Functional Approach Using Soil Protists as a Taxon-free Tool for Environmental Quality Assessment

Elizaveta A Ermolaeva[1], Edward AD Mitchell[1]

[1]Laboratory of Soil Biodiversity, University of Neuchâtel

Soil organisms are useful as bioindicators to assess the impact of ongoing climate change on ecosystem functioning. Peatlands, which represent a major reservoir of soil organic carbon, are threatened by anthropogenic influence. Water table depth (WTD) is a key factor controlling the carbon balance in peatlands. Testate amoebae are routinely used as WTD indicators using predictive models. These transfer functions require taxonomic identification based on shell morphology, but some taxa are commonly misidentified. An alternative approach is to use functional traits. Our aim was to assess the extent of taxonomic bias and to compare the performances of species-based and traits-based models.

A set of light microscopy images of testate amoeba was compiled using samples collected across European peatlands. Species identifications with degree of confidence for each picture were analysed by researchers with contrasted expertise. We compared diversity metrics derived by each observer. For our second aim, we developed a trait-based transfer function with a trait database for the most commonly identified species morphotypes.

The degree of identification bias differed among taxa leading to strong variation in diversity metrics. The functional traits model performed equally well compared to the morpho-taxa-based one.

As ecological information is being routinely lost due to species misidentifications and taxonomic uncertainty, taxon-free approaches potentially offer safe and robust alternatives for rapid and accurate ecological assessments. We conclude that functional traits models overcome limitations of taxonomy-based ones for WTD inference, and may also prove to be better-adapted for inferences of ecosystem functioning.