

Introducing the VESBO-project: Impact assessment of vascular plant encroachment on water and carbon cycling in a Sphagnum dominate bog

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Background

- Temperate and atlantic bogs play an important role in carbon and water storage
- Natural raised bogs are characterized by a *Sphagnum*dominated vegetation
- Majority of german bogs has been used for peat extraction or agriculture, but in the last decades the focus on restoration for reasons of nature and climate protection was increasing
- Ecological restoration after peat extraction: \rightarrow Re-establishment of quasinatural hydrological conditions & ecosystem typical vegetation
- Lately, a shift in vegetation vascular plants in bogs was observed^[1]
- → Impacts of vascular plants encroachment on water and carbon cycling are unknown

VESBO – project aims and output

Mechanistic analysis of evapotranspiration, net carbon balance and soil carbon sequestration

- → Partitioning of total ecosystem fluxes into bryophyte, graminoid and tree contributions to quantify contribution of plant functional groups to the total net-exchange of ecosystems
- \rightarrow Evaluation of the impact of the vegetation shift on water, net ecosystem carbon and GHG balance
- \rightarrow Parameterization of a soil-vegetation-atmosphere-transport (SVAT) model
- \rightarrow Assessment of vascular plant removal as nature conservation measure



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composition from bryophyte to

Central Hypothesis:

- Reduced water saturation main reason for vascular plant encroachment
- ET water loss is increased after successful encroachment, inducing an effective feedback loop for expansion
- Increased raises SOI aeration mineralization exceeding enhanced ecosystem sequestration by vascular plants, overall weakening the long term peat formation.

The SVAT-Model

The model ^[2] will be used for the model setup:



- 1-D, multi-layer, multi-species SVAT model including a separate bryophyte layer
- Bayesian inference of plant functional type parameters

References: ^[1] Kapfer J, Grytnes JA, Gunnarsson U, Birks HJB (2011) Fine-scale changes in vegetation composition in a boreal mire over 50 years. Journal of Ecology, 99, 1179–1189. ⁽²⁾ Launiainen et al., Coupling boreal forest CO2, H2O and energy flows by a vertically structured forest canopy - Soil model with separate bryophyte layer, Ecological Modelling, 2015.

peat



The VESBO-project – field site and data acquisition







 \rightarrow Two project sites with comparable soil conditions and land use history



Field setup (© Piayda, edited): One Eddy Covariance Tower in each site, Chamber measurements (H_2O, CO_2, CH_4) , meterological and soil hydrological measurements, vegetation traits









Lichtenmoor

- Restored atlantic (Lower Saxony)
- Vascular plant encroachment

Sphagnum-dominated

- temperate raised bog
- Drainage and peat mining since 19th century
- Rewetting activities in 1984
- 14 km² nature conservation area, 2.5 km² under European Habitat Directive

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