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Relationships between wood anatomical traits and climate conditions at three beech forest sites in Slovenia

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It is uncertain how European beech (Fagus sylvatica L.) will perform under climate change. Several dendroclimatological studies suggest that increasing temperature will positively affect radial increments at sites optimal for its growth. However, it is not entirely clear how changing growth conditions will affect wood anatomy and thus wood properties. The aim of this study was therefore to analyse the relationships between climate conditions (temperature and precipitation) and wood anatomical traits in beech trees growing at optimal beech forest sites in Slovenia. Three forest sites representing the main Slovenian beech provenances were selected (Idrija, Javorniki, and Mašun). At each site, 16 increment cores were collected in 2016 and subsequently prepared for observation under the light microscope. Image analysis software (Image Pro-Plus and Roxas) were used for quantitative wood anatomy. Mean vessel area, vessel density, and relative conductive area were analysed in tree rings between 1960-2016. Furthermore, tree rings were divided into four quarters to assess the intra-annual variability in vessel features also in relation to weather conditions. The preliminary results indicated that there was a significant difference in tree-ring widths as well as in vessel features among the selected forest sites. Idrija, the late flushing provenance, had the narrowest tree rings, the highest vessel density and relative conductive area, and smallest mean vessel area. The other two sites had a similar mean vessel area, while the widest tree-ring width and the smallest vessel density and relative conductive area were observed at Mašun (the mid-flushing provenance). The response of tree-ring width and vessel features to changing climate conditions differed among sites/provenance. Tree-ring widths at Idrija and Javornik were positively affected by late winter temperature, while tree-ring widths at Mašun were mostly affected by summer precipitation. In the case of vessel features, the highest correlations with climate data were observed in the fourth quarter of the rings with late summer temperature and precipitation. In conclusion, early spring temperatures and summer precipitation proved to be the most important climatic factors affecting beech growth and vessel features.