# Water-related Soil-Moss Interactions at Different Scales

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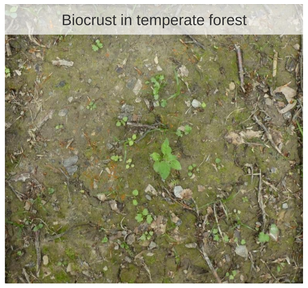
## Introduction

Despite being small in size, mosses fulfill vital roles in ecosystem functioning, especially in temperate ecosystems. Due to their unique ecology and physiology, they affect water and nutrient cycles, even at larger scales. This study investigated water-related interactions between soil and moss from the site scale of skid trails in temperate forests to the microscopic scale of individual structural moss traits.

1. The effect of biocrusts and mosses on soil erosion was surveyed in skid trails.
2. Different soil-moss combinations and their impact on runoff, percolation, and sediment discharge were investigated in infiltration boxes.
3. The influence of moss structural traits on maximum water storage capacity ($WSC_{max}$) and its interactions with soil water content was studied.





## Research Area


The project took place in the Schönbuch Nature Park in South Germany, which is a low-altitude, hilly and forested area in the subatlantic temperate climate zone.





## Hypothesis I

Biocrusts & mosses are major factors in mitigating soil erosion in temperate forests after disturbances

## Hypothesis II

Moss covers reduce surface runoff, soil erosion, and increase percolation

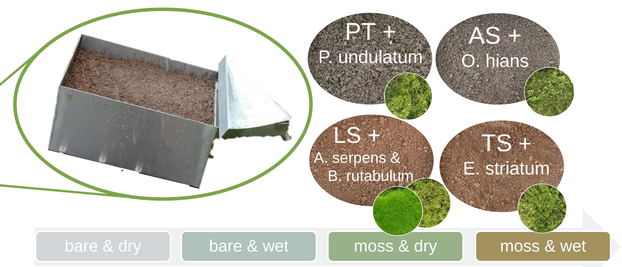
## Hypothesis III

Mosses influence water dynamics in soil and their $WSC_{max}$ is related to their total surface area

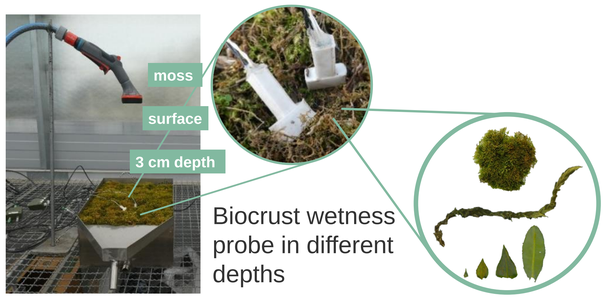
## Methods & Experimental Design

### Rainfall simulations with micro runoff plots

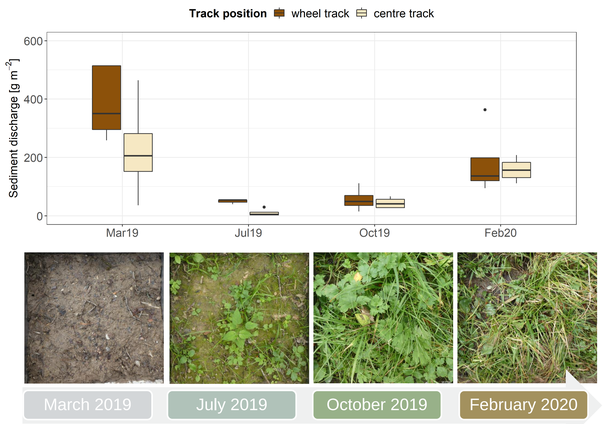

### Rainfall simulations with infiltration boxes



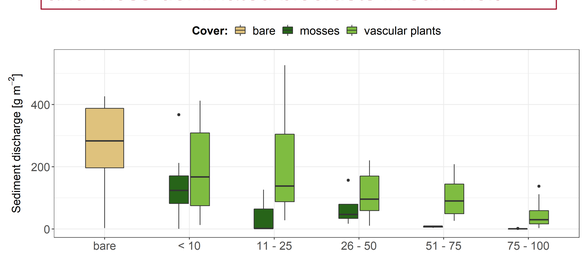

### Water content monitoring & moss structural traits



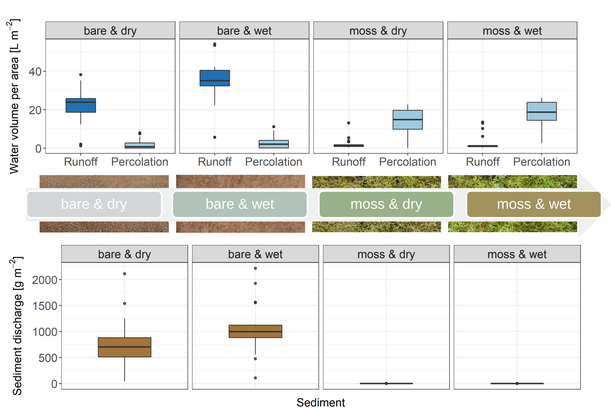

## Results & Conclusions



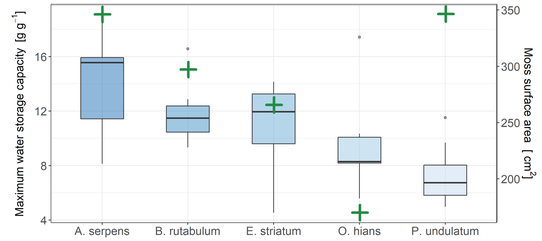

The highest reduction of soil erosion was observed with the occurrence of protonema- and moss-dominated biocrusts in summer.



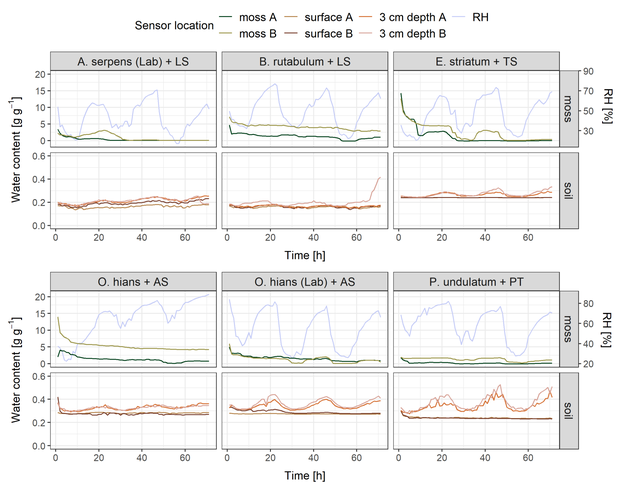

Mosses made a major contribution to erosion control after disturbance, even more than vascular plants.




Surface runoff and sediment discharge were highest in bare & wet treatments and a high reduction in surface runoff and sediment discharge due to moss cover was evident.




$WSC_{max}$ of mosses species varied widely, which could not be explained by total surface area.




Mosses prevented desiccation of the substrate, although even dense moss covers did not completely seal the surface.

## Contact & Further Reading

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Gall, C., Nebel, M., Quandt, D., Scholten, T., Seitz, S. (2022): Pioneer biocrust communities prevent soil erosion in temperate forests after disturbances, *Biogeosciences*, 19, 3225–3245.

Thielen, SM., Gall, C., Ebner, M., Nebel, M., Scholten, T., Seitz, S. (2021): Water's path from moss to soil: A multi-methodological study on water absorption and evaporation of soil-moss combinations, *Journal of Hydrology and Hydromechanics*, 69 (4), 421-435.