MASARYK UNIVERSITY

Faculty of Science

Czech Republic

Macroecological and environmental patterns of urban algal biodiversity in Central Europe

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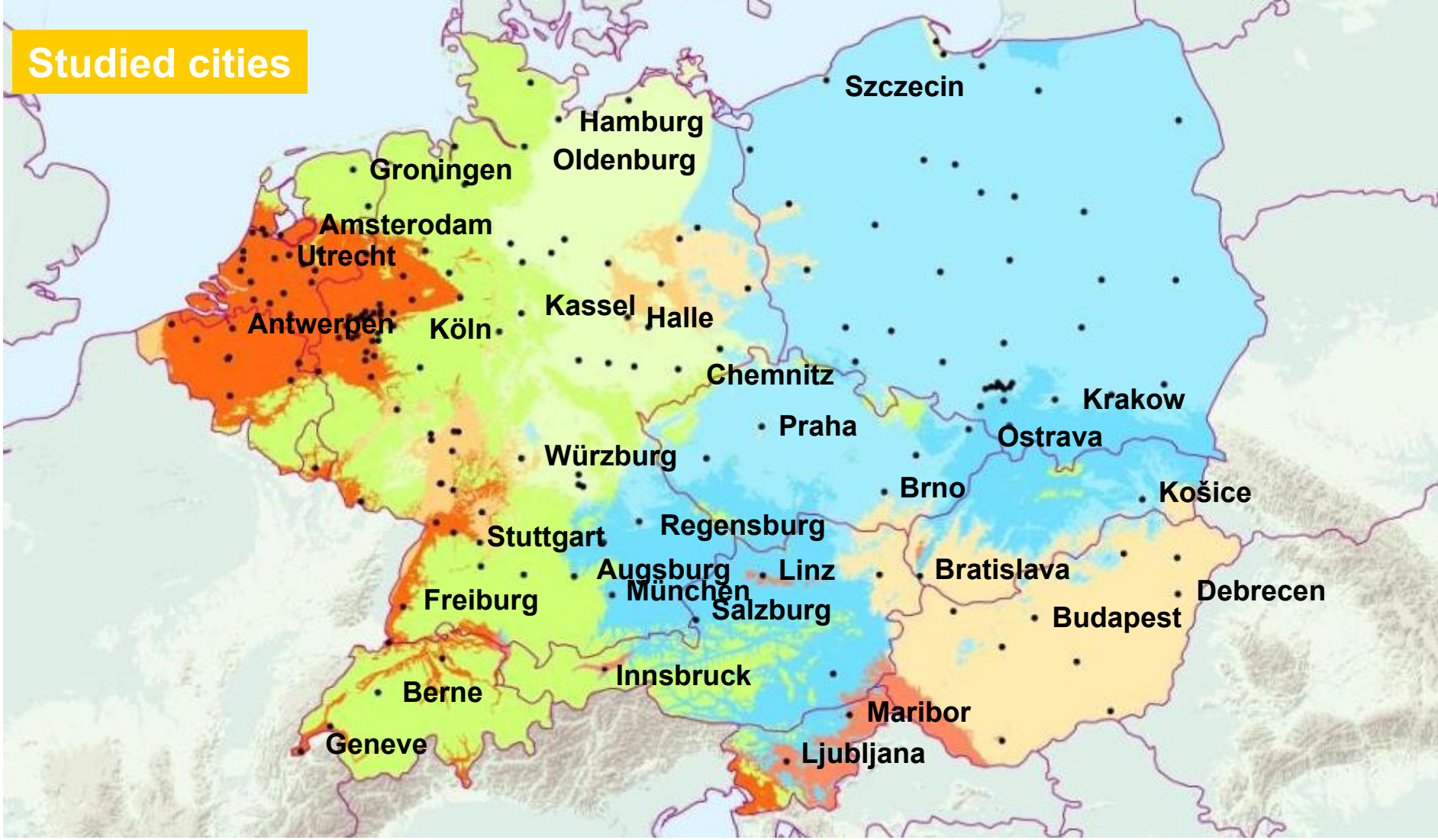
Urban microflora

European urban microfloras are at the periphery of scientific interests in phycology…

Our question

Are species richness, diversity and composition in Central European cities more strongly controlled by habitat, substrata or climatic conditions?

Which species of microalgae are diagnostic for assemblages in Central European cities?



t < 9 C; precipitation > 700 mm; temp. difference VII-I >19
t < 9 C; precipitation < 700 mm; temp. difference VII-I >19
t < 9 C; precipitation > 700 mm; temp. difference VII-I <19
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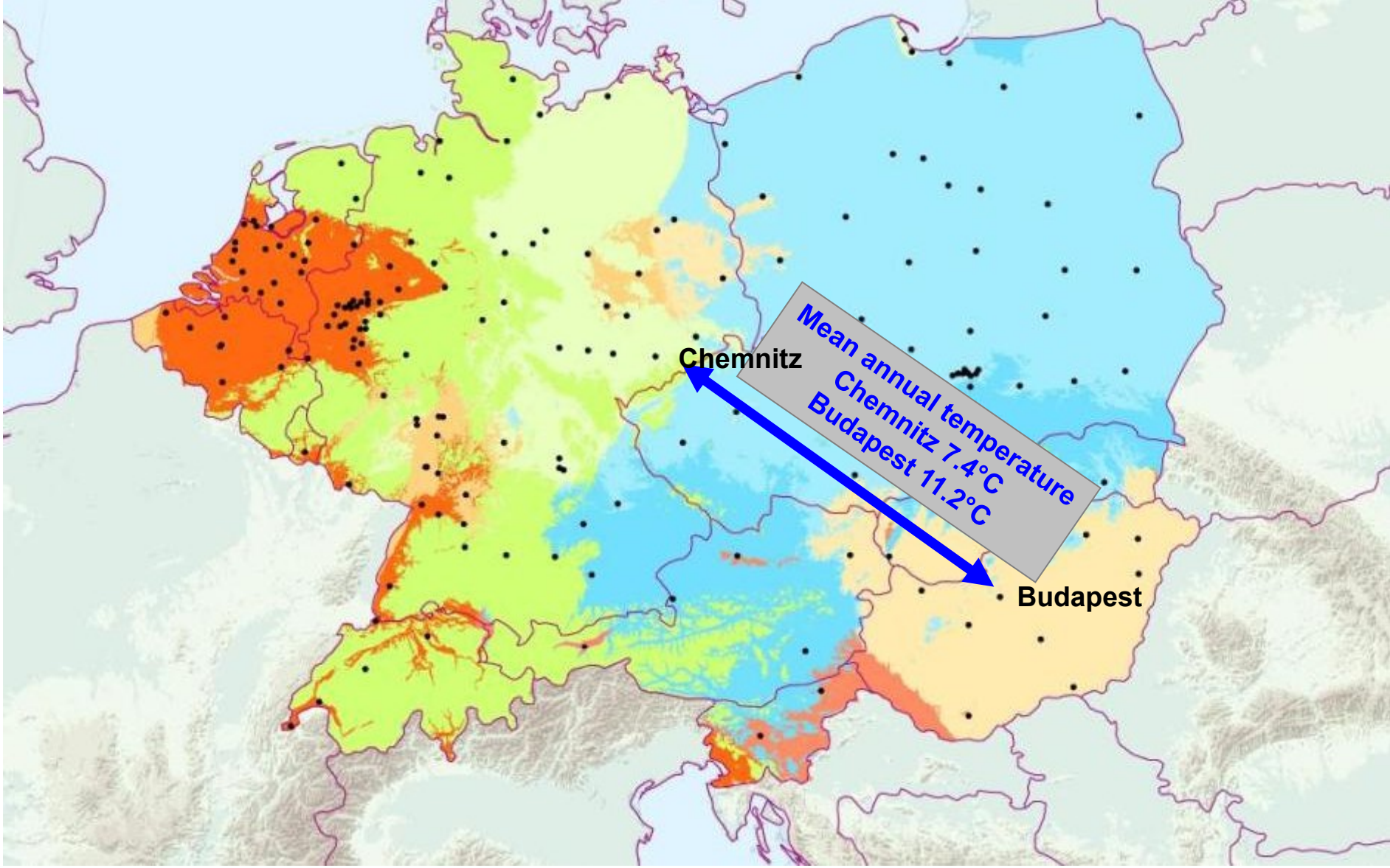
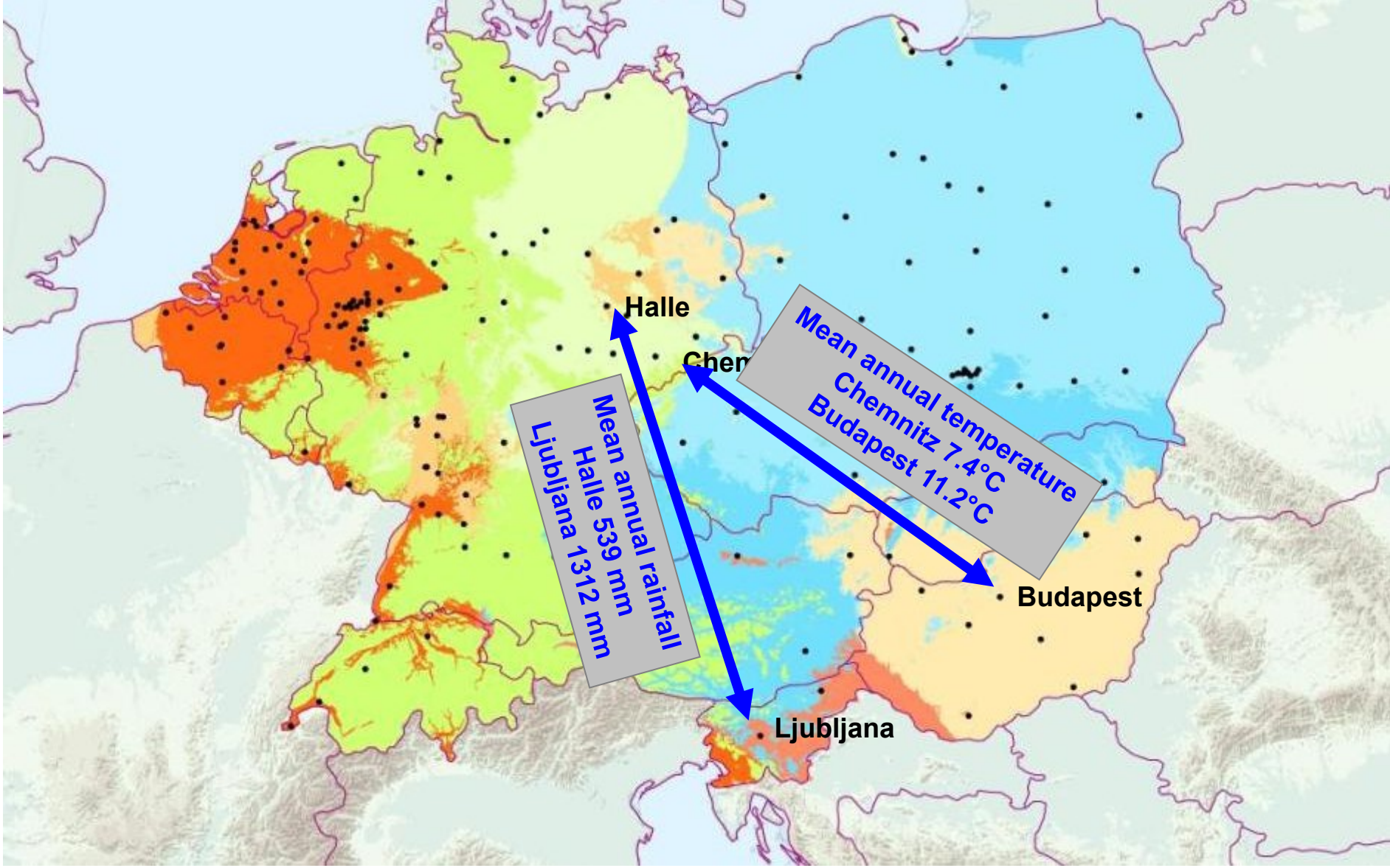
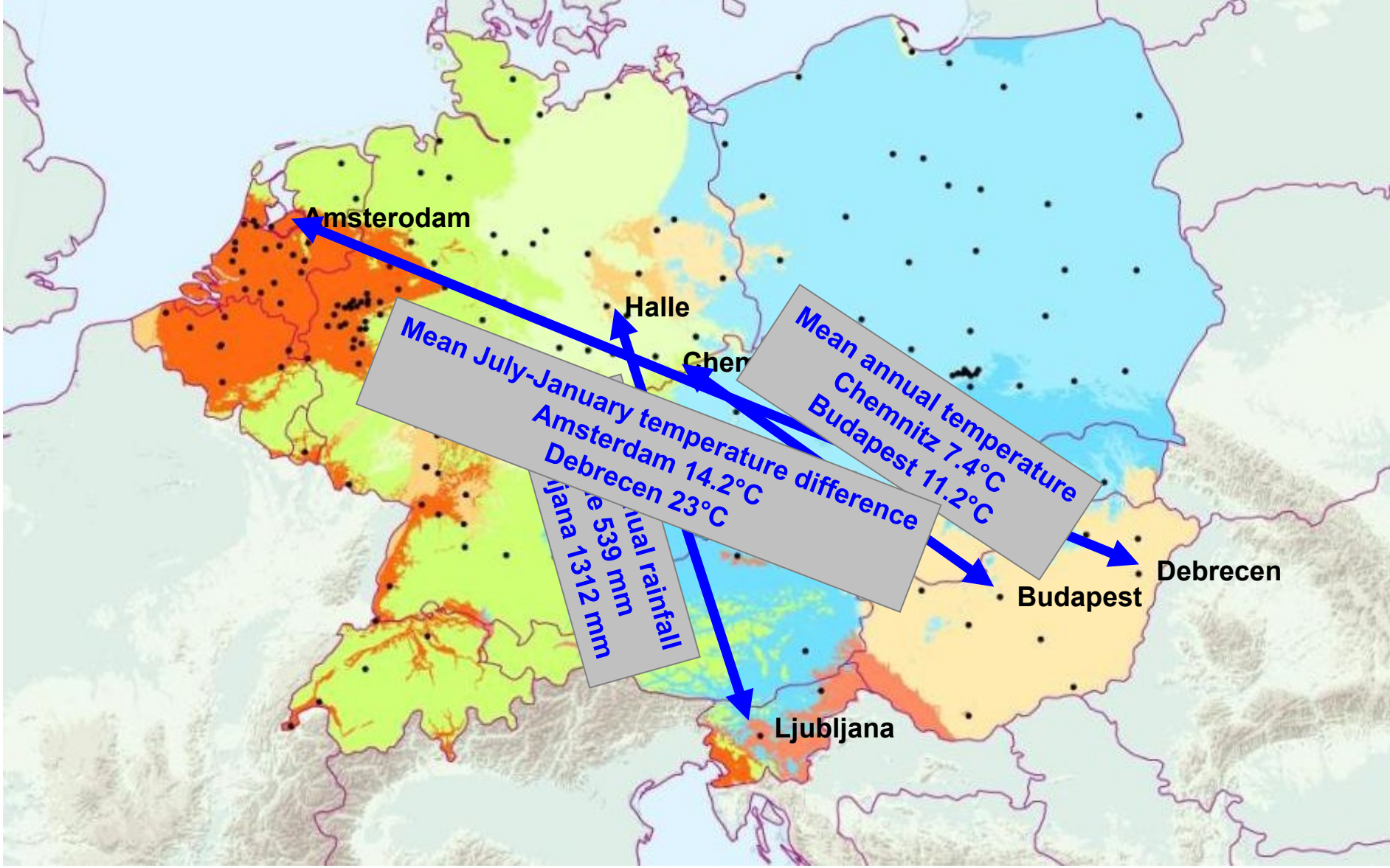

Chemnitz
Mean annual temperature
Chemnitz 7.4°C
Budapest 11.2°C
Budapest


Halle
Chem
Mean annual temperature
Chemnitz 7.4°C
Budapest 11.2°C
Budapest
Mean annual rainfall
Halle 539 mm
Ljubljana 1312 mm
Ljubljana


Amsterodam
Halle
Chem
Mean annual temperature
Chemnitz 7.4°C
Budapest 11.2°C
Mean July-January temperature difference
Amsterdam 14.2°C
Debrecen 23°C
ual rainfall
e 539 mm
ljana 1312 mm
Debrecen
Budapest
Ljubljana

Sampling design

June–August; 2007–2009

four different urban habitats (cetre - tree bark, park - tree bark, centre - sandstone, park - sandstone)

1 m above the ground

presence/absence data

species were characterized according to their taxonomy and autecology (7 taxonomic groups)

Cultivation

Media BBM, Z and bi-phase (water-soil)

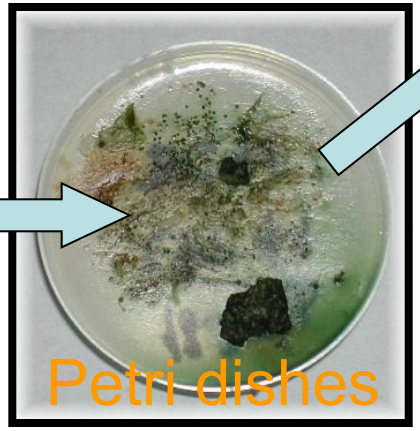
Statistical analysis

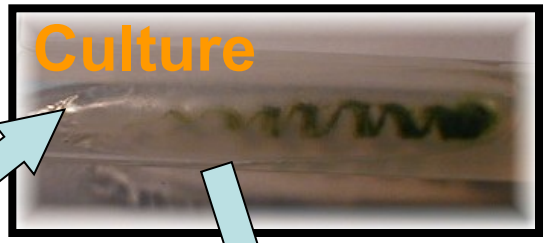
CANOCO version 4.5, JUICE

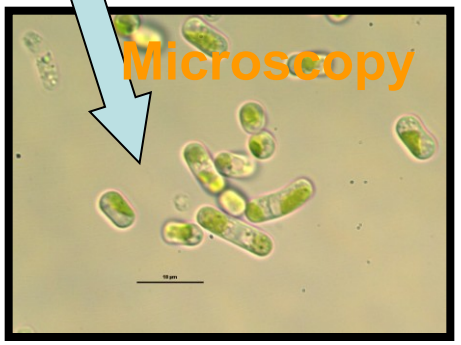

Habitat


Sampling site


Detail of substrate
1 cm 2 3 4 5


Petri dishes


Culture


Microscopy

Centre

Centre - bark

Centre - sandstone

City park

City park – bark

City park - sandstone

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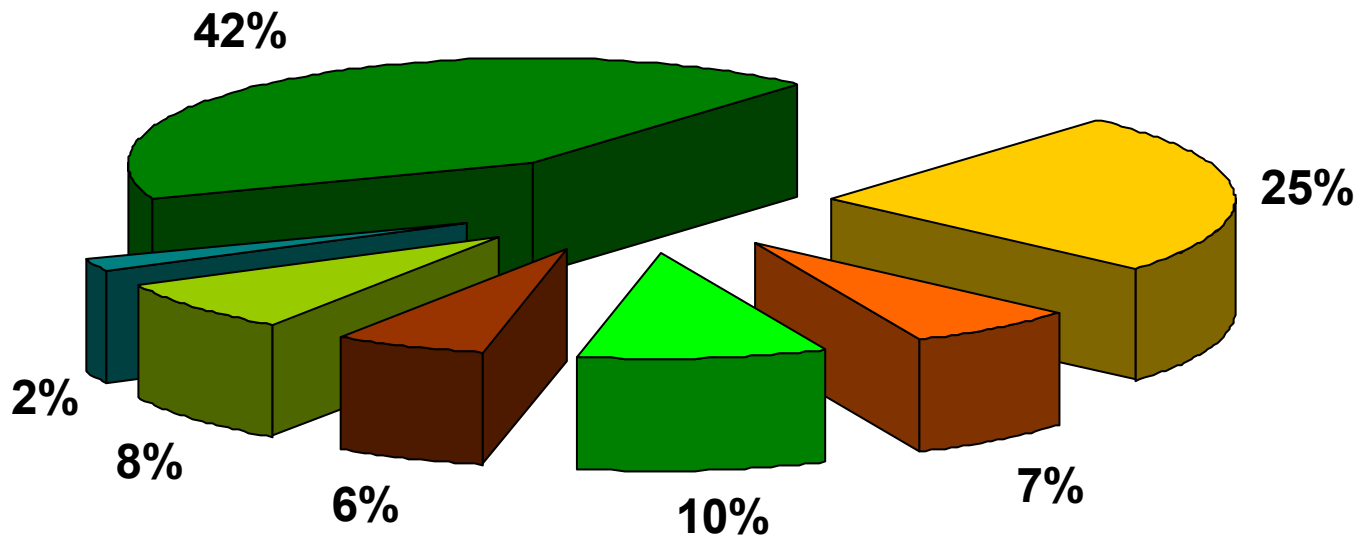
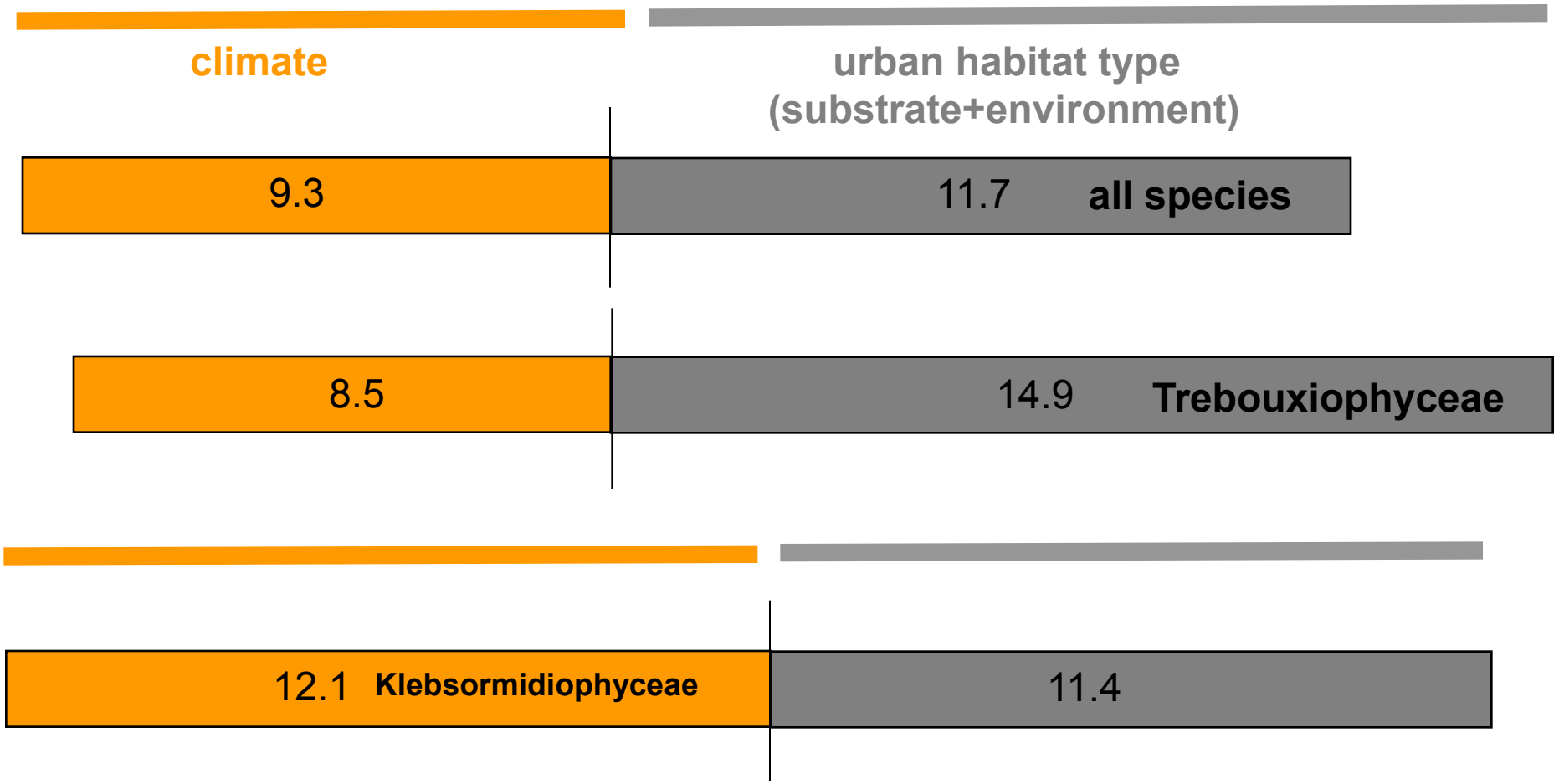
RESULTS

- Total species richness: 129 taxa
- Frequence of species: 0-55 Centre (mean 10), 0-56 Bark (mean 17)
- All habitats: min 9 max 53 (mean 28)
- Habitat Centre: min 9 max 41 (mean 20)
- Habitat Park: min 19 max 53 (mean 35)

Ratio of each algal class in urban habitats

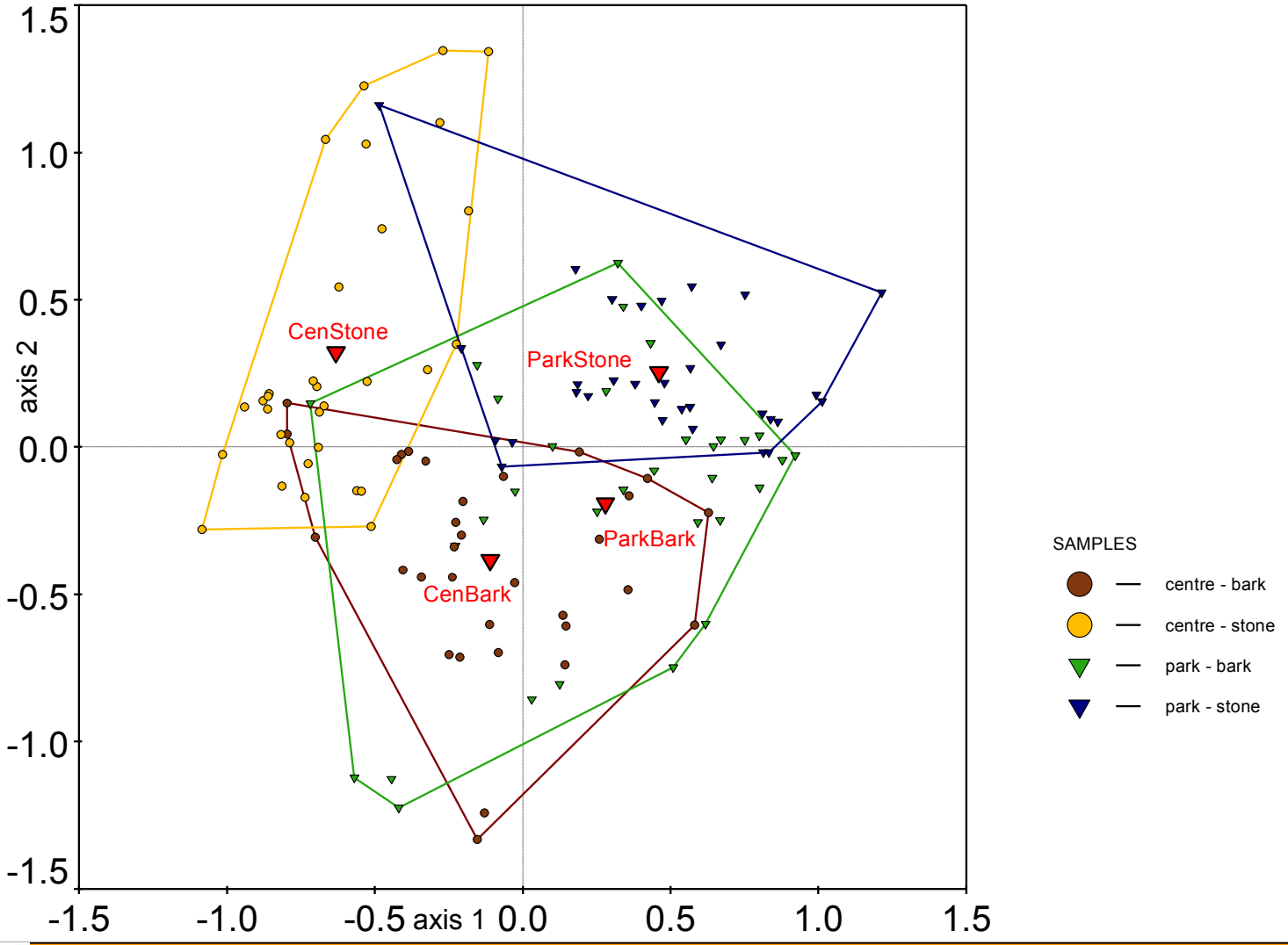


Explained variation in species composition

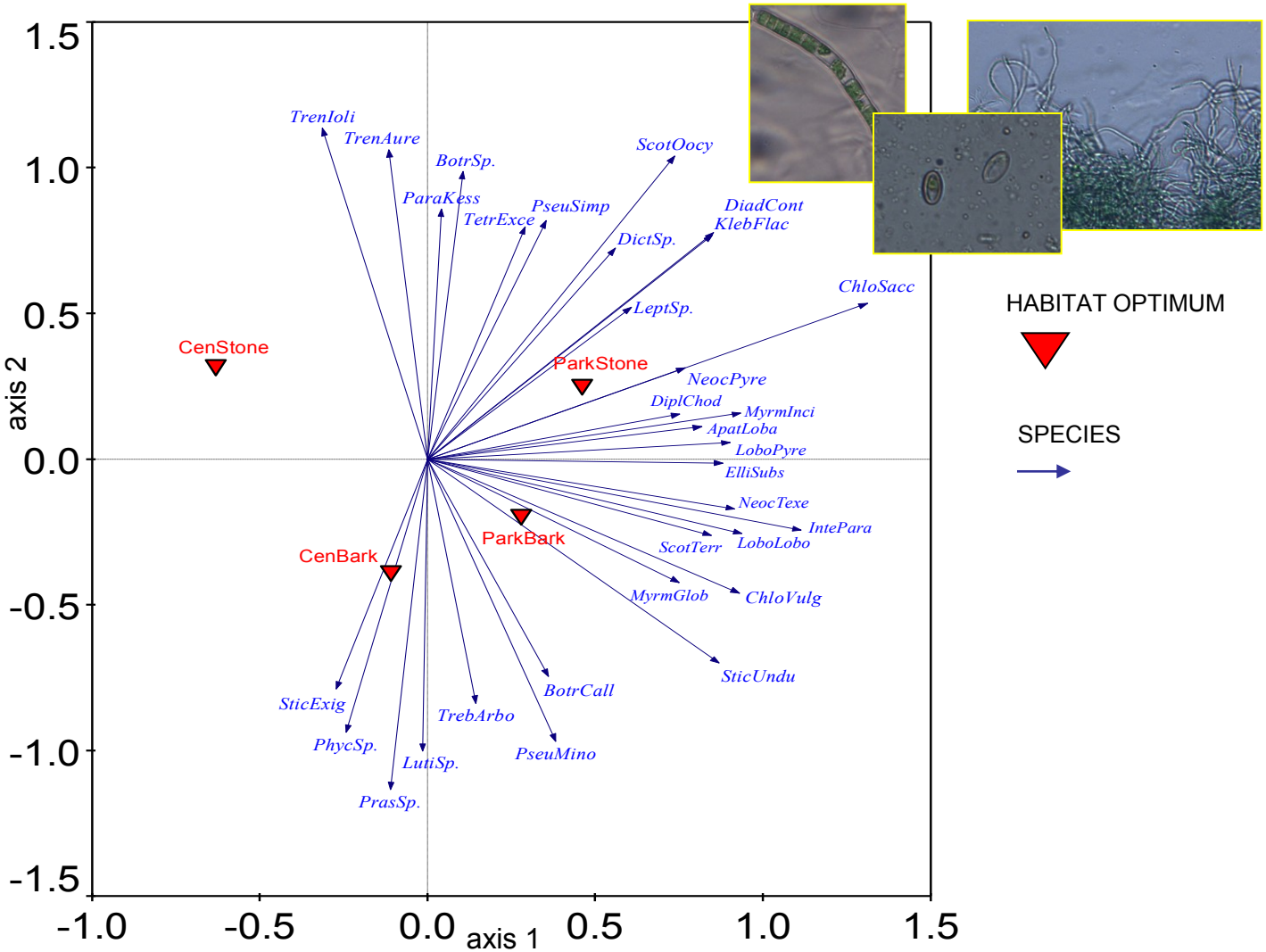


RDA analysis

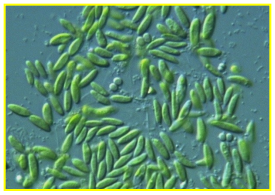
Ordination by partial PCA, with habitat types used (substrate+environment) as passively projected variables and climate data as covariables

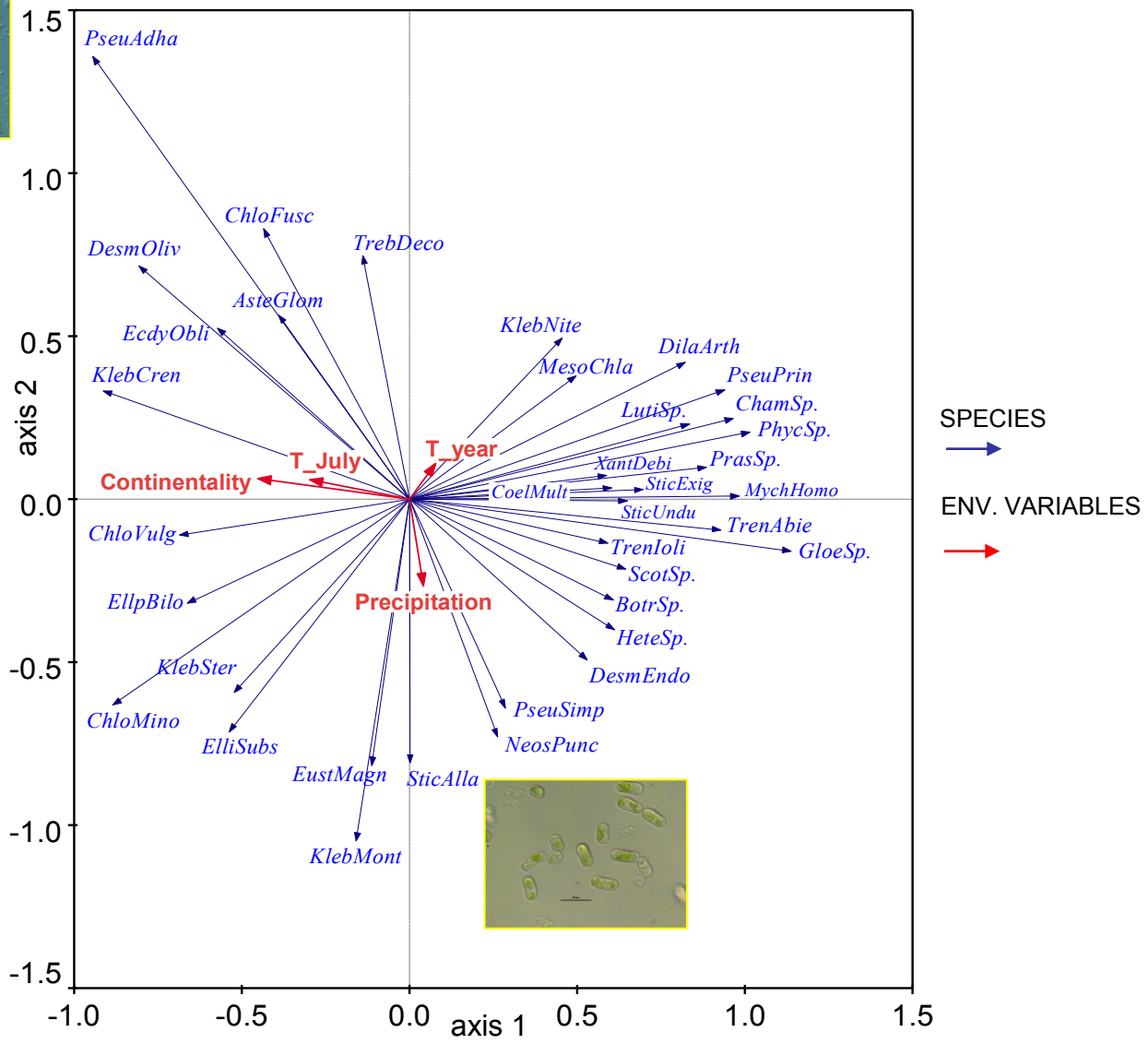


Ordination by partial PCA, with habitat types used as passively projected variables and climate data as covariables



RDA analysis, for species and climate

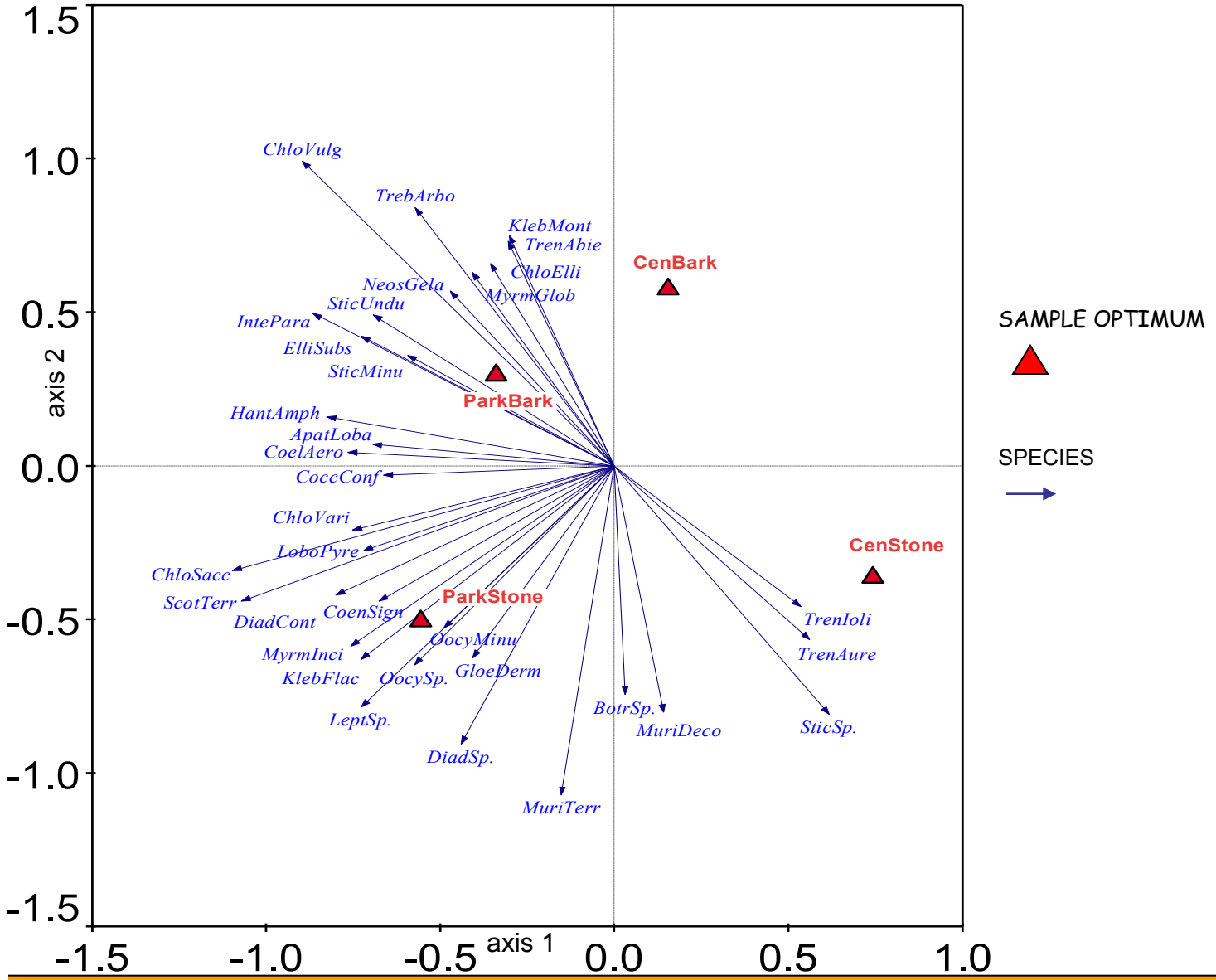




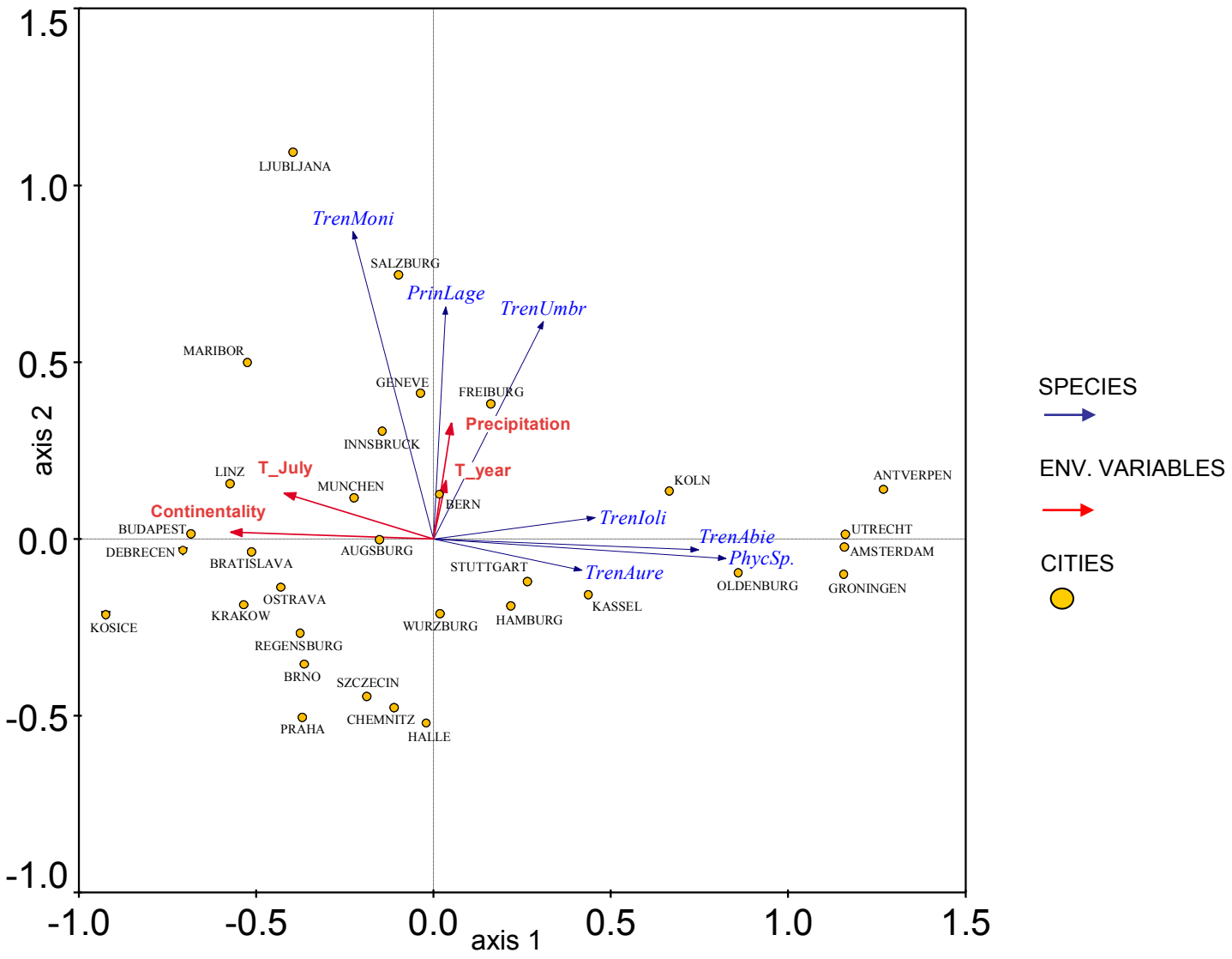
SPECIES

ENV. VARIABLES

RDA analysis, for species and habitat types



RDA analysis, for Trentepohliophyceae and climate with cities

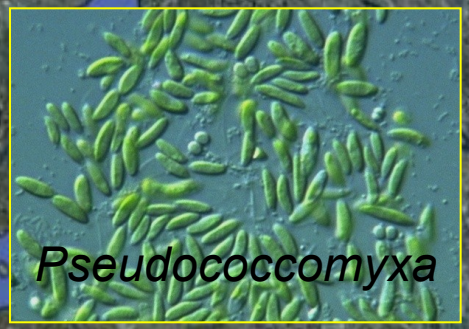


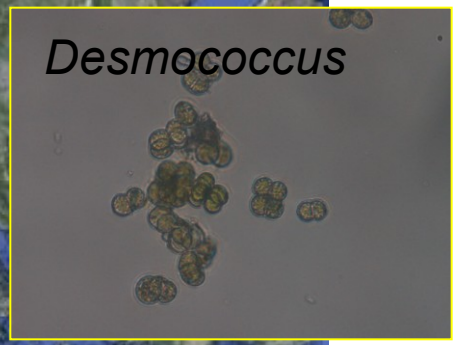
DIAGNOSTIC SPECIES OF URBAN MICROALGAL ASSEMBLAGES (JUICE - Cluster analysis)

- Synoptic table with 129 taxa
- 8 clusters
- Interpretable only clusters 6, 7 and 8
- Cluster 6 – Park habitat in eastern part of Central Europe
- Cluster 7 – Tree Bark in western part of Central Europe
- Cluster 8 – Sandstone in western part of Central Europe

Continental climate, in Park habitat - Diagnostic species

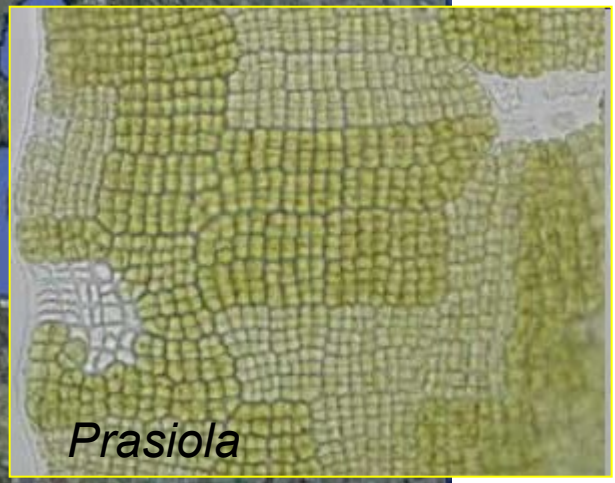
- *Pseudococcomyxa adhaerens*
- *Desmococcus olivaceus*
- *Tetracystis excentrica*
- *Xanthonema pascheri*
- *Tetracystis sarcinalis*
- *Chlorella fusca*
- *Neochloris pyrenoidosa*

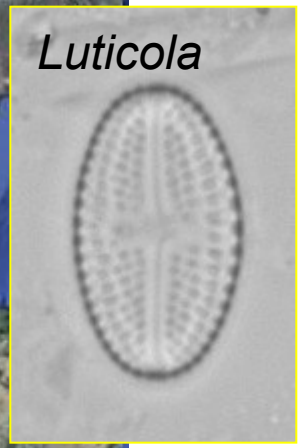


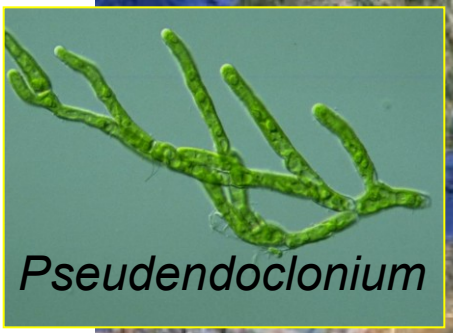


Oceanic climate in Park on Bark - Diagnostic species

- *Prasiola sp.*
- *Luticola sp.*
- *Pseudendoclonium printzii*
- *Dilabifilum arthropyreniae*
- *Chamaepinnularia sp.*
- *Botrydiopsis callosa*
- *Spongiochloris sp.*
- *Stichococcus exiguus*
- *Klebsormidium nitens*
- *Mesotaenium chlamydosporum*
- *Phycopeltis sp.*







Oceanic climate, in Park on Sandstone - Diagnostic species

- *Trentepohlia aurea*
- *Trentepohlia iolithus*
- *Parachlorella kessleri*
- *Botrydiopsis sp.*

Conclusions

- Differences among urban habitats and substrata cause the most important changes in species composition and diversity of urban phycoflora (except class Trentepohliophyceae – climatic conditions)

- The climatic conditions (continentality) are important predictors for significant differences in microalgal assemblages

- Diagnostic species were found only for three interpretable assemblages because of suboceanic gradient across Central Europe


Acknowledgements
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Thanks for your attention