

# Skid trails impact carbon and nutrient turnover in managed forests

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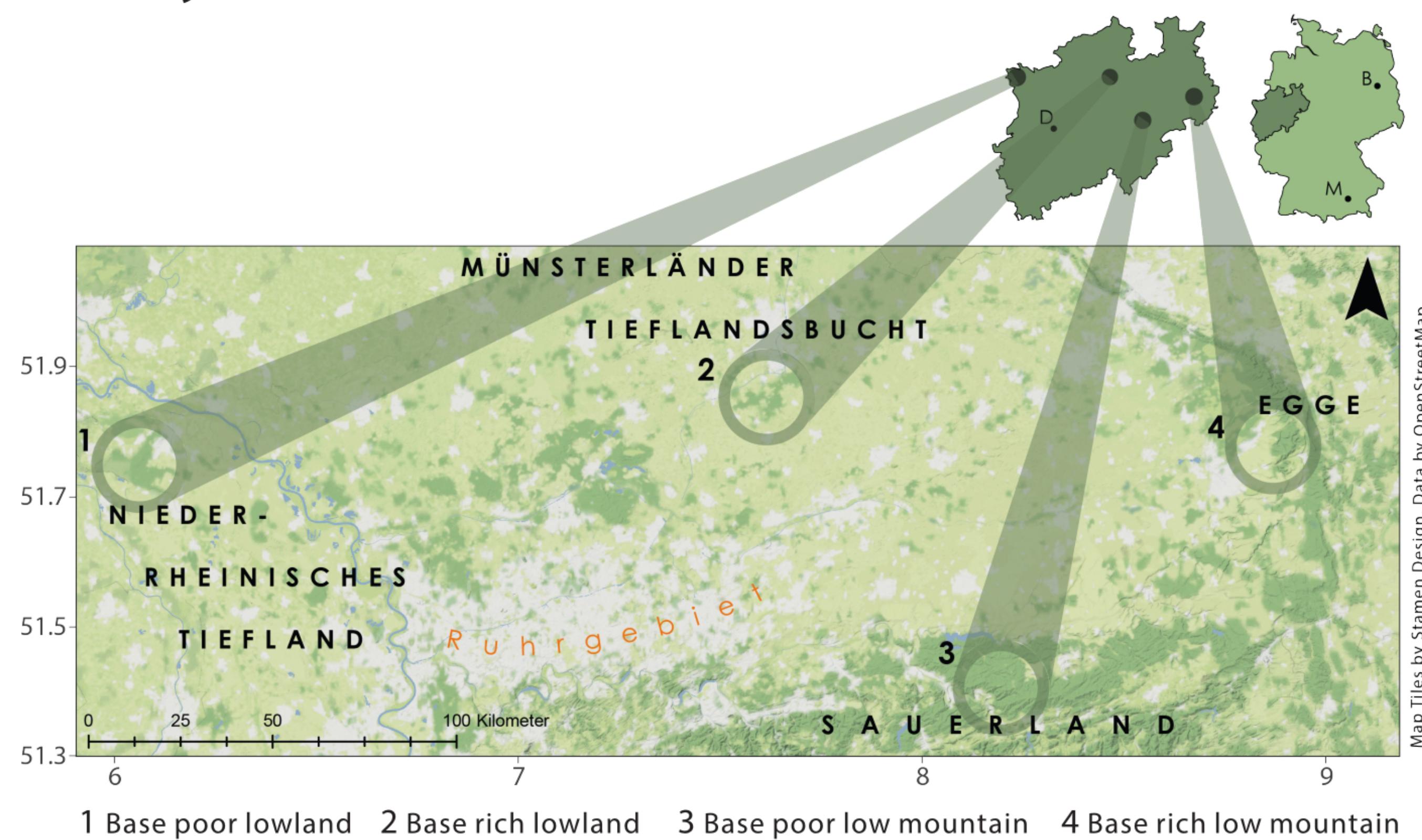
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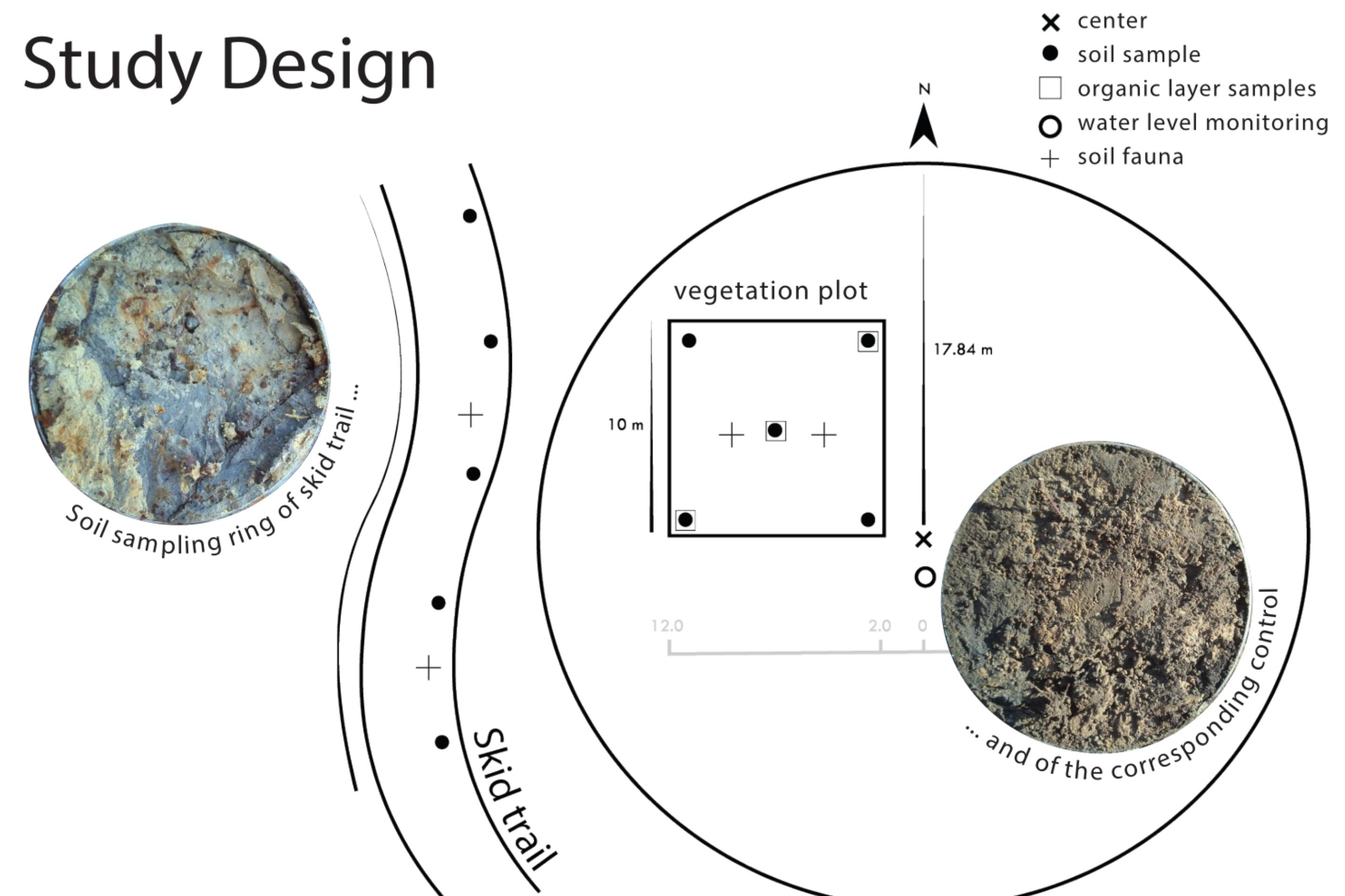
## Background

- > Skid trails comprise 10 %–20 % of the forest area in Germany
- > Soil compaction through heavy machinery is a major threat on soil ecological processes that are so far poorly understood
- > We systematically investigated the influence of skid trails on physical, chemical and microbiological soil parameters at 84 paired plots across four Central European forest types.

## Study Sites



## Study Design



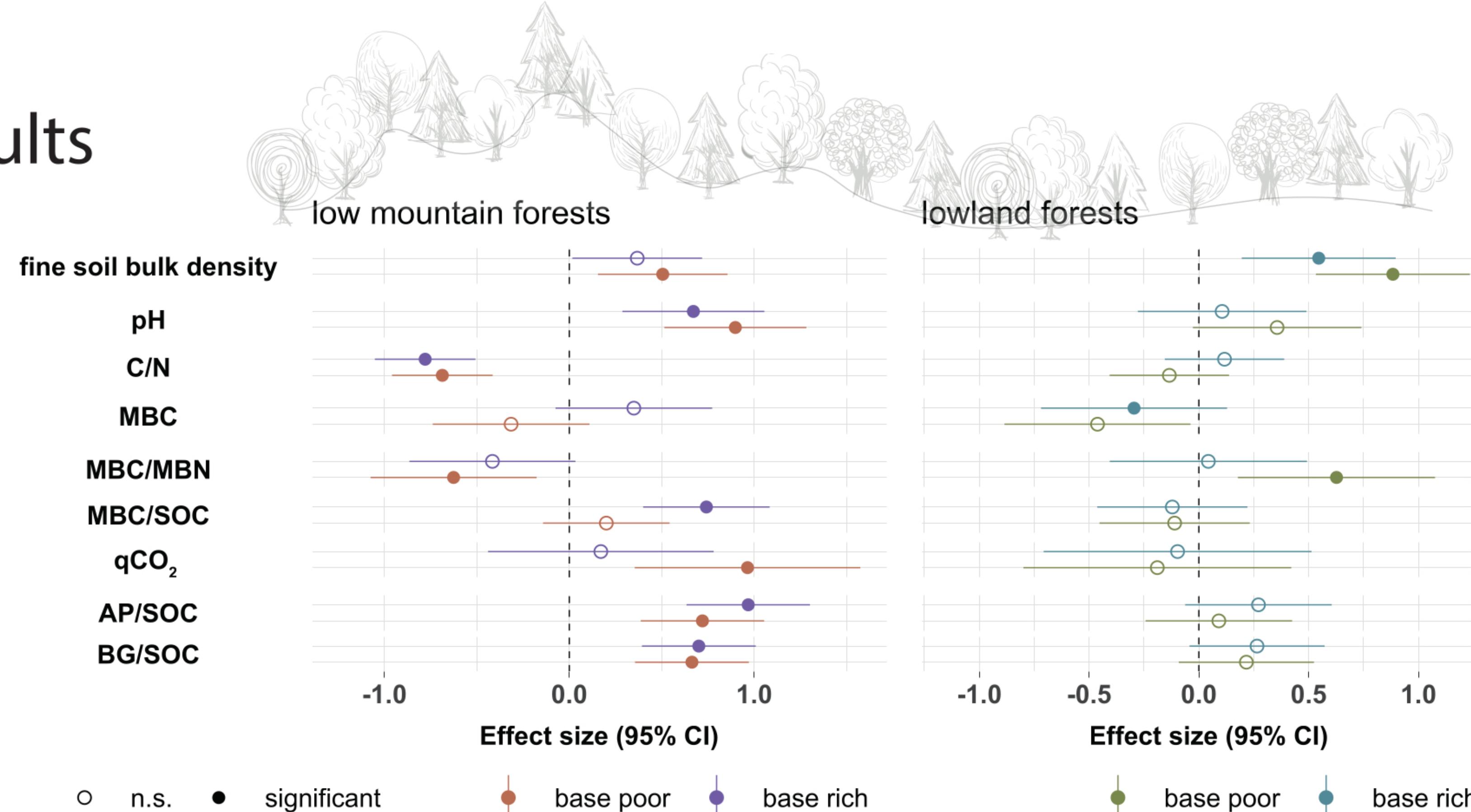
21 skid trails per study area:

- > 7 in medium old stands with native stocking
- > 7 in old stands with native stocking
- > 7 in forests with non-native coniferous stocking

Mineral Topsoil Analysis (0 - 5 cm)  
Soil Fauna Survey  
(Springtails & Earthworms)

- > Bulk density and pH
- > Soil organic carbon SOC, nitrogen N & phosphorus Porg
- > Microbial biomass carbon MBC & nitrogen MBN
- > Specific soil respiration ( $qCO_2$ )
- > Extracellular enzyme activities of Hydrolases and Oxidases  
for example acid Phosphatase AP &  $\beta$ -Glucosidase BG
- > Readily available fractions of C, N & P

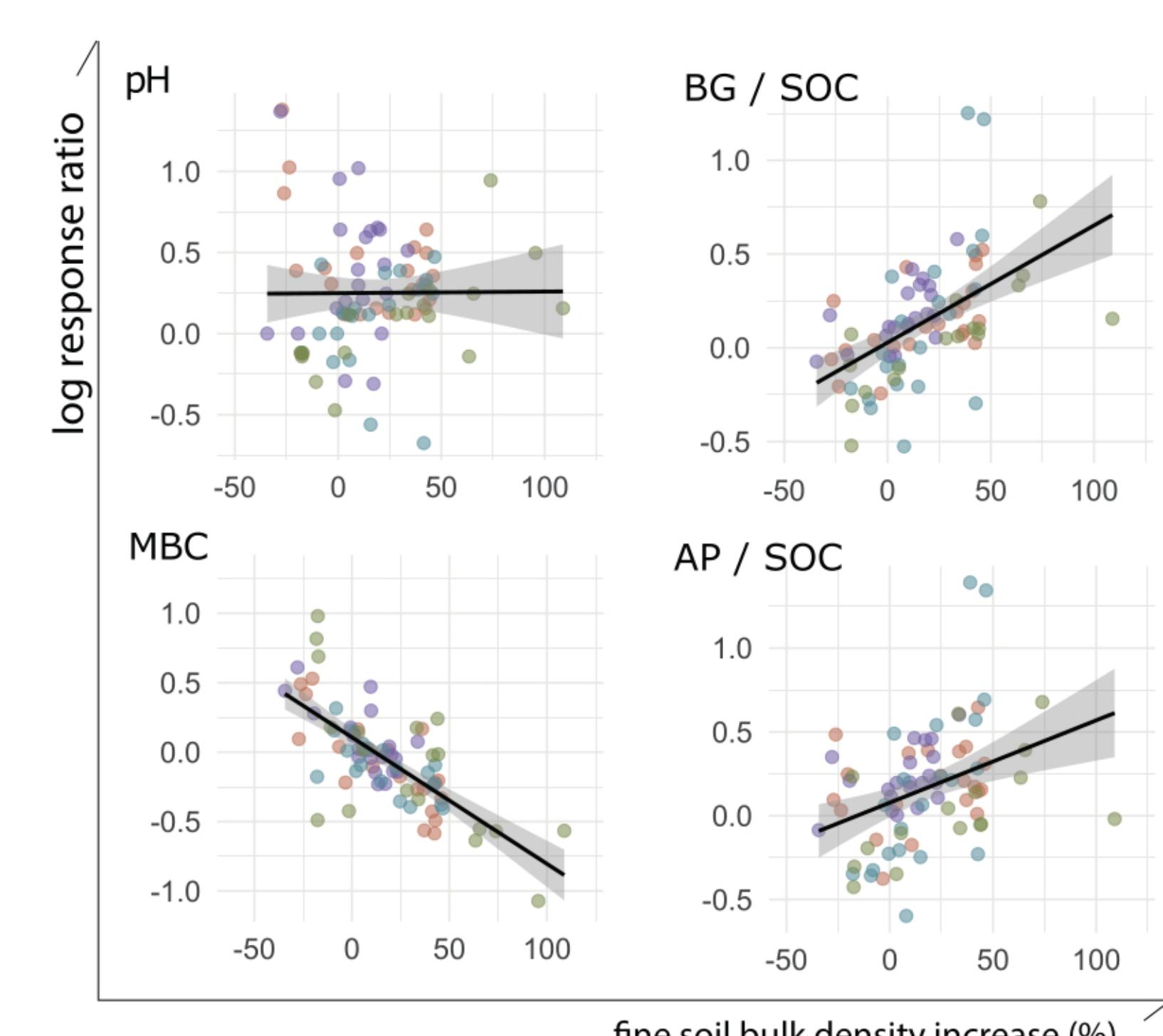
## Results



> Effect of skid trails on selected soil parameters. An effect size of 0 indicates no difference between skid trails and control, a negative value suggests lower values on skid trails, while a positive effect size indicates higher values. We used lmer models with skid trail as the fixed factor, plot as a random factor, and the relevant soil parameter as the response variable.

> Soil physical and chemical parameters are changed by the skid trail: soil density and pH are higher, the C/N ratio becomes narrower, i.e. the proportion of nitrogen in the soil increases.

> Soil composition changes on skid trails, which results in altered habitats for (micro)organisms. Skid trails in low mountain areas showed a decrease in the C/N ratio of microbial biomass (MBC/MBN), as well as increased microbial (MBC/SOC) and enzyme activities leading to faster carbon turnover (lower C/N) and increased CO<sub>2</sub> losses ( $qCO_2$ ) from the soil.



> Correlation between the relative increase in the bulk density of fine soil per plot (n=84) and the effect size (presented as the log response ratio) of a set of analyzed soil properties.

> The relative increase in the bulk density of the fine soil controls the effects of skid trails on many soil parameters, as shown by negative correlations with for example SOC, N or MBC and positive ones with specific enzyme activities involved in the C- and P-cycle.

## Related publications



RESEARCH ARTICLE

Severity of topsoil compaction controls the impact of skid trails on soil ecological processes



Journal of Applied Ecology

OPEN



Global Change Biology

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Disentangling the Impact of Forest Management Intensity Components on Soil Biological Processes

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