Impacts of climate change on forest soil microbial community structure and function

Katy J. Faulkner[1], Sally Hilton[1], Simon Oakley[2], Kelly Mason[2], Niall P. McNamara[2], Christopher J. van der Gast[3], Sami Ullah[4], Gary D. Bending[1]

[1] School of Life Sciences, University of Warwick, CV4 7AL [2] Centre of Ecology and Hydrology, Lancaster, LA1 4AP
[3] School of Healthcare Science, Manchester Metropolitan University, M1 5GD [4] School of Geography, Earth and Environmental Sciences, University of Birmingham, B15 2TT

Climate change is predicted to alter **precipitation patterns** and increase the **frequency** of **high rainfall events** [1].

Global atmospheric carbon dioxide (CO_2) levels are expected to reach **550 ppm** by **2050**, an increase of +150 ppm compared to current levels [2].

Forests are thought to be one of the most **sensitive biomes** to climate extremes [3] and are an important carbon stock, harbor biodiversity and regulate climate.

Aim: to investigate how forest soil-climate feedbacks, particularly those involving microbial community structure and function, could be affected by climate change.

Climate change, high rainfall, microbial communities, soil, forests, resilience, biodiversity, ecosystem functioning, biogeochemical cycling

Overview: Forest climate-soil feedbacks

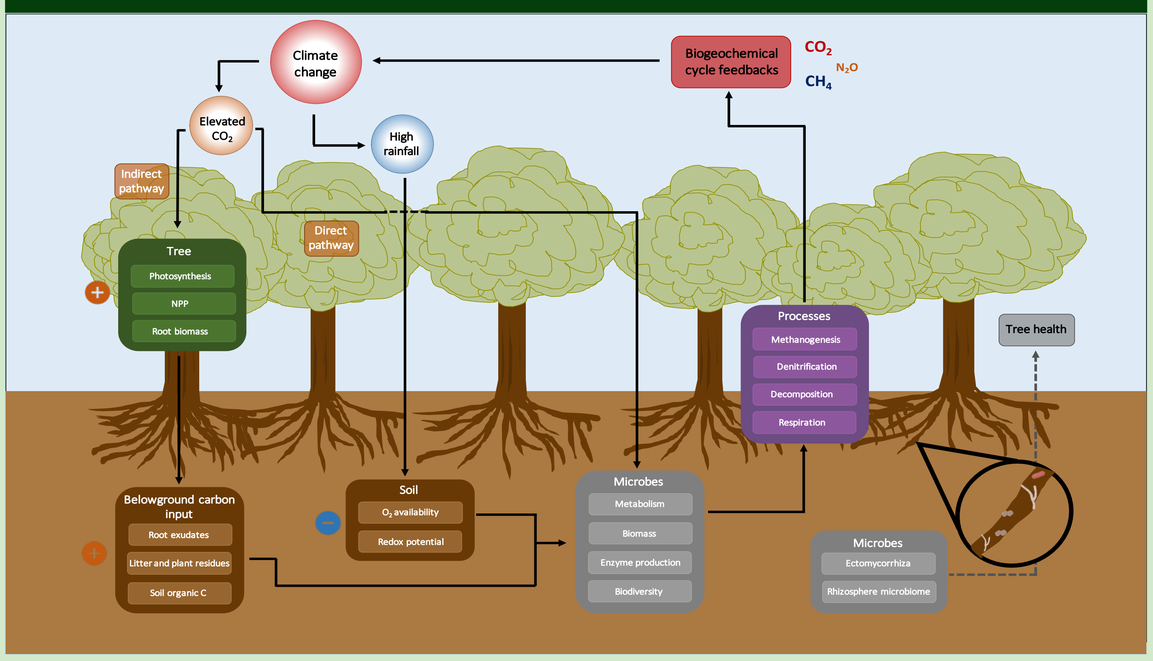
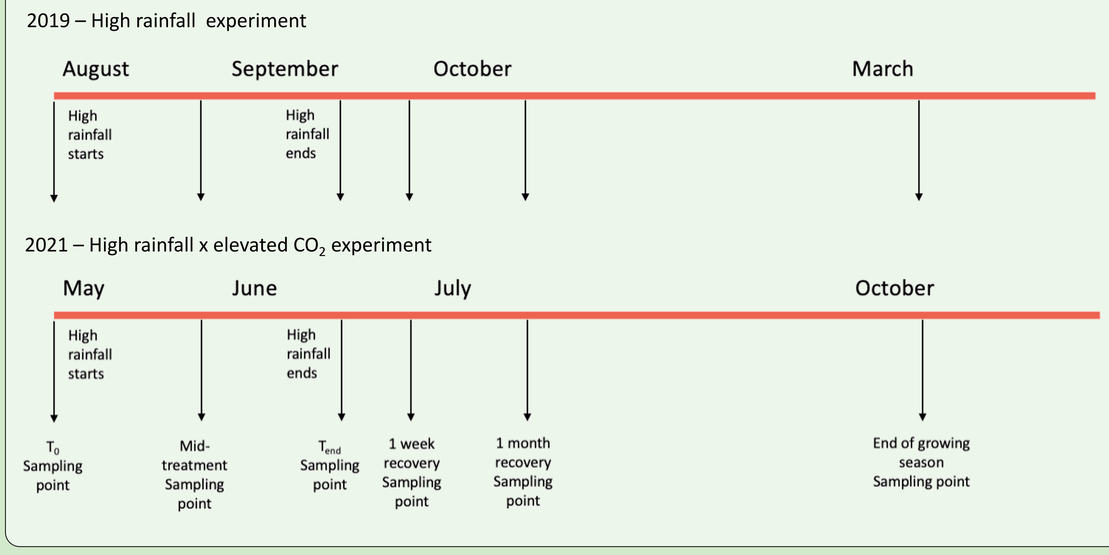


Figure 1. Overview of the impacts elevated CO2 (eCO2) and high rainfall could have on microbial communities and soil and microbial processes.

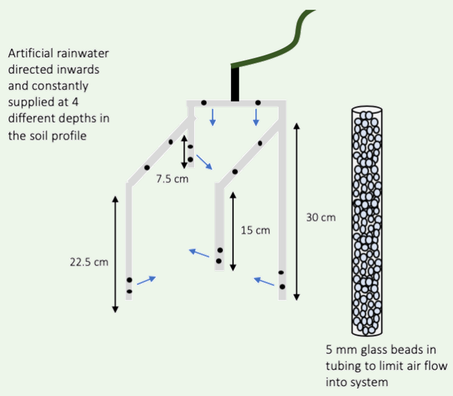
Experimental timelines



Experimental set-up and methods

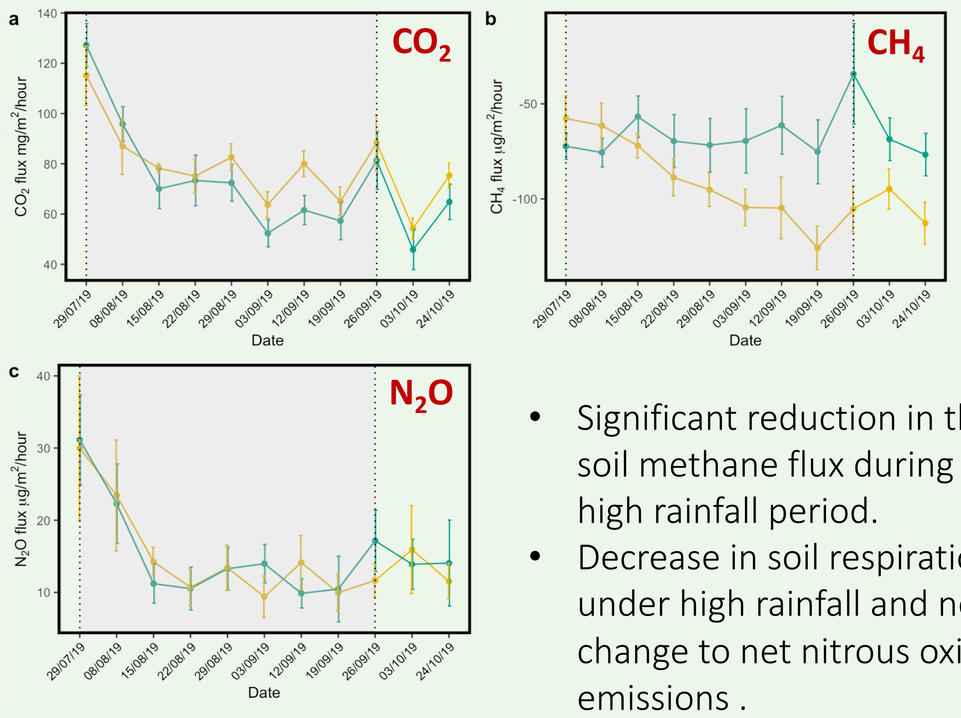
in situ field approach to experimentally simulate high rainfall

- We have developed an *in situ* mesocosm and peristaltic pump watering system to artificially alter soil moisture in a highly controlled way in all levels of the soil profile.
- We explore changes to both soil microbial community structure and function via amplicon sequencing, qPCR, extracellular enzyme activity assays, nutrient assays and greenhouse gas measurements.



Results

Forest methane sink capacity significantly reduced under high rainfall



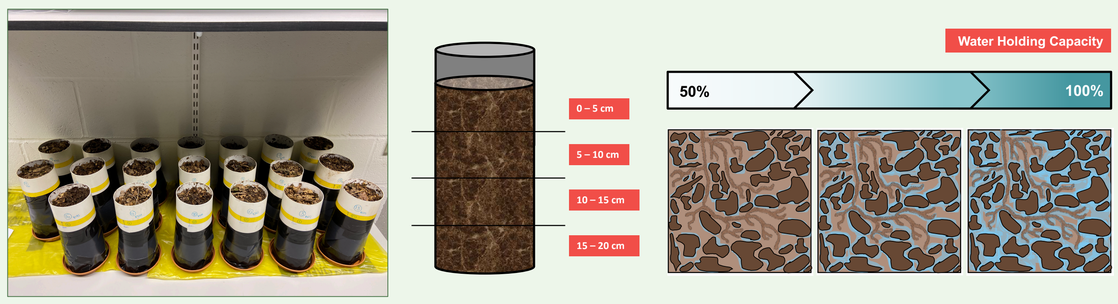
- Significant reduction in the soil methane flux during the high rainfall period.
- Decrease in soil respiration under high rainfall and no change to net nitrous oxide emissions .

- We found a significant reduction in chitinase activity in the high rainfall treatments (data not shown).
- Molecular data (16S amplicon sequencing and qPCR) is currently being processed.

Future work

What microbial groups and processes are driving the reduction in methane sink capacity under high rainfall?

- A highly controlled laboratory experiment will allow us to gain a more mechanistic understanding of the main drivers for the change in forest methane sink capacity we found in our field experiment.
- 15 cores (20 x 10 cm) have been treated at three different water holding capacities (50, 75, 100 %) for an 8-week period after which they will be sliced into 4 sections and destructively harvested.



References

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[2] Smith, M.R. and Myers, S.S. (2018) Impact of anthropogenic CO2 emissions on global human nutrition. Nature Climate Change 8(9), 834-+.
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@katyjfaulkner Email: katy.faulkner@warwick.ac.uk