Anisohydric species acclimated hydraulic traits to high temperature while isohydric species increased dieback during drought in temperate tree species

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Climate warming are projected to increase the frequency of climate extremes. The physiological response of tree species to these changes has not been well characterized. Particularly, how hydraulic parameters may adjust with temperature and what are the impacts during severe drought in mesic forest tree species have limited study. Further, the pattern of responses to drought and recovery has been linked with isohydry-anisohydry strategies, but we do not know if these strategies are still relevant in the hotter and drier future.

To fill this knowledge gap, we built a factorial experiment with ambient (AT) and high temperature (HT; ambient +4.5 ^{0}C) for two growing seasons, with six weeks of initial acclimation period, four weeks of drought, and six weeks of recovery during the first year on seven tree species. Throughout, we followed water relations, leaf gas exchange, stem water potential, and hydraulic conductivity.

Seedlings were acclimated to prolonged HT by adjusting key hydraulic traits and increasing anisohydry strategies, but these traits were not coordinated, as some isohydric species had surprisingly high stem water potentials at 50% loss of xylem conductivity (P_{50}) and some anisohydric species had negative safety margins. In addition to this, anisohydric species reduced stem water potential during drought and delayed recovery, while isohydric species experienced earlier reductions in photosynthesis and increased dieback at HT.

Our findings highlight that hydraulic traits may acclimate to HT and reduce some of the additive effects during drought in anisohydric species, but hotter drought intensified soil and atmospheric drought and increased mortality in isohydric species. Thus, acclimation of hydraulic traits to HT may help anisohydric species to avoid some of the consequences but can't compensate for the negative effects.