Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title:	**Forest ecosystem functioning in response to wetter winters along a large climatic gradient (WetWin)**
Project ID:	303
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PROJECT DESCRIPTION

General research topic

Climate models consistently project moderate to large increases in air temperatures in most temperate ecosystems over the next century, with warming in winter exceeding warming in all other seasons for central and northern Europe (IPCC 2013). In addition, winter precipitation is expected to increase and to shift from snow towards rain (IPCC 2013). Soil temperature over winter, which is strongly driven by snow cover, drives many relevant ecological processes in temperate ecosystems (e.g. biogeochemistry or overwintering of organisms, Kreyling2010). Notably, decomposition and mineralization rates depend on soil temperatures and increase with warming (Rustad et al. 2001). Increased winter rain is consequently expected to lead to stronger N-leaching of the mineralized nutrients and may also increase nutrient input via atmospheric deposition (Bowles et al. 2018). It is unclear how such increased mineralization, deposition and leaching would affect primary productivity and other ecosystem functions (Kreyling2020).

Experiment and analyses

We simulated winter climate change in European beech forests at their north-eastern distribution range between Rostock in Germany and Gdansk in Poland (Fig.1). Therefore, experimental manipulations of individual trees were carried out with rain addition and snow exclusion treatments during winter (Fig. 2).

Please find the hypotheses formulated at the beginning of the project in Fig. 3.

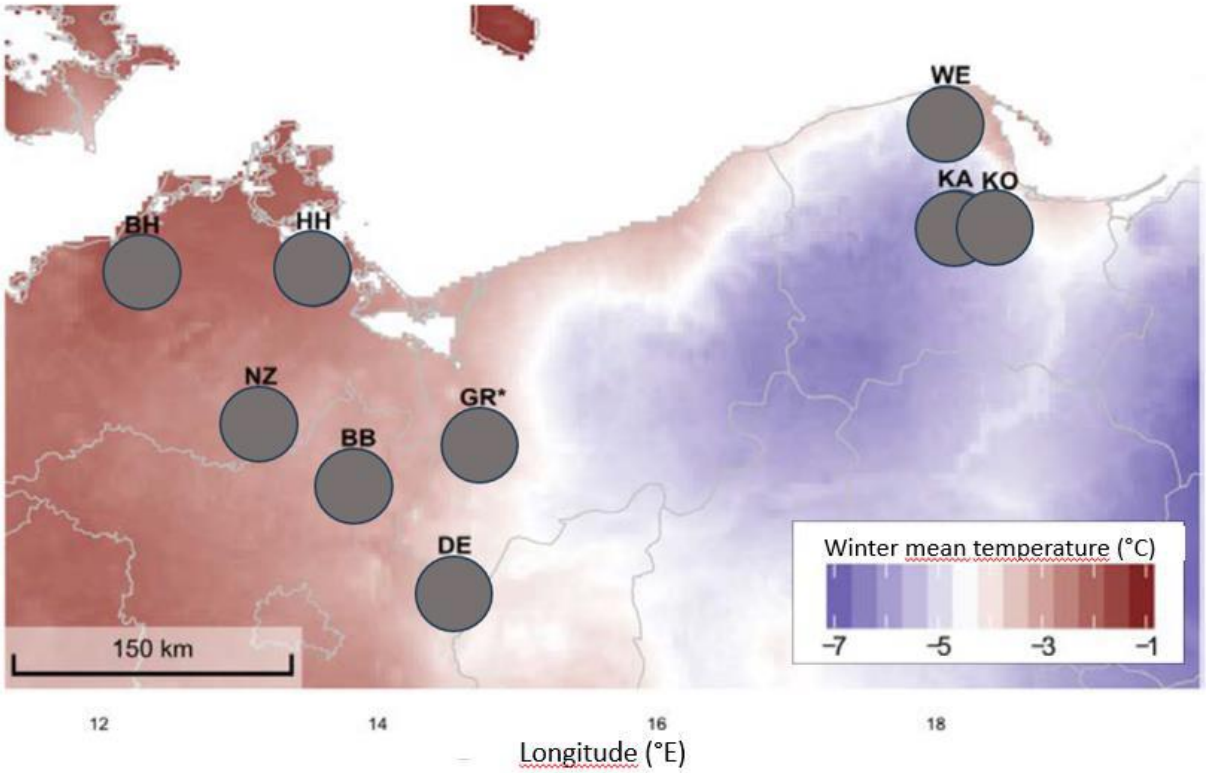

Fig. 1 Study sites of the project in Germany and Poland.

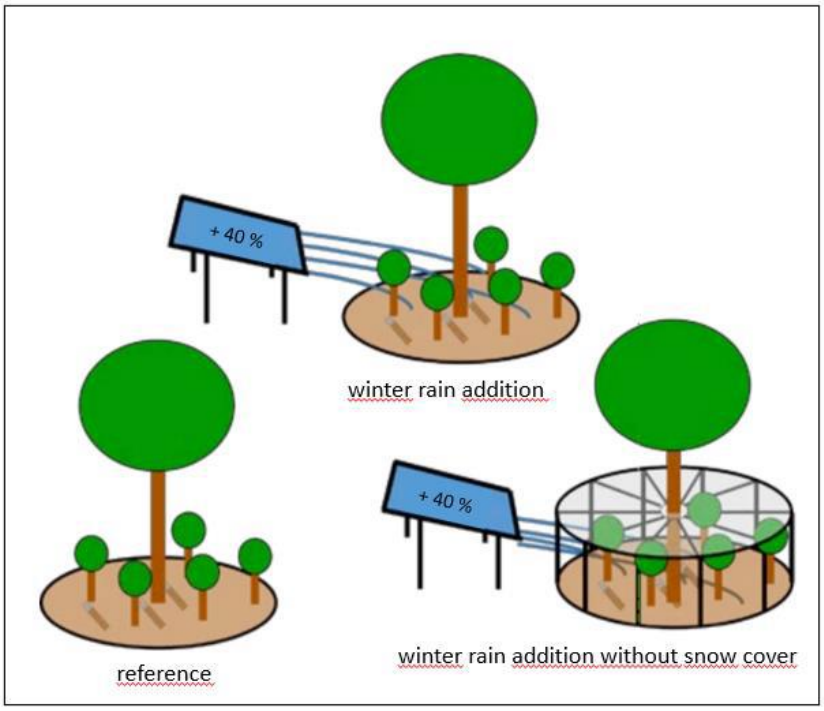

Fig. 2 Experimental manipulations at one exemplary study site.

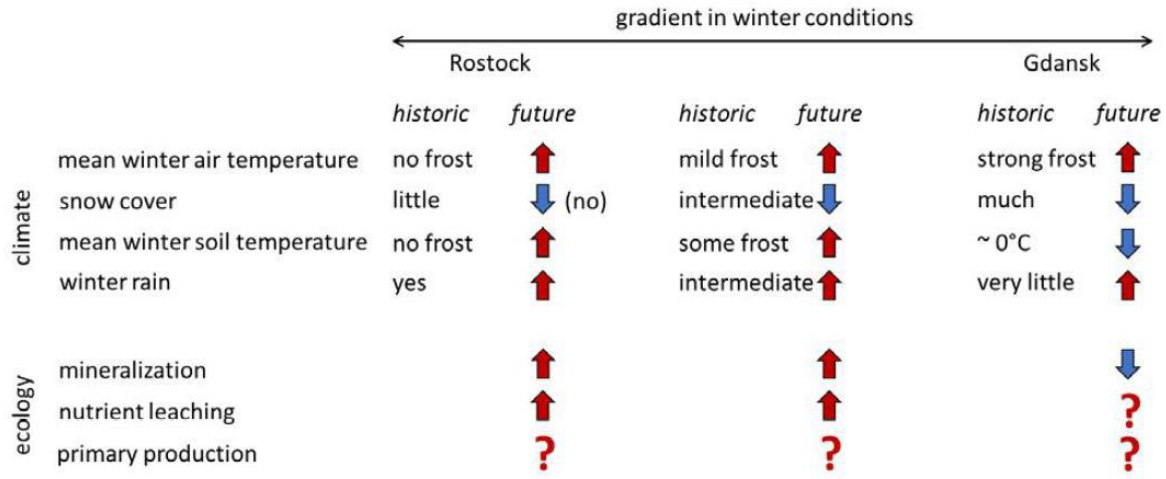

Fig.3 Expected climatic changes and hypotheses for ecological responses to wetter winter conditions in a gradient between historically warm and snow-poor conditions to historically cold and snowy conditions. Question marks identify key uncertainties for which the state of the art does not provide enough data to formulatea clear hypothesis.

Several response parameters were analysed including decomposition, mineralization, above-and belowground growth, nutrient availability, deposition and leaching.

For the nutrient analyses, the Plant Root Simulator (PRS) technology was used. PRS probes are ion exchange resin membranes held in plastic supports that are easily inserted into the soil to measure ion supply in situ (https://www.westernag.ca/innovations/technology/basics).

PRS probes were inserted into the upper soil layer to test nutrient availability for the plants and into 50 cm depth to test nutrient leaching.

First results

We found significant enhancement of nitrogen and sulphur deposition in the rain addition plots. Interestingly, the additional amount of deposition in response to the rain addition treatment was immediately washed out and did neither affect decomposition rates nor above- or belowground growth of the manipulated trees.

Importance of ICP Forests Level II data

Since the PRS probe technology does not provide absolute values of nutrient supply, but only relative values depending on the burial length, I now want to evaluate how big this leaching effect may be in terms of changing climate (wetter winters). Therefore, I require temporally and spacially dissolved data of deposition rates within our study area in north-eastern Germany and northern Poland for the study years 2021, 2022 and 2023. If the current years are not yet available, it is also very useful to get data of previous years. This would help me a lot to put the results of my experiment into a larger context.

Literature

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