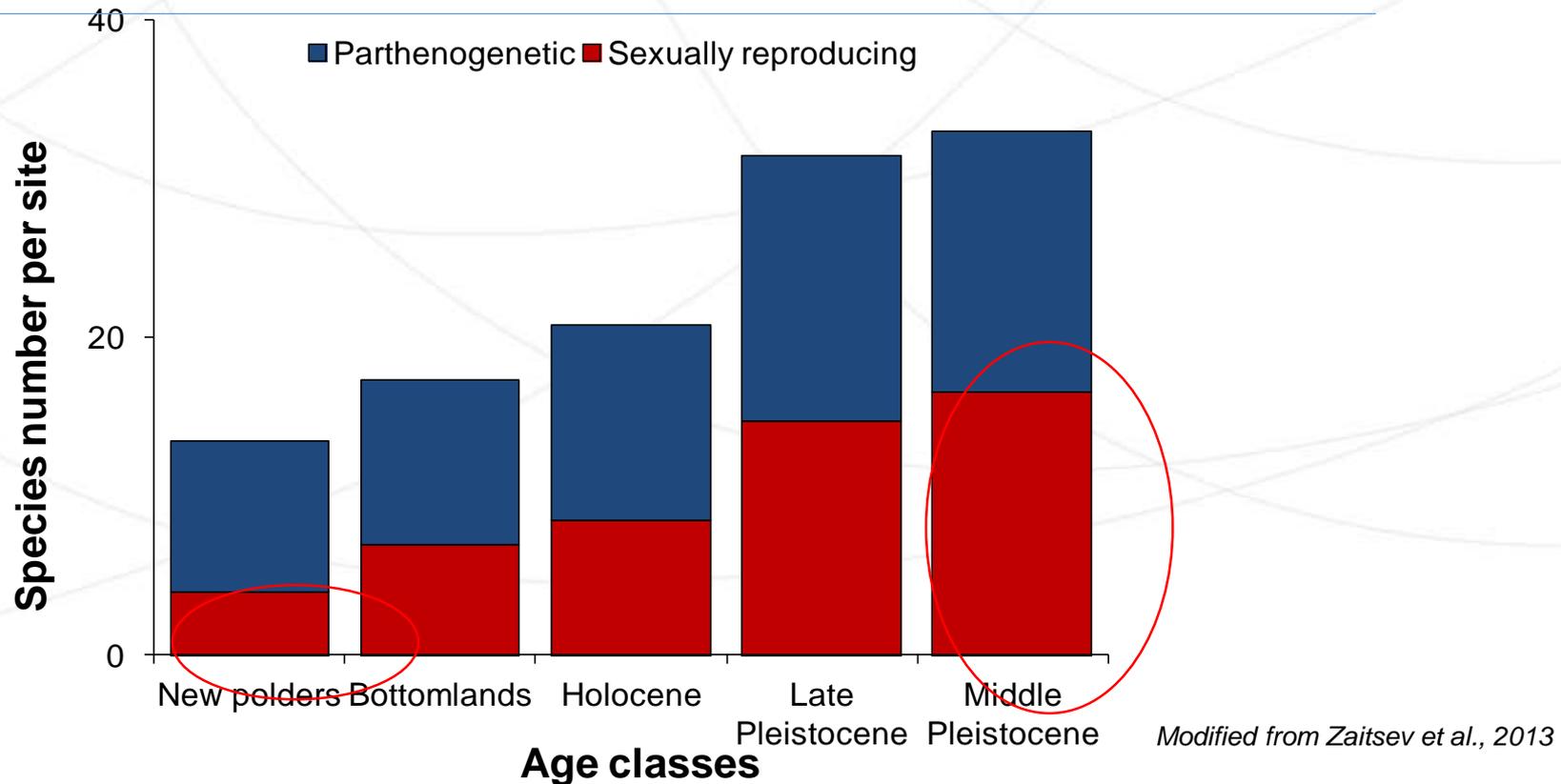
Impact of geologic age



Modified from Zaitsev et al., 2013

- Species richness corresponds best with age (GRM, $p < 0.001$)
- Soil type had no significant impact (GRM, n.s.)

Impact of geologic age: ecological context

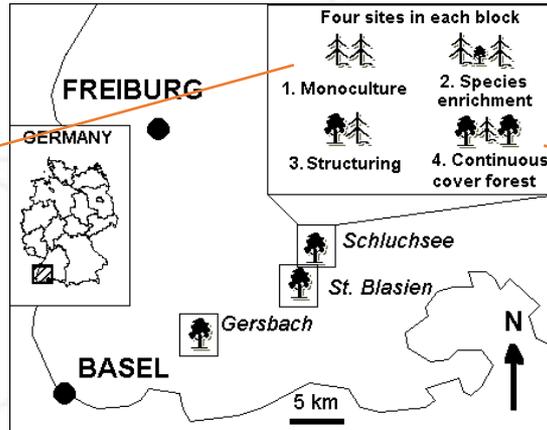


- Relative increase of sexually reproducing species number (ANOVA, $p < 0.01$)
- ✓ Indicates microhabitat differentiation growth with increasing landscape age

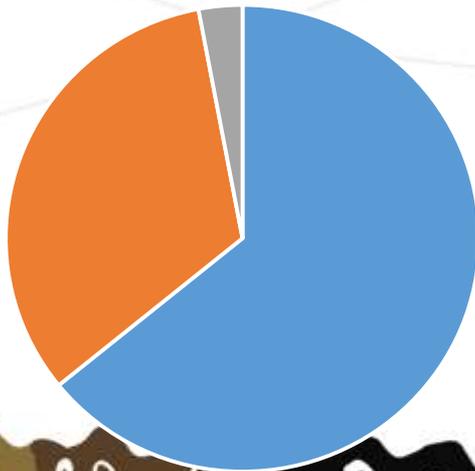
Going more local: Impact of tree stand uniformity on oribatid diversity



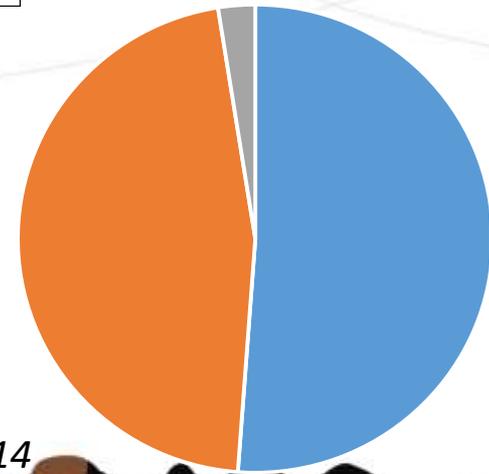
Monoculture



Mixed forest



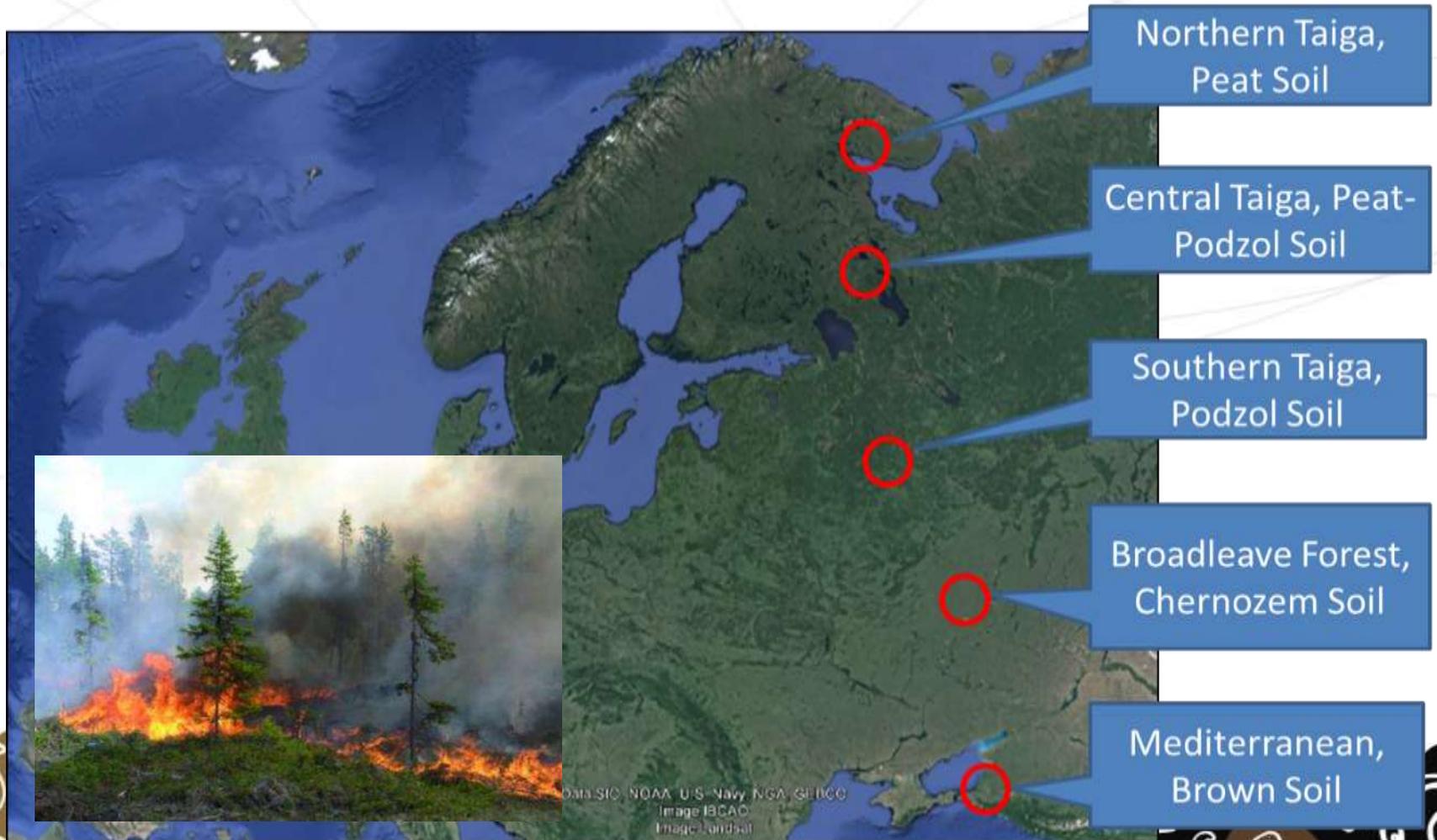
- Palaeartic and Holarctic
- Narrower distribution
- Not known



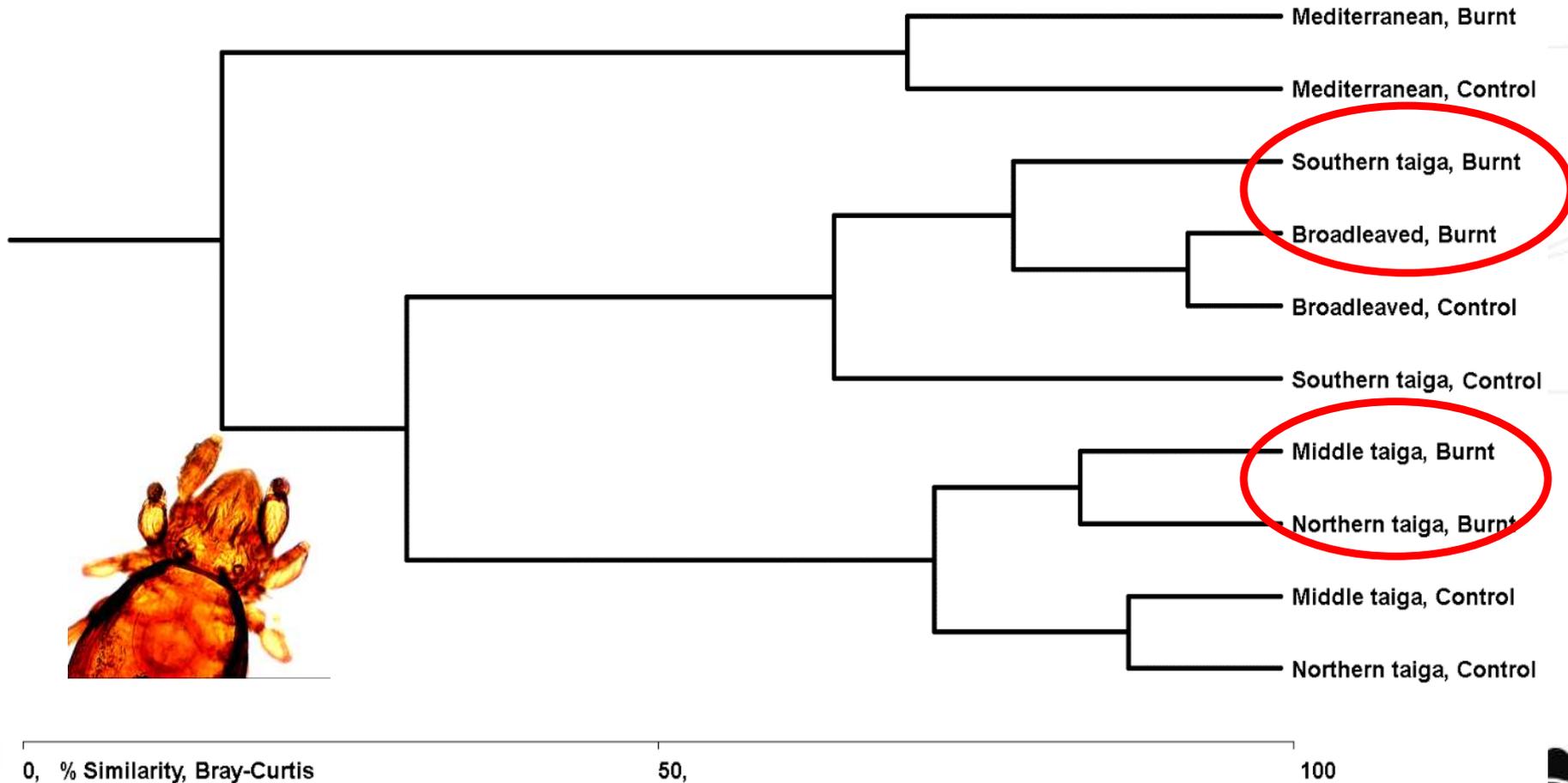
Data from Zaitsev et al., 2014

ANOVA on arcsin transformed data, $F=5.69$, $p < 0.01$

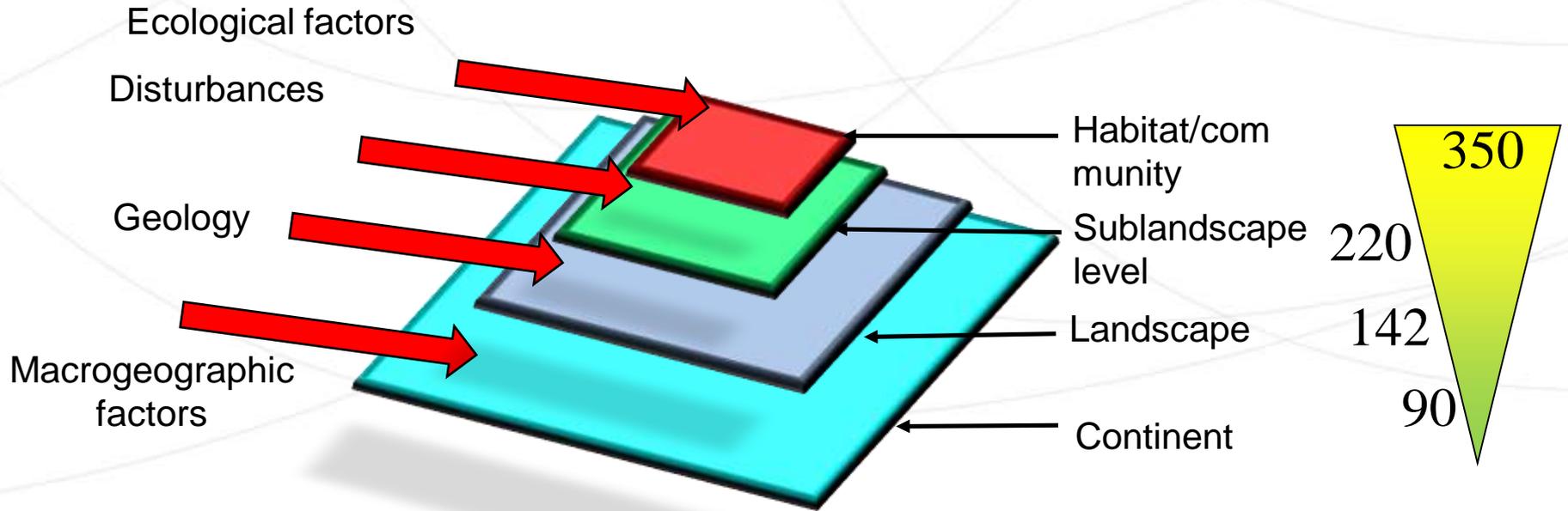
Disturbances: forest fires



Disturbances: forest fires



Overimposed set of filters



Species richness variance,
% of the lowest values in standardized samples



Conclusions

- Study of geographic gradients requires appropriate coverage and spatial resolution to avoid unnecessary stochasticity induced by locally acting ecological factors.
- Ecological drivers may override geographic patterns locally by the order of magnitude.
- Simplification of micro- and macrohabitat structure and unification of edaphic parameters after disturbances reduces the effect of macrogeographic factors.





**Thank you for
your attention**