

# Leaf phenology and carbon storage dynamics along the vertical gradient of mature tree crowns

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## Background

Phenological avoidance is common between forest layers, seedlings avoid the shade by opening their leaves earlier than the adult trees. But whether that also happens within the crowns of adult trees is unclear. Phenology and light availability are major drivers of seasonal non-structural carbohydrate (NSC) storage dynamics, therefore differences in these dynamics might be expected between sun- and shade twigs of tree crowns, especially if there is phenological avoidance.

We investigate differences in the timing of leaf phenology and the seasonal dynamics of NSC along the vertical gradient in the crowns of adult trees from nine common temperate species, at the Swiss Canopy Crane II site in Hölstein, Switzerland.

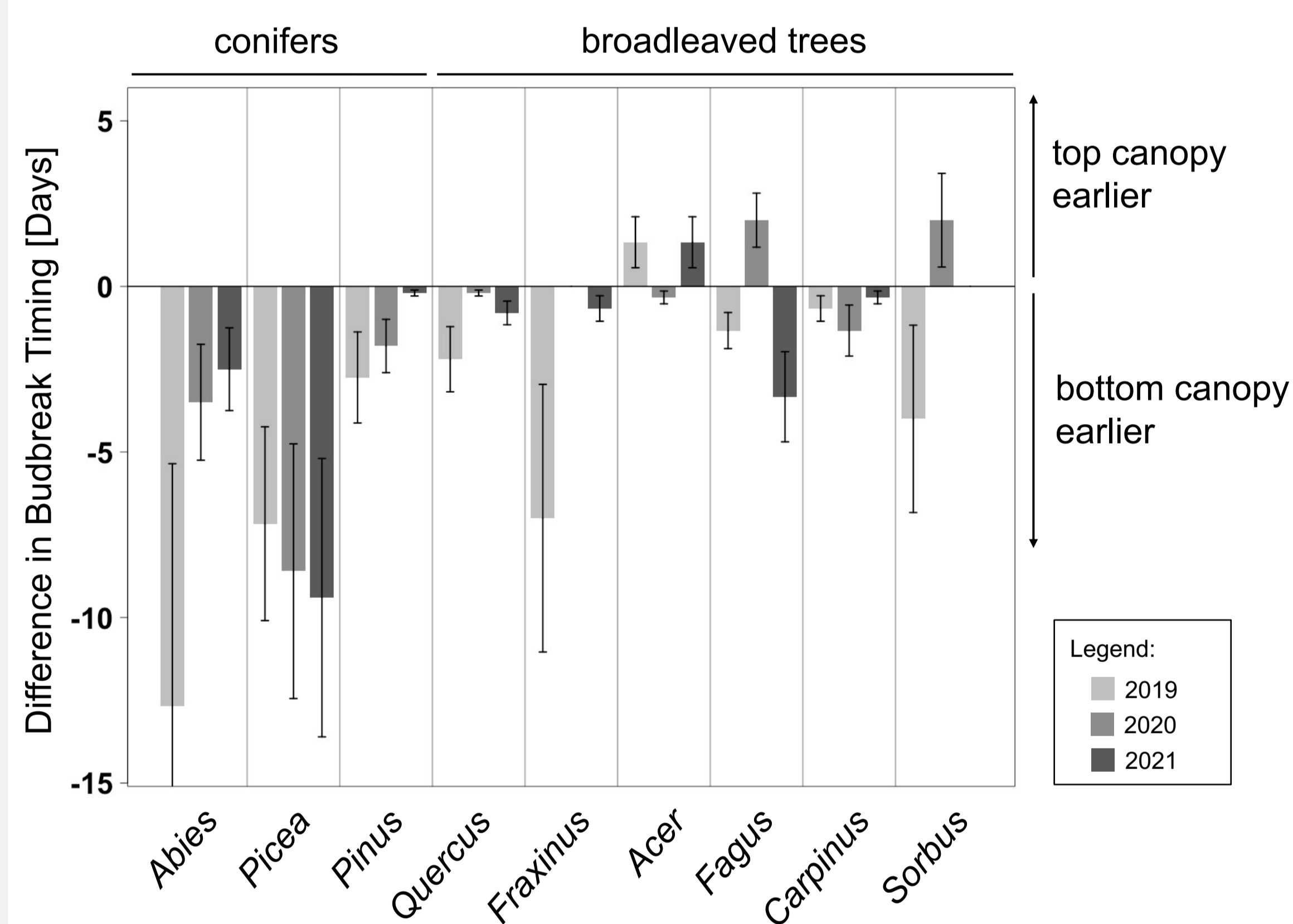
## Objectives

- 1) Is there phenological avoidance within individual crowns of large trees?
- 2) Do seasonal NSC dynamics differ between sun- and shade twigs?
- 3) Are these differences driven by phenological avoidance and light availability?

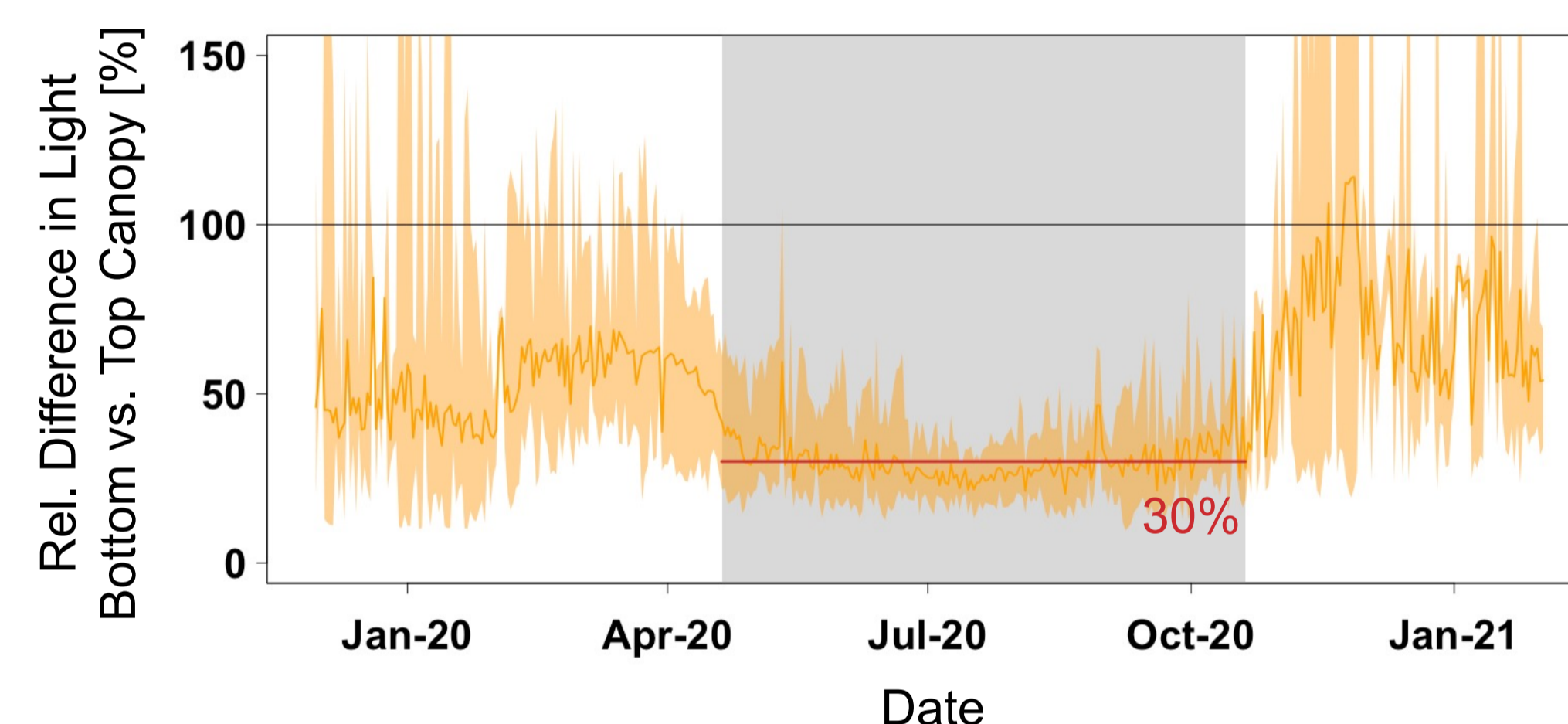
## Conclusions

- 1) No clear pattern of phenological avoidance within tree crowns.
- 2) Very similar NSC values between sun- and shade twigs throughout the season and in all nine species.
- 3) Trees seem to target certain amounts of stored carbon, especially at the end of the season.
- 4) NSC is not a good proxy for twig level C source-sink balance.

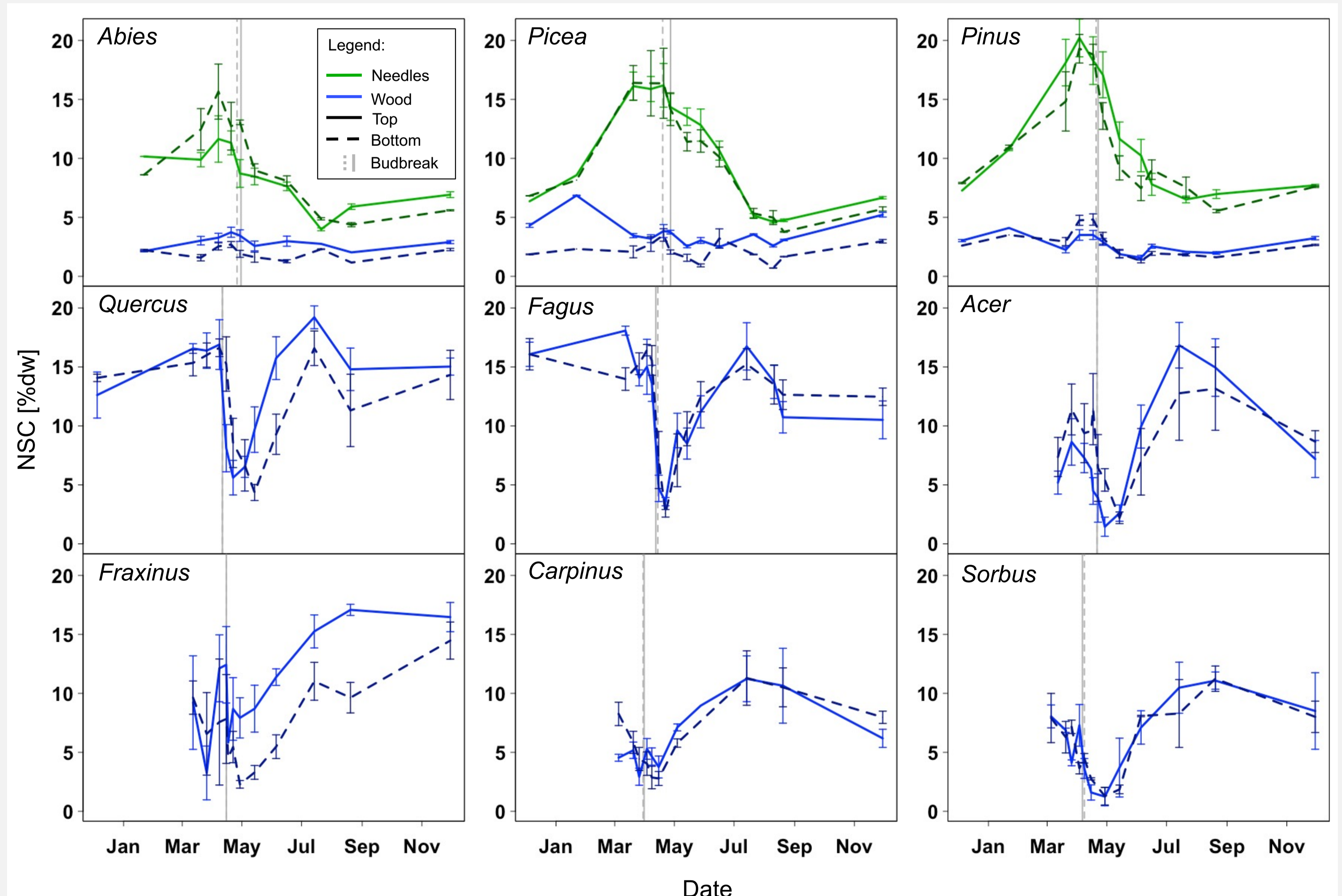
## Results & Discussion



There was no clear difference in budbreak timing between top and bottom crowns in the broadleaved species. Differences were mostly very small and inconsistent between years. Only the evergreen conifers *Abies* and *Picea* show consistently earlier leaf-out at the bottom of their crowns.



The light availability at the bottom of the tree crowns relative to the top is on average 30% throughout the growing season (grey box) in the forest at the Swiss Canopy Crane II site.



NSC levels were very similar in the top and the bottom crown in most species and throughout the season. Especially the levels at the end of the season were very close in all species. The seasonal dynamics of NSC were mostly driven by starch, with soluble sugars staying much more constant.



Swiss Canopy Crane II site