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Potential of typical highland and mountain forests in the Czech Republic for climate-smart forestry: ecosystem-scale drought responses

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Climate-smart forestry (CSF) consists of an extensive framework of actions directed to mitigating and adapting to global climate change impacts on the resilience and productivity of forest ecosystems. This study investigates the impact of the pan-European 2018 drought on carbon exchange dynamics in typical highland and mountain forests in the Czech Republic, including two coniferous (Norway spruce at Bílý Kříž and Rajec) and one deciduous (European beech at Štítná) stand. Our results show annual net ecosystem CO₂ uptake at Rajec to be reduced by 50% during the drought year in comparison to a reference year with normal climatic conditions. Bílý Kříž is less affected by drought, as the local microclimate ensures sufficient water supply. The European beech forest at Štítná is most resilient against drought and its negative impacts: there we detect no differences in carbon exchange dynamics between the drought year and the reference year. We consider the matching of tree species to site conditions as crucial in the context of CSF, specifically regarding the stand response to water limitation and water supply and demand. Successively replacing spruce with beech trees in areas with high water demand but limited water supply, like Rajec, will support the goals of CSF.