

Updated Call for contributions to the EcoXtremes AquaDiva-Ecotron experiment

As part of the collaborative research project CRC 1076 AquaDiva at the Friedrich Schiller University Jena, a large-scale experiment will be carried out in the Ecotron facility in Bad Lauchstädt from May to November 2019 in cooperation with the German Center for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig.

The experiment aims to explore the consequences of large-scale changes in precipitation regimes on the linkages between surface and subsurface habitats. Specifically, we will examine how extreme events like summer drought followed by heavy precipitation impact carbon and water dynamics within the soil column of beech forest and grassland ecosystems.

The specific questions we will address in **EcoXtremes** are:

- 1) How carbon turnover processes, microbial communities, and gas fluxes are altered under predicted increases in weather extremes?
- 2) How do these contrasting drought / heavy precipitation regimes alter the transport mechanisms of organic matter (POM, DOM), nutrients, microorganisms and viruses, inorganic particles, and colloids through the soil column?
- 3) Do we see differences in microbial activities and decomposition rates?
- 4) Does the overlying ecosystem type (grassland vs. beech forest) predictably alter carbon fluxes & transport mechanisms under these precipitation extremes?
- 5) How does aboveground and belowground biodiversity react to weather extremes?

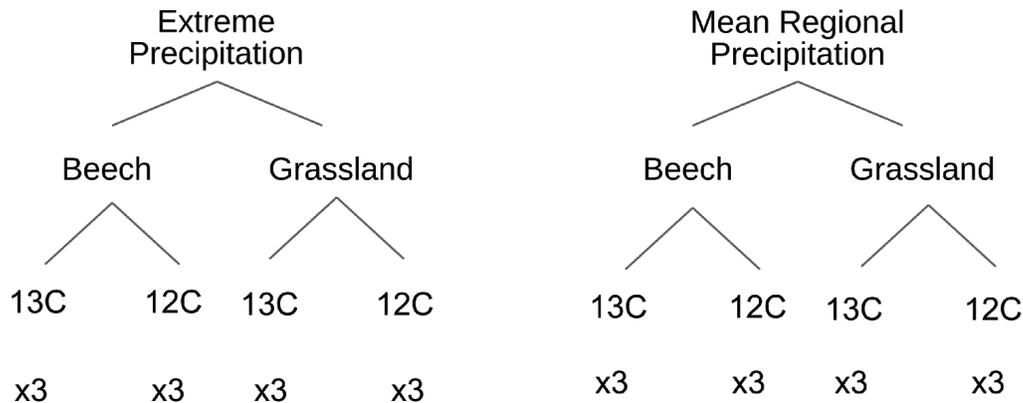
For this purpose, the EcoUnits of the Ecotrons of the iDiv and the UFZ Halle / Leipzig in Bad Lauchstädt will be used. In these EcoUnits, undisturbed soil columns can be manipulated and observed as isolated ecosystems in small-scale lysimeters under controlled conditions.

For the planned large-scale experiment, 12 lysimeters with soil monoliths from beech forest soil with young trees (*Fagus sylvatica* (L.), top height <100cm) will be taken and 12 lysimeters will be extracted from nearby grassland soil. Due to soil depth constraints at the Hainich CZE, we will extract the soil monoliths from the second field site of the CRC AquaDiva, the Würzbachgrund near Hummelshain. Here slightly acidic soils (pH 5.2 to 6.2) have developed on sandstone (Stagnic Luvisol, Parabraunerde-Haftpseudogley) with a loess coverage and a low soil skeleton content.

Due to monolith extraction challenges we are unable to retrieve sufficient beech monoliths to test the planned herbivore treatment. Instead we will compare the response of the planned beech soils with grassland soils.

We propose a **2-factor ANOVA** based design to elucidate the effects of (1) precipitation regime (regional mean vs. 2018 extremes) and (2) ecosystem type (beech forest vs. Grassland) on carbon and water fluxes, nutrient dynamics, and microbial responses with time. Each treatment will have 6 replicates, and of these, 3 will be amended with ¹³C-labeled *F sylvatica* or

^{13}C -labeled *Lolium perenne* (perennial ryegrass) leaf litter to track rates and pathways of organic matter decomposition.



Factor 1: Precipitation

We will take advantage of the data from the climate station in the Hainich CZE to estimate the average precipitation amount. The extreme event will be based on measured rainfall intensities observed in 2018 with its extreme drought followed by local heavy rainfalls.

Factor 2: Ecosystem

CRC AquaDiva studies three land use types (forest, grassland, and agriculture). Here we will explicitly compare the impacts of extreme weather events on beech dominated forest soils and grassland soils.

Additional Factor: Labeled carbon

The ^{13}C labeled beech-leaf/grass litter will be added to 3 of the 6 replicates of each treatment, and will trace the fate of surface derived organic matter in the chambers. The labeled litter is essential in order to parse out the relevant processes, and their rates, acting upon the transportation of surface carbon through the soil column. The amount of litter needed to conduct this experiment was determined from the literature, in order to ensure there is enough sensitivity to distinguish between the labeled cores and the unlabeled controls.

What we can do and not do:

As we will use undisturbed soil monoliths, we cannot do destructive sampling over time. There is the chance to take (soil) samples in the field close to the core holes, when we extract the soil monoliths (April and May), and of course at the end of the experiment.

During the experiment, we will measure water fluxes, have access to the gas phase, measure soil water with suction cups in 3 soil depths.

Experiment Specifics and Timeline

Number of EcoUnits needed: 6, 24 replicates

Time schedule: May 2019, – End late fall 2019

April-May 2019: field work to obtain the soil monoliths

May: establishment of EcoUnits

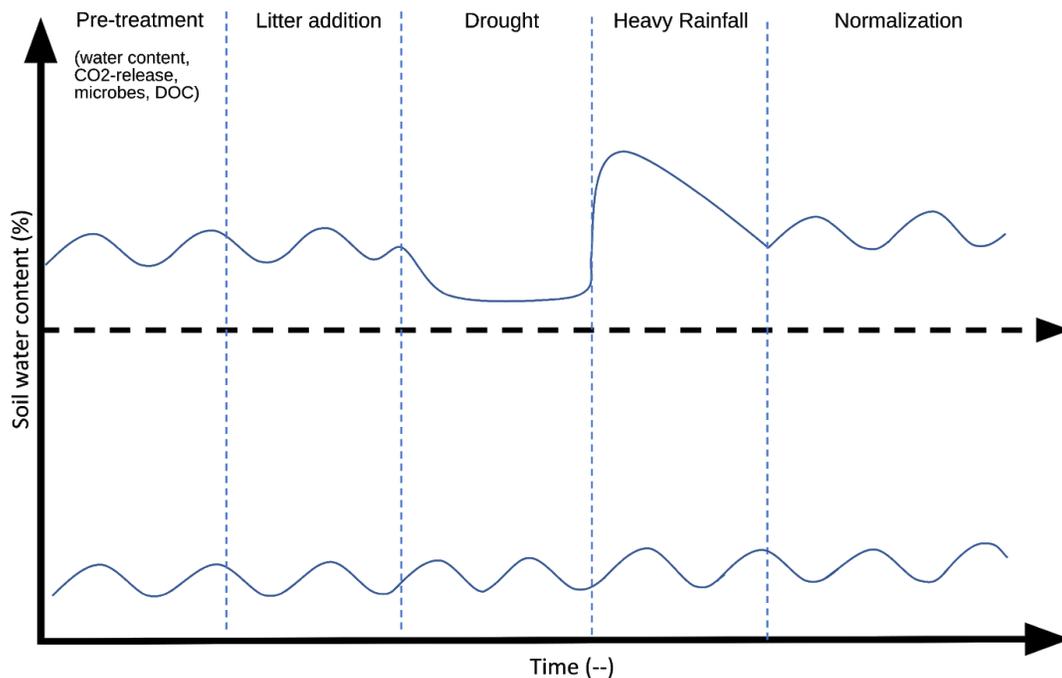
May-June: 4 weeks pre-treatment phase (to mark central system state variables (e.g. soil respiration, water flows, possibly enzyme activity)

July-August: variable, as the water stress level depends on the soil supply and the plant available water capacity) a simulated drought

September: 4 weeks rewetting (with heavy rain event at the beginning – N-mobilization especially as nitrate)

October: recovery phase and adjustment with state variables of the pre-treatment phase, to see if the system has returned to the initial state (reviewed by soil respiration, water flows, possibly enzyme activity etc.)

November: end



AquaDiva iDiv Ecotron Team:

This will be a collaborative project in part designed by PIs Kirsten Küsel, Martin Taubert, Beate Michalzik, and Anke Hildebrandt with input given by Nico Eisenhauer. Will Overholt will be the leading postdoc.

Additional PIs from the CRC AquaDiva already stated their interest in participation. It is also planned that collaborators from iDiv can contribute.

With this call we ask you to state:

- (i) your interest to collaborate
- (ii) formulate your major research question(s)
- (iii) define the parameters you want to measure (which technique you want to use, etc.)
- (iv) define your sample size (amount of soil needed, ml of soil water needed, etc.)

Thank you for all who have updated the below Google Sheet.

If you have not, please do so by May 19th with your research theme, methods, and requested sample volume.

Google sheet:

<https://docs.google.com/spreadsheets/d/1-0HXR9w7qikVR8PBwsf3C5j3j0mh5vDqZMU31BNk1o8/edit?usp=sharing>

In addition, we request a small project description (1-2 pages) **by May 26th** at the latest. Please find a template and an example attached.