IsotopeANA

Water use efficiency and resilience in beech trees following the 2018 extreme drought in northeastern France

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Collaboration: Département de la Santé des Forêts (DSF)

Summary (300 words max)

Context —Recently, an unprecedented decline of European beech (Fagus sylvatica L.) is observed in Central Europe following the 2018-2020 drought event, that is extremely worrying for stakeholders. We need to improve our understanding of the risks for beech tree dieback under hotter droughts in the future.

Objectives — The project aims to understand the physiological mechanisms that allow beech trees to resist drought and promote their recovery and, on the contrary, those that lead to tree death. Particular attention will be paid to water use efficiency (WUE), a functional trait that integrates both carbon and water responses of trees.

Approaches — In the Northeast of France, 60 trees with different crown condition, monitored since 2019 by the DSF, will be selected. These trees are distributed in four stands presenting different soil water deficit, retrospectively calculated with the soil water balance model, BILJOU©. Tree core will be sampled for ^{13}C and ^{18}O analyses in last 10 tree rings (rings before, during and after drought) to determinate the annual WUE and water and carbon limitations to the variation in WUE. In addition, retrospective xylem wood anatomy measurements and cambial growth on the same tree from the parallel project RiskForBeech will complete the dataset.

Expected results and impacts — The results should help identify physiological thresholds for drought-induced decline in beech trees. Monitoring WUE in tree rings in parallel to cambial growth and crown conditions evolution could help predict a trajectory of tree resilience or decline after extreme drought events.