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Forest management and hotter droughts: tree-growth monitoring during 2018/2019 in northeastern Germany

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Forests are vital ecosystem service providers and are thought to play an important role as carbon sinks in climate-warming mitigation. Climate change can modify environmental forcing of tree growth, bringing changes in growth performance and ultimately in ecosystem community composition. Thus, studying how trees and forests react to a changing environment is required to preserve and manage them sustainably. It is largely unexplored how extreme weather events, such as the so called “hotter-droughts”, interact with silvicultural interventions (thinning). To address this problem, we explore a monitoring data set from 2017-2020 of three broadleaved species native to the Central European temperate forest (*Fagus sylvatica* L., *Quercus robur* L., *Betula pendula* Roth). To investigate the effect of thinning interventions and weather conditions on intra-annual growth, an experimental gap was created at the end of 2016 in the studied stands. Trees standing next to the gap and others on closed-stand conditions were equipped with band-dendrometers, which were read out bi-weekly throughout the four vegetation periods. The obtained growth-curves were used to compare absolute and relative growth between experimental conditions (gap vs. closed), and non-linear models were fitted to derive the phenology of stem-growth. In general, trees under gap conditions revealed smaller increments than trees in closed stands during the drought years 2018/2019, but especially for 2019. Species differences indicate beech was most sensitive to the extreme summer drought, as expected given the conclusions of several dendroecological studies. The results indicate different sensitivities to extreme events on the years following silvicultural interventions between tree species. As gap-formation occurs also naturally in temperate forests, these results suggest a possible mechanism through which legacy-effects and variability in individual climate responses arise, which can help unravel climatic signals in tree-rings and explain how they are modulated by ecological conditions and management interventions. Monitoring of tree-growth in a high-temporal resolution seems a valuable approach to understand the impact of extreme events and climate change on tree-growth. The obtained insights are relevant for improving sustainable silvicultural management, as the suitability of a species for a site might change upon further warming and more frequent drought spells. We recommend continuing to explore tree-growth at finer time-scales to shed light on species performance under climate change.