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Climate-driven variations in functional strategies of temperate forest ecosystems

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Tree functional strategies play a crucial role regulating the fitness and ability of forests to cope with water stress. However, current understanding on community-level functional strategies of forest ecosystems and how they vary with geographic patterns is still limited. We combined eight functional traits (e.g. leaf nitrogen content, xylem conductivity, leaf area to sapwood area ratio, leaf mass area, xylem water potential at 50% loss of conductivity, slope for the curve between P50-P88, leaf turgor loss point and wood density) with forest inventory data across the USA and Europe (12,332 0.25° gridcells) to identify functional strategies with respect to water stress and to analyse their relationships with climate factors and across functional groups. Principal components analysis suggests that functional strategies at species-level could be captured at community-level. Acquisitive-conservative strategies loaded along the first dimension, while the water storage and isohydricity strategies loaded along the second dimension. Spatial patterns of community-level strategies showed more explanatory power with temperature than aridity. Multiple community-level strategies at a grid cell were observed at water-limited sites, which were broadly captured by broad functional groups based on leaf type and phenology. Our findings promote the understanding of forest adaptation to drought and provide a basis for improving the ability of ecosystem models to predict the patterns of tree mortality and forest biomass accumulation.