GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN IN PUBLICA COMMODA SEIT 1737

Wintersemester 2023/24

FORSCHUNGSORIENTIERTES LEHREN UND LERNEN (FOLL)

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Algae – not only in the ocean?

Biodiversity of algae and cyanobacteria in surface soils, deadwood and tree barks

Why did we dig in the dirt?

- The impact of soil algae biodiversity is often underestimated and there is not much research
- Our project is part of the research in the DFG-funded Biodiversity Exploratories in the region of Hainich-Dün (Thuringia, Germany; www.biodiversity-exploratories.de)
- We collected samples from surface soils of research plots of forest and grassland and used them for our analyses of the algae diversity

Importance of soil algae:

- Energy and nutrient input
- Improvement of soil fertility
- Improvement of soil hydrology
- Stimulation of microbial activity
- Pioneers in colonization
- Erosion control
- Food source

Microscopic image of what can be found in a typical soil: Diatomes, Cyanobacteria, green algae, fungi and dirt particles

Aim:

- Assessment of the biodiversity of algae and cyanobacteria in soils
- Investigation of the changes in the diversity under different land use and land use and vegetation

Investigated areas:

Forest: plot with Gap experiment (FOX) with an opening of the canopy and leaving/adding additional deadwood

Samples along transects from:

- Plot area inside the gap (iF)
- Plot area outside the gap (oF)
- Deadwood inside and outside of the gap (DiF, DoF)
- Tree bark

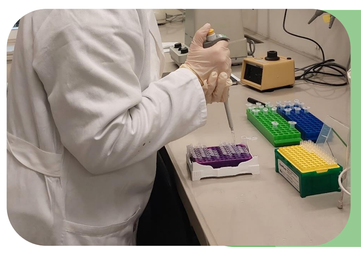
Grassland: (HEG6)

- Experimental plot under regular land use (EP)
- Unfertilized plot (UP)
- plot with reduced land use (RP)

Research process:

Excursion to Hainich-Dün exploratory with the collection of soil samples from different plots and transects

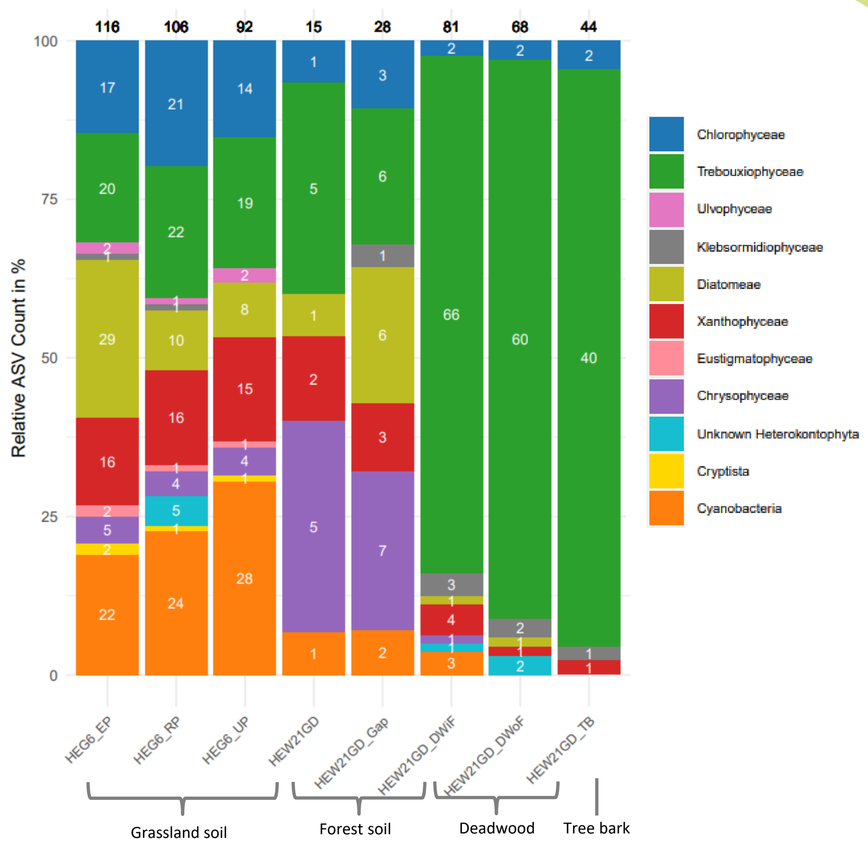
Culture algae ioslates on agar plates. Microscopy and first attempts to identify species



Laboratory work:

1. DNA extraction from soil samples
2. PCR
3. Gel electrophoresis
4. Sequencing
5. Bioinformatic analysis

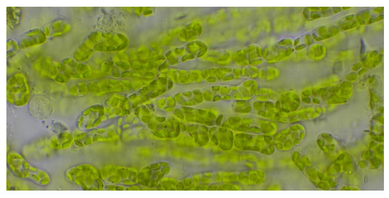
Excursion to the Nationalpark Hainich to collect samples



Relative abundance of cyanobacteria and eukaryotic algae at the studied research plots (based on UPA 23S sequences)

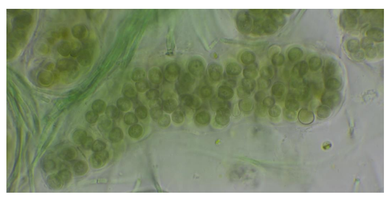
Results & Discussion:

- **Trebouxiophyceae** are common green algae symbionts in lichen. We found them on tree bark and deadwood
- **Diatomeae** produce silica shells, their frequent occurrence has not been researched
- **Xanthophyceae** are pioneer organisms in disturbed habitats, they can tolerate nutrient deficiency and modify the environment for other species over time



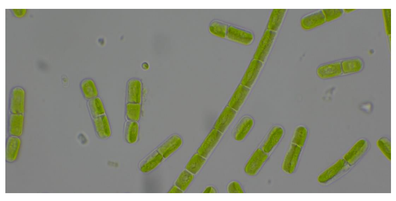
Heterococcus sp. - Xanthophyceae

- **Cyanobacteria** can fix nitrogen which is found in nutrient-rich soils

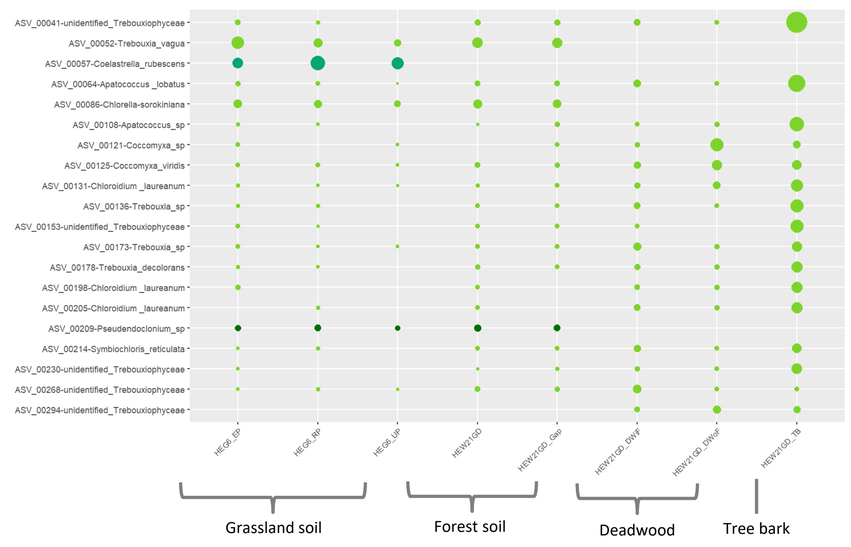


Nostoc sp. - Cyanobacteria

- **Klebsormidiophyceae** were common in our cultures, but their DNA could not be amplified by our primers



Klebsormidium sp. - Klebsormidiophyceae



First 20 most abundant ASVs (amplicon-based sequence variants) of green algae from soils, deadwood and treebark samples (based on ITS2 sequences)

Conclusion:

- Genetic diversity is influenced by different vegetation and intensities of land use
- Algae biodiversity in forests is related to that on deadwood and tree bark surfaces
- Grassland generally has a higher diversity than forest soils
- Mechanical disturbance and fertilization negatively influence the diversity

Limitations:

- Little genomic data and literature available
- We only collected samples once
- Some important soil algae species could not be amplified with our primers

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