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Experimental plant ecology meets dendroecology:

On the effects of climate and extreme weather events towards the cold distribution margin of European beech (*Fagus sylvatica* L.)

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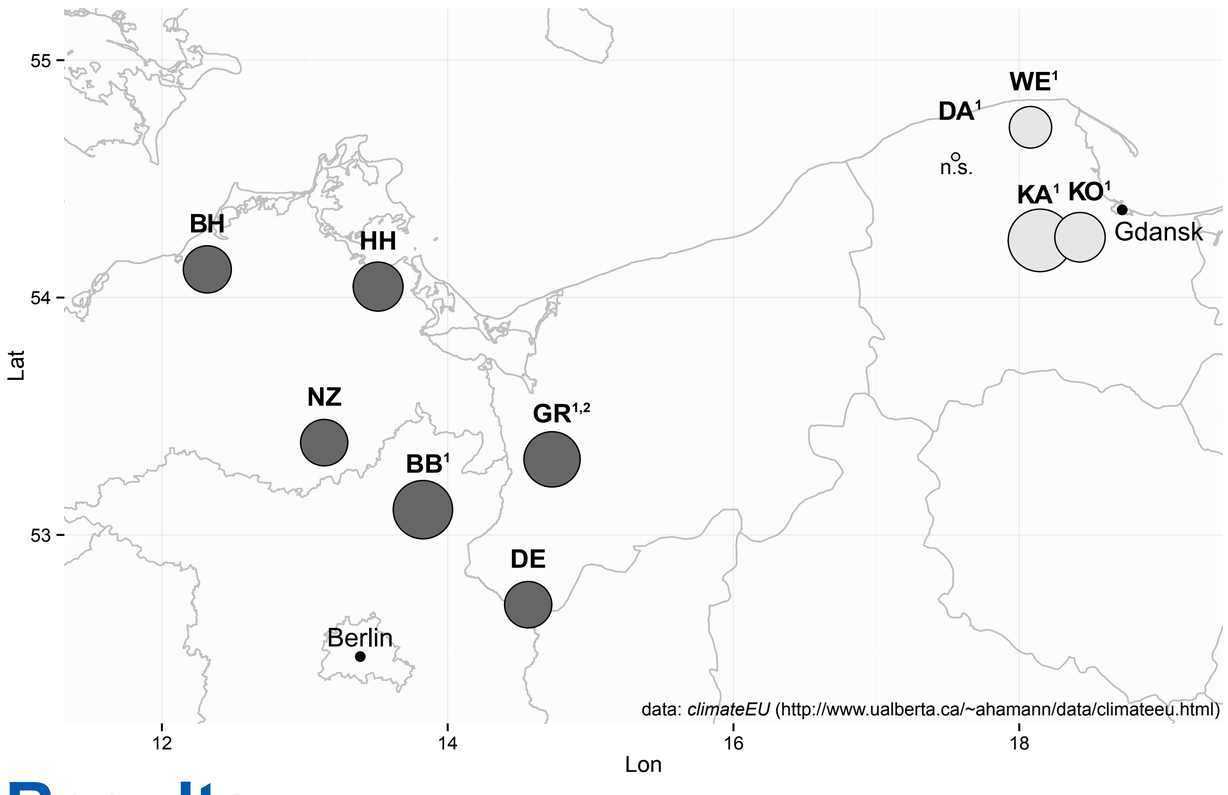
Background

European beech (*Fagus sylvatica*) reaches the margin of its closed distribution area in northern Poland. Approaching this eastern cold margin, growth responses to winter climate and extreme growth anomalies might increase. A combination of dendroecology and experimental plant ecology will provide insights into climate sensitivity and effects of extreme weather events in temperate beech forest ecosystems.



Climate-growth relationship (1940–2009)

Correlation (R)

0.20 0.25 0.30 0.35 0.40

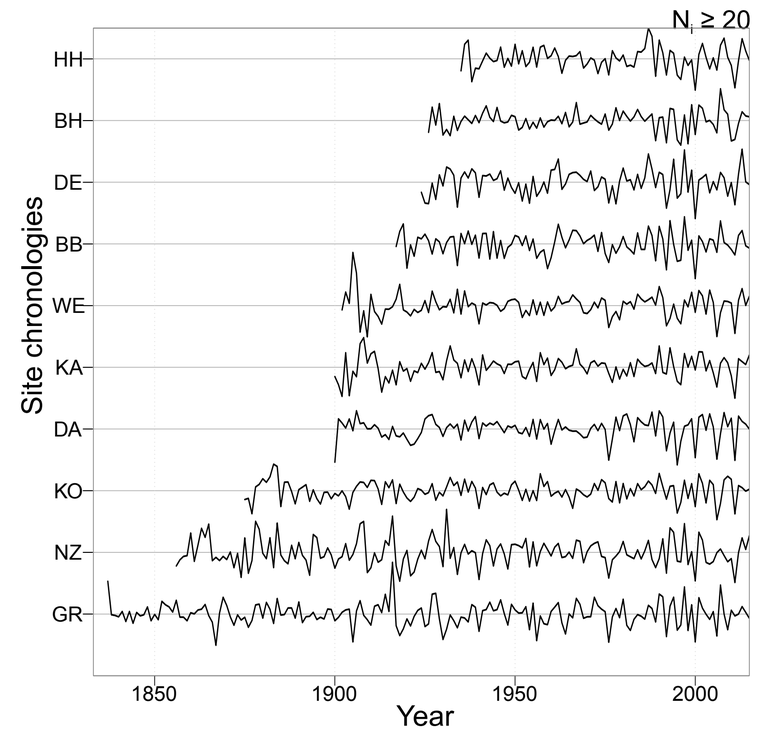
Significant growth response to summer precipitation (June)

Significant growth response to winter temperature (February)

Additional significantly
[1]negative response to T_{June}
[2]positive response to T_{Feb}

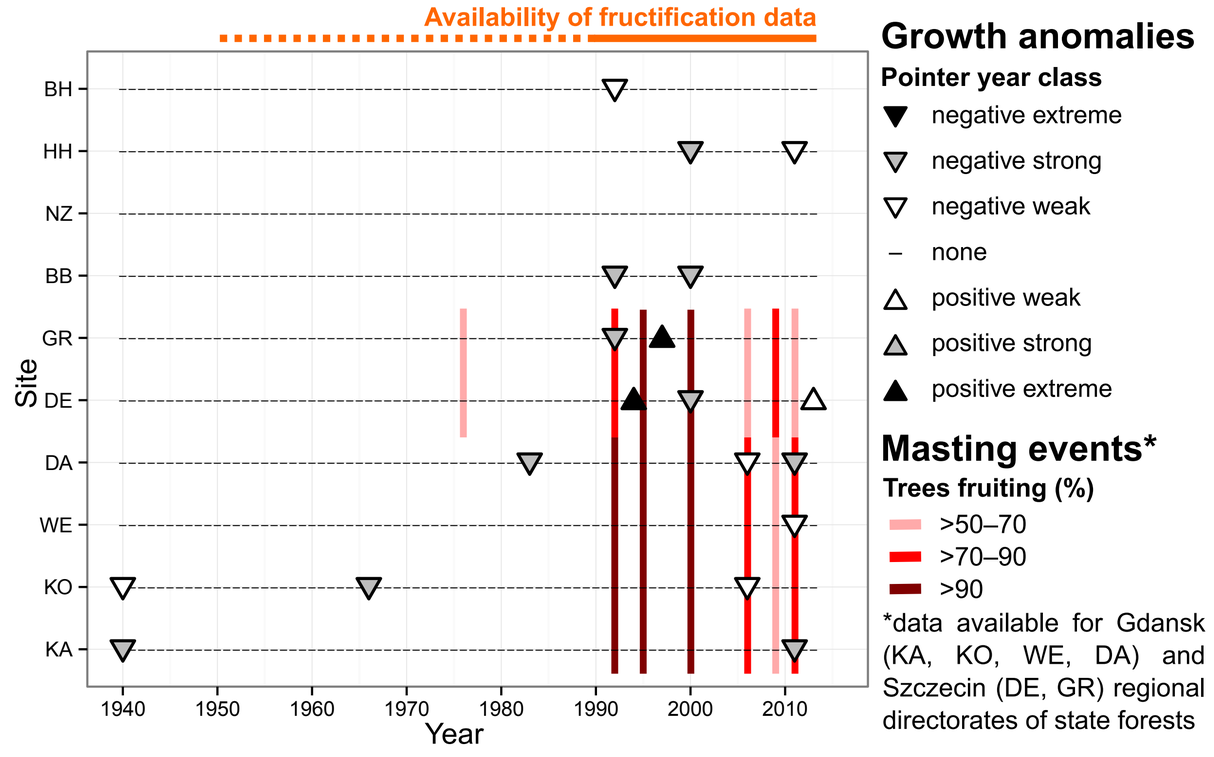
Mean Winter Temperature (°C)

−4 −3 −2 −1 0 1



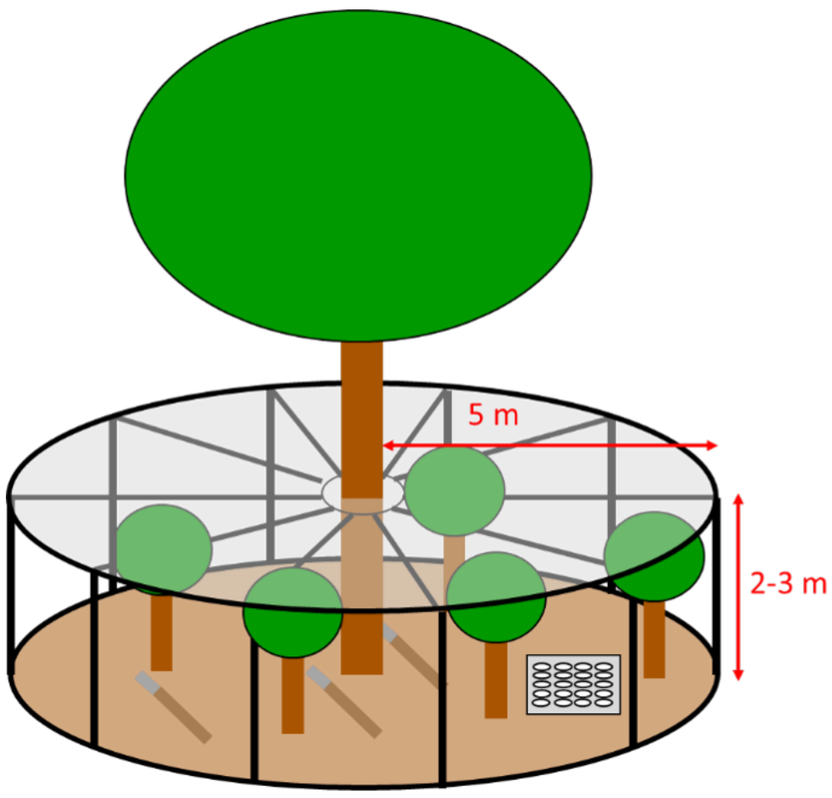
Results

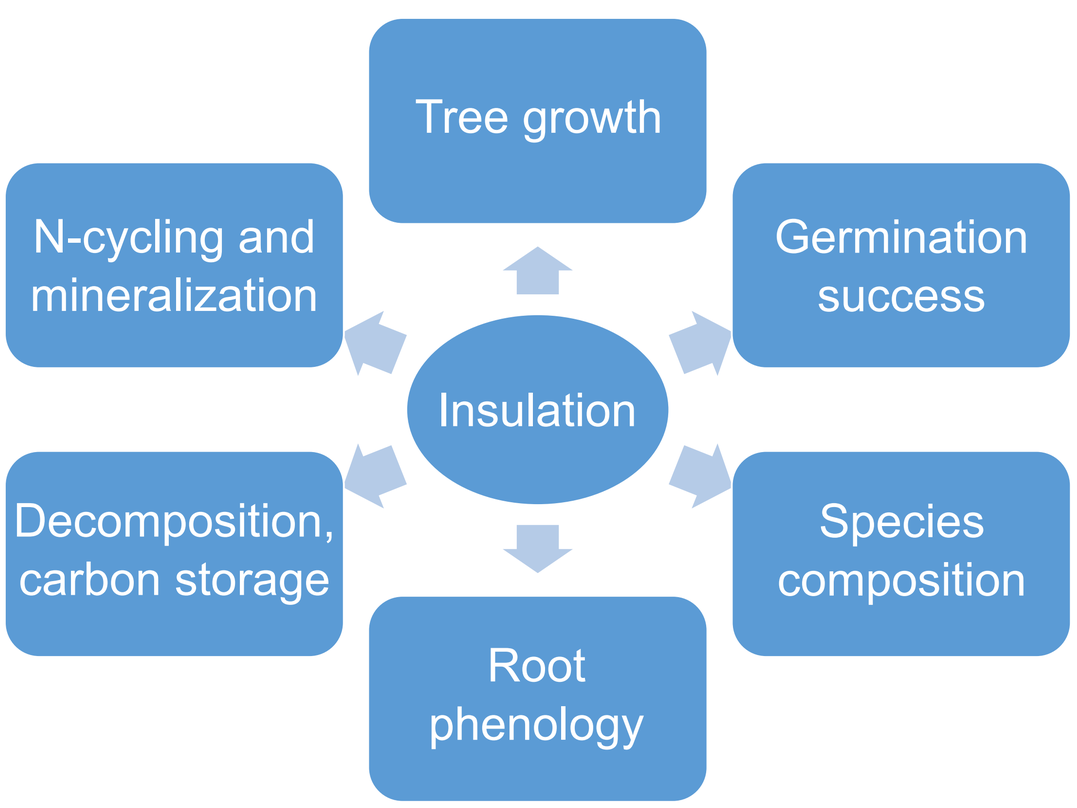
Growth of European beech strongly responded to summer precipitation at the western sites with warmer mean (winter) temperature. At the colder eastern sites, winter temperatures were found as main drivers for tree growth. Growth anomalies increased in time after 1990 instead of increasing spatially towards the cold margins. Transregionally occuring negative growth depressions coincided with recorded masting events.



Outlook to frost experiment

Based on the analysis of growth signals, representative sets of trees could be found for each site. These trees will be used for climate manipulation in future (ie. reduction vs. increase of snow cover/insulation in winter and control). Responses to experimentally altered insulation on above and below ground changes in beech forest ecosystems will be studied in Poland and Germany from winter 2016/2017 onwards.





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Experimental Plant Ecology

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