EXAFOR

EXTREME WEATHER EVENTS AND SOIL GREENHOUSE GAS FLUXES IN AUSTRIAN FORESTS. EVALUATING THE FEEDBACKS UNDER GLOBAL CHANGE

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Motivation

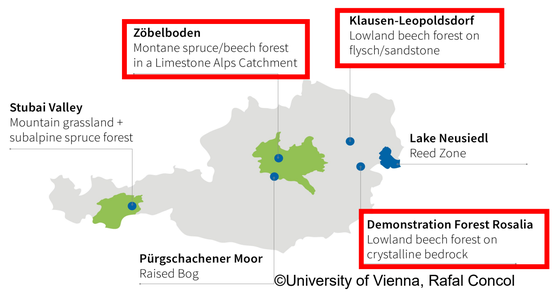
- Soils exchange large amounts of greenhouse gases with the atmosphere and are critical for the climate system.
- In Austria, forests are currently a net greenhouse gas sink.
- Climate change is changing the precipitation distribution, and both droughts and episodic rainfall events are becoming more frequent.
- Anthropogenic activities have also dramatically increased the N deposition rates into ecosystems, with abundant cases of N saturation.
- Forest ecosystems react to these disturbances, which may result in severe alterations of the C and N cycle of forest soils.

In this frame, the EXAFOR aim is

understand and quantify the impact of extreme weather events and atmospheric N deposition on the soil greenhouse gas balance of representative Austrian forests.

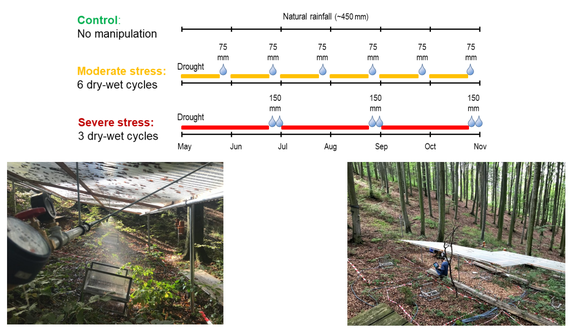
The EXAFOR Approach

Three representative Austrian beech forests



- Highly instrumented sites belonging to the LTER network, along a climatic and N deposition gradient

Field simulation of extreme events

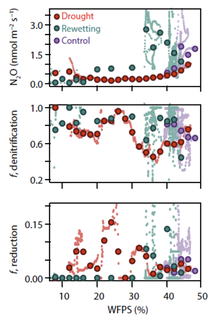


- Simulated drought and heavy rainfall events under field conditions
- Increase of atmospheric N deposition rates

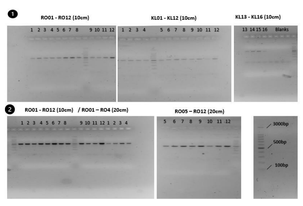
State-of-the-art measurements of greenhouse gas fluxes

- GasFluxTrailer: Subdaily estimates of greenhouse gas fluxes with automated chambers

Detailed microbial and nutrient analysis

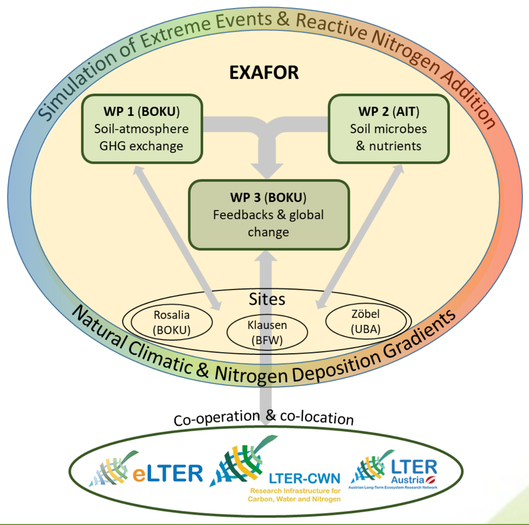


Harris, Díaz-Pinés et al 2021, Science Advances 7: eabb7118

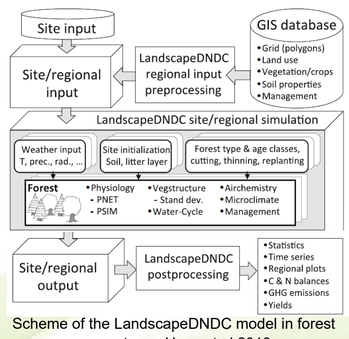


Villalba 2021

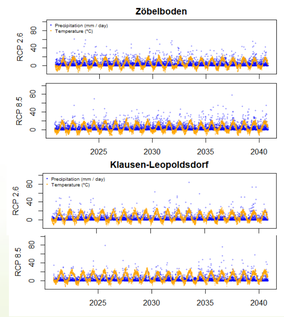
- Study of microbial processes with N_2O-isotopomers
- Novel methods for quantification of methanotrophic bacteria



Process-based biogeochemical modelling under future climate scenarios



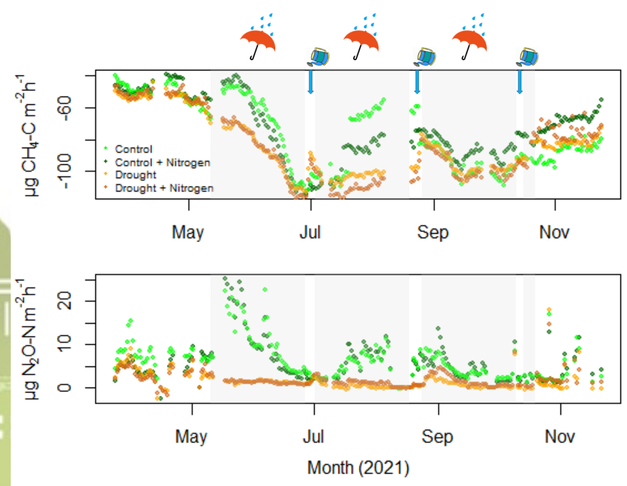
Scheme of the LandscapeDNDC model in forest ecosystems. Haas et al 2013



Regional climate model data from the EURO-CORDEX ensemble used for biogeochemical modelling

Ongoing Work and outlook

Effect of manipulations



Soil CH_4 and N_2O fluxes in Klausenleopoldsdorf during the manipulation. Grey areas denote precipitation-free periods for the „drought“ treatment

Where we are...

Tasks	WP1	WP2	WP3
	GHG Measurement campaigns in Rosalia	ddPCR, mic. biomass and nutrients Rosalia (2021)	Detailed experimental time plan
	Data analysis Rosalia	ddPCR, mic. biomass and nutrients Klausen	Data management policy
	GHG Measurement campaign in Klausen	ddPCR, mic. biomass and nutrients Rosalia (2022)	Rain-out-shelters operational in Rosalia (new plots)
	Data analysis Klausen	ddPCR, soil mic. biomass and nutrients Zöbelboden	Rain-out-shelters operational in Klausen
	GHG Measurement campaign in Zöbelboden	Community data	Rain-out-shelters operational in Zöbelboden
	Data analysis Zöbelboden		GHG fluxes modeled (RCP climate models)

Legend: Color — Degree of accomplishment: 0%, 25%, 50%, 75%, 100%

Overview on degree of accomplishment of the different project tasks (status March 2021, month 18/36)

Achievements

- Fernández-Alonso et al 2021, Biogeochemistry
- Invited talk in Ben-Gurion University
- One completed Master Thesis
- One ongoing PhD, two ongoing Master Theses
- Synergy with eLTER-PLUS (H2020):
  - Litterbag experiment started
  - Paired-experiment in Negev desert planned

Plot set-up in Zöbelboden, March 2022

Litterbag experiment in Rosalia (October 2021)

Dieses Projekt wird aus Mitteln des Klima- und Energiefonds gefördert und im Rahmen des Programms „Austrian Climate Research Program“ durchgeführt

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