

# Biomonitoring at the landscape level: a survey of springs in silicateous mountain regions

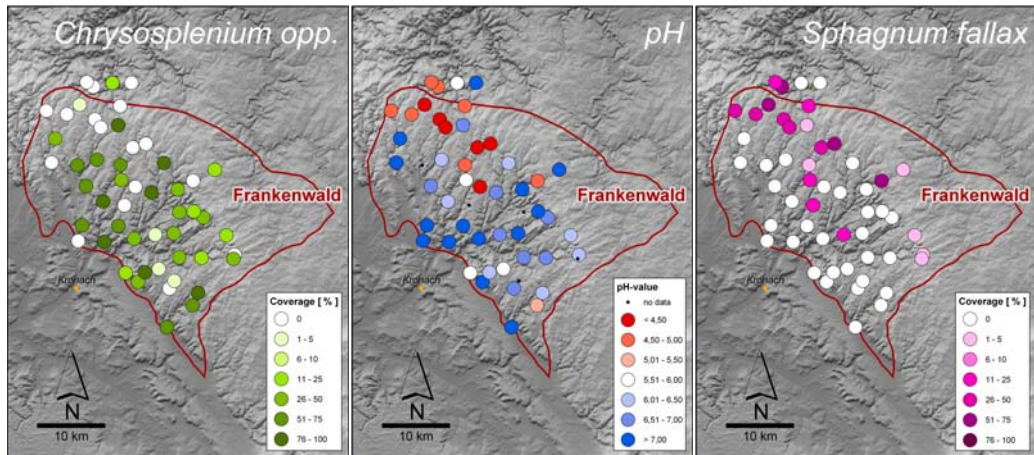
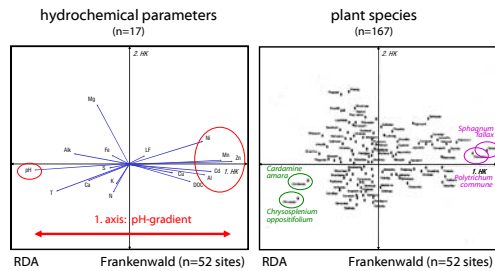
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## Identifying bioindicators

Vegetation of spring habitats in forested catchments is standing in close contact to ground water and is strongly influenced by its hydrochemical conditions. Using multivariate statistical methods, higher plants, mosses and liverworts have been tested to identify 1) the driving forces of species composition and 2) indicator species, which react sensibly to changes in water chemistry.

Spring vegetation proves to be a good indicator system to characterize the biogeochemistry of forest ecosystems, which is modified by atmospheric deposition. As shown by the ordination diagrams, low pH-values accompanied by high concentrations of Al, Cd, Zn and Mn are the main factor that is altering species composition.

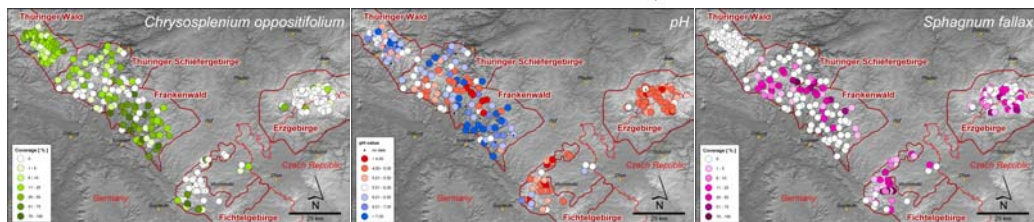
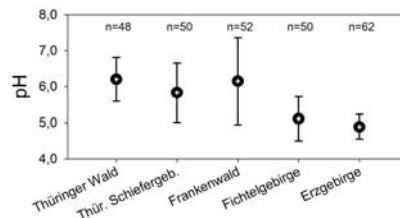
*Chrysosplenium oppositifolium* and *Cardamine amara* act as indicator species for neutral conditions, *Sphagnum fallax* and *Polytrichum commune* for acid conditions.



## Biomonitoring at the landscape scale

Spatial patterns of load situations can be shown clearly on different spatial scales, both within (e.g. Franckenwald; Figures above) and between landscapes (5 regions; Figures below) and both with water analyses and vegetation records.

In a recent project we are repeating the investigation of springwater chemistry and vegetation on different spatial and temporal scales, 3) to test if there is a recovery from acidification (as a consequence of the reduced deposition of acidifying pollutants) and 4) to quantify the delay of plant species' response (dynamic aspects).



## References

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