# IS THE EFFECT OF DROUGHT EXPRESSED BY STEM RADIAL INCREMENT LESS INTENSE IN SPRUCE-BEECH-LARCH MIXED STAND THAN IN MONOCULTURES?

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#### INTRODUCTION

We need to adapt our forests to ongoing climate change by modifying species composition. Continuously measured stem diameter variation (SDV) by automatic dendrometers shows stem shrinkage caused by water deficit and stem expansion caused by growth. To determine the tree water deficit (TWD), the "zero-growth concept" approach is commonly used. It assumes no growth during stem shrinkage and that growth occurs only when the stem radius exceeds the previous maximum radius value (Krejza et al., 2019; Zweifel et al., 2016).

### MAIN AIM

- ✓ Evaluate responses of spruce, beech, and larch to environmental conditions in 2022 and 2023,
- ✓ and whether the presence of larch can mitigate the effect of drought projected as the current value of tree water deficit (TWD).

#### HYPOTHESIS

✓ We have hypothesized that the value of TWD will increase during drought periods in monoculture stands than in mixed stand with the presence of European larch.



- 4 research sites with the same climatic conditions, slope, and age (50 70 years) in ŠLP ML Křtiny were established.
- 2 types of plots were selected: 3 monocultures stands of spruce, beech and larch and 1 mixed stand of spruce-larch-beech (32%-31%-29%).
- 30 automatic point dendrometers TOMST were installed at the beginning of growing season 2022.
- 1 dendrometer for the sub-dominant tree, 3 dendrometers for co-dominant trees, and 1 dendrometer for the dominant tree per each research site.
- Stem radial increment (SRI) and stress reaction expressed with TWD at single tree level ware calculated, and curves representing particular stand response were averaged.



Fig. 1: Map of ŠLP ML KŘTINY. An arrow marked the location of research sites.

#### RESULTS

The growing season (from 01.03. to 30.09.) 2023 there was sum of precipitation lower by 9% than in 2022. However, we recorded in 2023 higher mean SRI by 27% in all tree species growing in the mixture stand. This effect could be caused by the differences in distribution of precipitation. In 2023 precipitation significantly dominated at the beginning of the growing season (March-April; Fig. 2; red circle).



performed significantly higher increments than in the mixture. On the contrary, Beeches in mixture performed longer and higher growth in 2023.



Fig. 2: Cumulative daily precipitation for period 01.03. to 30.09, x-axis precipitation in 2022 and y-axis precipitation in 2023. Black line represents 1:1 line.

The longest period with TWD = 0  $\mu$ m (no drought stress) performed beech trees. However, here we speculate that automatic dendrometers are not accurate tool for identification of TWD in beech (Fig. 3). The highest TWD (92  $\mu$ m) performed larch in the mix stand. In general, we recorded higher water stress in the mixture site than in monocultures. Larches and spruces growing in monocultures

Fig. 3: Seasonal course of mean SRI (upper) and mean TWD (lower) per year 2022 (dashed lines) and 2023 (bold lines). The left plots belong to monocultures of spruce (green), larch (blue) and beech (red) and the right to mixture stand.

## CONCLUSION

We did not observe a significant benefit of the presence of larch on the growth of other tree species in the examined mixed stand.

#### **REFERENCES:**

KREJZA, Jan, et al. Evidence of climate-induced stress of Norway spruce along elevation gradient preceding the current dieback in Central Europe. *Trees*, 2021, 35.1: 103-119. ZWEIFEL, Roman, et al. Are trees able to grow in periods of stem shrinkage?. *New Phytologist*, 2016, 211.3: 839-849.



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