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## The 2018 drought and its consequences: Investigating the resilience of different tree species based on comprehensive long-term monitoring of forest hydrology

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Many forests in Central Europe experienced unprecedented drought conditions in 2018. The exceptionally long dry period, lasting from early-summer 2018 and into the winter, was followed by another dry summer with record-breaking temperatures. Ecohydrological consequences of extended droughts for these temperate forest systems are difficult to anticipate, and investigating the resilience of forest hydrological systems requires comprehensive and systematic long-term observations.

Monitoring at the TERENO-NE temperate forest observatory in northeastern Germany includes input characterization (throughfall and stemflow), high-resolution soil moisture observations in 14 different forest stands down to a depth of 2 m below the soil surface, shallow and deep groundwater observations, sap flow, tree water deficit and high-resolution tree growth measurements since 2012. The investigated forest stands cover the three tree species pine, oak and beech in both pure and mixed stands. This is complemented by terrestrial gravimetric measurements of total water storage changes. Steep hillslope transects allow us to investigate the impact of presence or absence of groundwater availability on tree water uptake and growth.

We find that after the unprecedented drought in 2018, which already had pronounced ecohydrological effects, the rainfall amounts over the winter 2018/19 were insufficient to refill the subsurface water storages. Dry conditions altered the growth phenology of each monitored tree species, while tree-water deficit and tree growth were negatively impacted in both years, but to varying extent. Soil moisture storage and dynamics are strongly affected and the drought caused a long-term memory effect.