

Since there is a lack of experimental warming experiments investigating the effects on tree growth I did a more general search on growth phenology

Farnsworth et al. **Phenology and growth of three temperate forest life forms in response to artificial soil warming**

- only soil warming. therefore tricky to evaluate effects on above-ground growth responses

Etzold et al. 2021: Number of growth days and not length of the growth period determines radial stem growth of temperate trees

Very interesting paper using dendrometers across Switzerland (160 individuals 7 temperate tree species at 47 sites across Switzerland over 8 years). They found that across a wide environmental gradient there are still some species-specific patterns of growth phenology. Peak growth happens always before the summer solstice.

From the potential growing season growth occurred only on 29-77 days (30 - 80% of the GS).

Growth is limited mainly by photoperiod that seems to set the 'window of opportunity', high VPD and low soil moisture.

Gricar et. al. 2020: Timeline of Leaf and Cambial Phenology in Relation to Development of Initial Conduits in Xylem and Phloem in Three Coexisting Sub-Mediterranean Deciduous Tree Species

microcores at high time intervall to investigate xylem and phloem phenology

- ring-porous species showed radial growth activity a month before buds were swollen.

- diffuse-porous: same bud and cambium activity

Tumajer et al 2022: Limitation by vapour pressure deficit shapes different intra-annual growth patterns of diffuse- and ring-porous temperate broadleaves

Using dendrometers:

- Ring-porous: redistribute growth according to optimal VPD

- diffuse-porous: sustain growth under suboptimal VPD