Institute: Institute of Environmental Sciences

Topic: The importance of nutrient content and microbiological properties of forest soils for temperature sensitivity

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Background information:

One of the major consequences of climate change in European forest areas will be increased frequency and severity of heat and drought events. Despite decades of empirical research, the nature and magnitude of the effect of global warming on C cycling in European forest ecosystems are still uncertain. This is mainly due to the independent or interactive effects of different factors. The chemical composition of the organic matter, temperature changes and soil moisture are the main factors influencing soil microbiome and the distribution, diversity and function of soil microorganisms which determine rate of global biogeochemical cycles and thus global climate changes. However different groups of microbes in different environmental conditions e.g. in different forest types, may respond differently accelerating or reducing human caused climate change.

The main question to be addressed in the project:

The main objective of the planned research is estimation soil microbial parameters from different forest type, characterized by different natural levels of biogens (P, N and S) in mitigation or enhancing potential climate changes. The more specific purpose of this project is to test if fungi dominant in coniferous e.g.

Pine forests are the key, mostly sensitive microbial group responsible for changes in the rate of soil processes under climate changes, or if other microbial groups dominant in deciduous or riparian soil are similarly sensitive to temperature changes. The next aim is to estimate the influence of nutrient ratio (P/C, N/C, S/C), present in the studied soils on the temperature sensitivity of soil processes.

Working with the PhD student we want to compare the sensitivity of Scots pine, deciduous and riparian forest organic matter to different temperatures and try to assess the levels of nutrients responsible for the diverse answer but also estimate the relationship between microbial genetic and physiological diversity for temperature.

Information on the methods/description of work:

Planned experiments will be based on soil laboratory incubation in different temperatures, measuring the soil respiration and nitrogen mineralization rate, enzymes activity and different soil microbial communities properties like the genetic structure of the community using e.g. Illumina sequencing and microbial community structure (using PLFA method).

Additional information (e.g. Special requirements from the student)**:**

The student will focus on the field and laboratory analysis of different soil and microbial properties. The PhD student should have a basic knowledge of ecology, especially global changes and their effects on ecological processes. An experience in microbiological and molecular methods will be another advantage. Of course, English language and laboratory skills are also expected.

Place/name of potential foreign collaborator:

1. Dr Hamed Azarbad - Philipps University Marburg, *Germany*
2. *Prof. Marcin Chodak- University of Science and Technology, Kraków*

References:

[1] Chen J. et.al.2020. Long-term nitrogen loading alleviates phosphorus limitation in terrestrial ecosystems. Glob. Change Biol. 26:5077–5086.

[2] Klimek B., Chodak M., Jaźwa M., Azarbad H., Niklińska M. 2020. Soil physicochemical and microbial drivers of temperature sensitivity of soil organic matter decomposition under boreal forests. Pedosphere 30(4): 528-534.
[3] Niklińska M., Maryański M., Laskowski R. 1999. Effect of temperature on humus respiration rate and nitrogen mineralization: Implication for global climate change. Biogeochemistry 44:239-257.