Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: **Simulating the impacts of drought-induced tree mortality at the stand scale**

Project ID: **308**

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PROJECT DESCRIPTION

Simulating observed drought-induced mortality patterns in temperate forests is a significant challenge for forest modeling, as both empirical and dynamic models often struggle to adequately capture and reproduce mortality events resulting from the combination of climatic extremes and biotic disturbances (Steinkamp and Hickler, 2015).
In a first study, we investigated the drivers and processes that led to observed mortality patterns during the drought years 2018-2019 in selected managed forest stands in Switzerland. To this end, we developed a modeling framework that combines predisposing and inciting stress factors, according to the decline disease theory (Manion 1981, Pedersen 1998) to explain the observed mortality patterns following the 2018 drought event. This modeling approach has been implemented in the forest gap model ForClim (Bugmann 1994; Huber et al., 2020).
To validate our approach, we conducted a simulation study on six sites primarily dominated by beech, where canopy decline followed by tree mortality has been observed (Neycken et al. 2022). Our simulation results indicate that the new model version of ForClim can indeed accurately model and reproduce the mortality events triggered by the extreme droughts between 2018 and 2020 in Switzerland.
However, our approach has only been tested on a very limited number of sites and solely for one specific tree species (*Fagus sylvatica*). Therefore, our next step is to evaluate the new ForClim version across a larger number of sites, encompassing additional species and spanning larger environmental and climatic gradients.

We recently came across the study conducted by George et al. in 2022, in which ICP Level I forest data have been used to assess long-term assessment of mortality patterns induced by drought for selected tree species at the European level. We believe that the ICP Level I forest data aligns perfectly with our research objectives, as it provides comprehensive and long-term assessments of mortality patterns induced by drought, which we would need to validate a newly developed modeling approach in a simulation study with the forest gap model ForClim.

As in George et al, we intend to request only plots in which: i) mortality instances, specifically removal mortality, was attributed to drought, ii) survey years begin in 1992 onwards as to obtain a constant sample size for each year, iii) the main species are *Abies alba, Fagus sylvatica, Picea abies and Pinus sylvestris*.

Our overall goal is to initialize the model with observed data and run simulations in selected plots in which drought-induced mortality has been observed and sites in which no mortality was recorded (e.g., control plots).

Ultimately, we will present our findings in a peer-reviewed publication based on the above study which will advance our research and contribute to the scientific community.

References

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