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Current state and resilience of three main tree species in southern Germany with regard to drier and hotter weather conditions over the past 50 years

Annette Debel and Achim Bräuning
Friedrich-Alexander University Erlangen-Nuremberg, Erlangen, Germany

Latest drought events and their already visible damage to trees highlight the crucial need to assess the current state and resilience of forest ecosystems in southern Germany. However, commonly applied dendroclimatic approaches rarely take into account, how weather patterns affecting trees are modified by topographic conditions. For this purpose, three main tree species were studied at three low mountain ranges and three corresponding basins in the topographically complex province of Bavaria (southeast Germany). A response analysis between climate proxies and tree-ring widths was used to investigate climate-growth relationships over the past 50 years of both coniferous and deciduous tree species at each forest site. Temporal stability of tree responses to climate was compared for two 25-year periods to detect possible modifications in climate-growth correlations. A pointer year analysis was also conducted to analyze tree response to climatic extreme events. The results showed that Scots pine (*Pinus sylvestris*) was the most vulnerable and least drought-resistant of the investigated tree species. Although Norway spruce (*Picea abies*) and European beech (*Fagus sylvatica*) benefited from an extended growing season at high elevation sites, they showed higher drought sensitivity over the past 25 years. Beech responses were rather inhomogeneous and even differed in the optimal precipitation period. However, lower correlation coefficients for summer precipitation at the driest site may indicate the ability of beech to adapt to less summer precipitation. Nevertheless, increasing drought frequency, as predicted, poses a serious threat to all studied tree species, including even the colder and more humid sites. Hence, to more accurately estimate risk potentials under future weather conditions, we will combine dendroclimatological results with climate modelling scenarios, particularly expected future frequencies of critical weather types on the local scale.