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How late spring frosts affect tree-ring growth and wood anatomical traits of European beech in Mediterranean mountain forests?

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Xylem anatomical traits in series of annual tree rings, allow establishing structure-function relationships and assessing species sensitivity to environmental variability. Extreme events such as late spring frosts (LSF) and drought spells are among the main climate-induced disturbances affecting European beech (*Fagus sylvatica L.*) forests, especially in the Mediterranean region. In this study we aimed to i) compare chronologies of tree-ring widths and vessel traits of beech trees located along an elevation gradient and ii) determine the variability of tree-ring traits before and after LSF occurrence. The study sites, located in the Italian Apennines and Spanish Pyrenees, were hit by severe LSF in recent years. We investigated how tree growth and vessel traits varied in relation to indicators of spring frost occurrence, i.e., mean minimum temperatures, accumulated degree days and temperatures anomalies. Then, we checked vessel traits in rings formed right after the frost events and compared them to those measured in non-affected trees. Radial growth reductions ranged from 36 % to 84 % and this negative effect of LSF on radial growth was only detected during the same LSF year. Growth fully recovered within 1–2 years after the LSF. We found a decrease of vessels diameter and surface area, and higher vessel density with increasing elevations. Vessel traits did not provide added values for detecting spring frost sensitivity. In fact, LSF caused the formation of very narrow rings but no-significant differences in vessels traits. Our results indicate a good recovery capacity of European beech and no legacy effects caused by LSFs. However, other xylem proxies (e.g., fiber cell wall) could better detect LSF impacts on wood formation.