Growth Resilience in Various Compartments of Scots Pine Under Drought: A Comparison between Pure and Mixed Stand Conditions.

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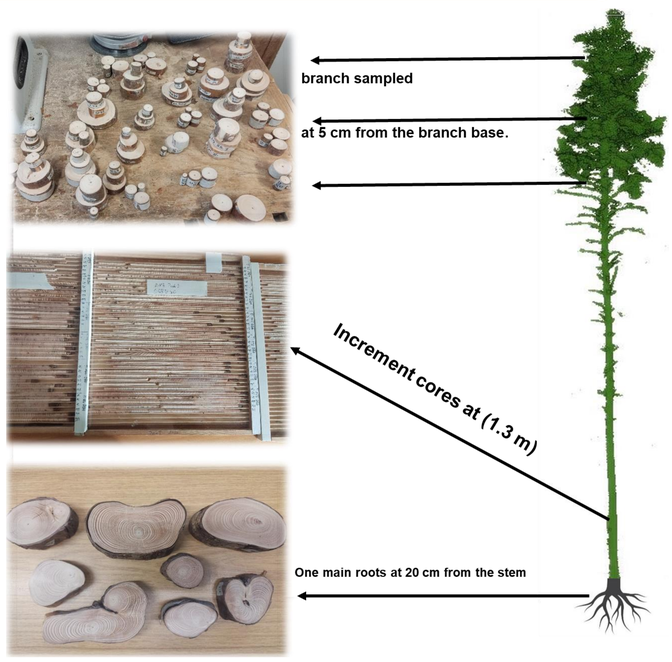
Introduction and Study Objectives

Climate Impact: Climate change intensifies droughts, altering precipitation and evapotranspiration, which increases tree mortality and affects carbon dynamics in global forests (Batllori et al., 2020; Peñuelas et al., 2017).
Methodology Shift: Traditional tree-ring analysis is evolving to address biases in interpreting tree growth data post-drought by integrating measurements from different tree parts—stems, and roots (Pretzsch et al., 2013; Bottero et al., 2021; Nikolova et al., 2011; Míguez et al., 2023).
Innovation: By combining traditional and novel dendrochronological techniques, this research offers new insights into forest adaptation strategies under climate-induced stress.
Specific Objective: Compare the resistance, recovery, and resilience in dry years at the tree compartment level (growth of stem, branches, roots, and height) in Scots pine growing in intra- and interspecific competition with beech.

Material and Methods

Study Area: Research focused on Scots pine in Geisenfeld and Amberg, southeastern Germany.
Sampling Method: 31 dominant Scots pines were sampled for detailed growth analysis, using standard dendrochronological methods including the measurement of tree ring widths from increment cores and disks (from stem, branch and root), in addition to height growth.
Data Analysis: Tree Ring Width (TRW) chronologies were constructed, focusing on climatic signals by applying Friedman's super smoother to filter non-climatic growth patterns. Drought impacts were assessed using the Standardized Precipitation-Evaporation Index (SPEI).
Statistical Approach: Resilience to drought was quantified using Linear Mixed Models (LMMs), analyzing resistance, recovery, and resilience based on radial and height growth data in relation to DBH, site conditions, and SPEI.



Preliminary Results & Conclusions

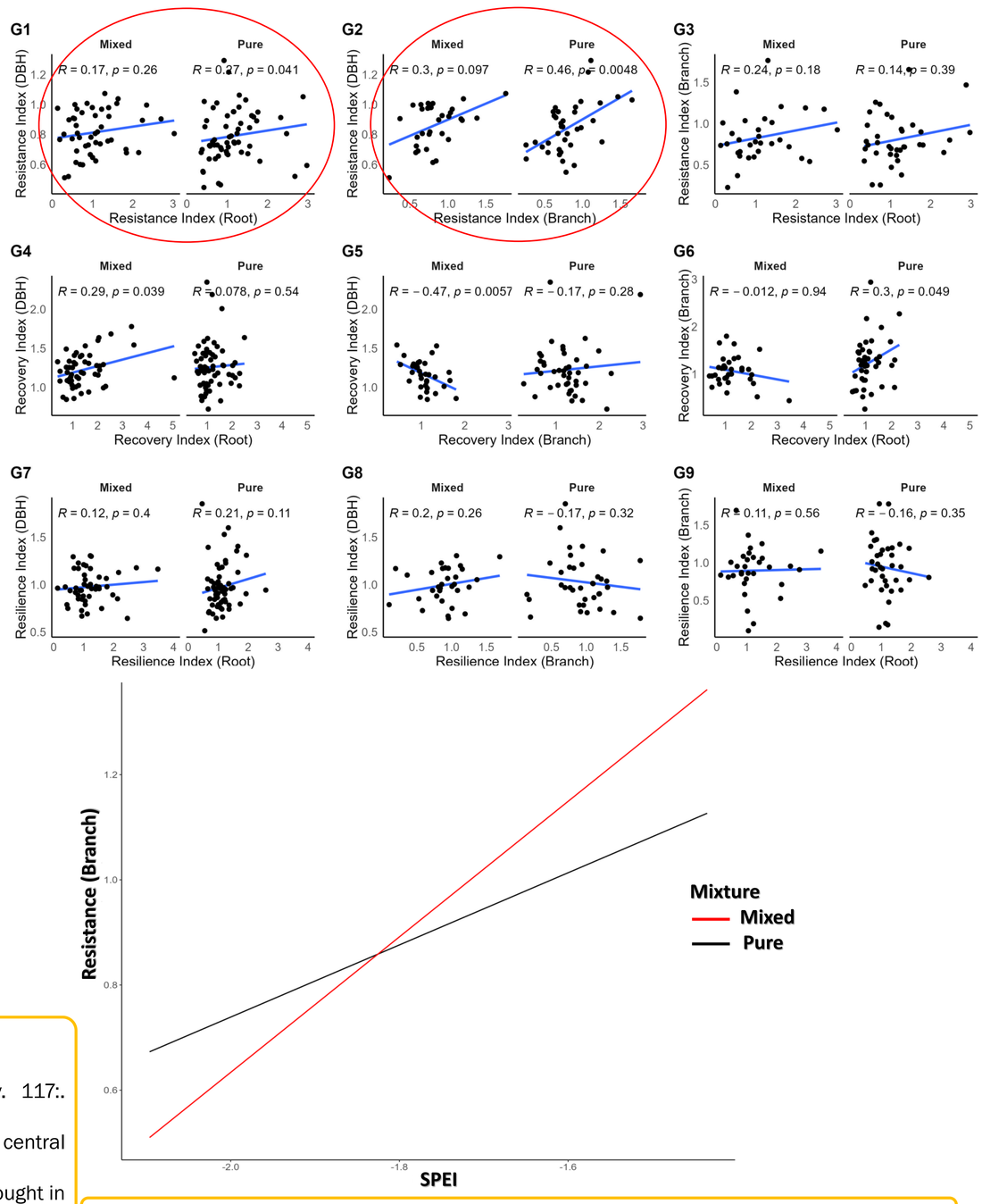
Growth Resistance and Drought Intensity:

- Resistance is influenced by site-specific conditions across all tree compartments (branches, stem, roots).
- Drought intensity significantly impacts resistance in branches and stems.
- In mixed stands, mixing enhances resistance in branches under moderate drought conditions; however, this diminishes with increased drought intensity.

Growth Recovery: No significant relationship found between variables and height growth recovery.
Recovery in stem, branch, and root compartments shows sensitivity to mixing effects and to the rest of variables. However, all these effects on the recovery disappear in the resilience which is the result of the joint effect of resistance and recovery.

Growth Resilience: Resilience reflects resistance patterns, with mixing effect predominantly affecting branch resilience.
Mixing Effects: The mixing effect does not seem to have a significant impact, as it only affected the resilience components in the branch and not the other parts of the tree.

Stand Variability: In pure stands, a positive correlation was observed between stem and branch resistance, as well as between stem and root resistance. However, these correlations were not significant under mixed conditions. This suggests a distinct pattern between pure and mixed stands, indicating that the stem may not always be representative of overall tree growth.



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