

Effects of climatic conditions on radial growth and sap-flow along an elevation gradient in an inner-alpine dry valley

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Water availability in mountain forests might change in the future due to rising temperatures and changing precipitation patterns, affecting tree water relations and growth conditions. Changing temperature and precipitation along an elevation gradient in an inner-alpine dry valley in South Tyrol-Italy were used to investigate possible effects of climate change on the transpiration and growth of European Larch (*Larix decidua*). Stem circumference variation of European Larch was measured for 4 years (2012-2015) with automatic band dendrometers and sap flow for 2 years (2013-2014) with trunk heat balance sensors at 3 sites at elevations of 1115 m, 1715 m, and 1990 m above sea level at a SE-exposed slope. During the first two, rather dry, years, transpiration and stem circumference were reduced during dry periods of one to three weeks at the two lower but not at the highest site. As a consequence, overall yearly radial growth was largest at the highest site in those two years. In 2014, with very high precipitation and colder summer temperatures no correlation of elevation, transpiration, and radial growth was observed. In 2015, with a dry and hot summer, initially high growth rates were strongly reduced after the end of May at the two lower sites. Overall the radial growth of *Larix decidua* seems to be limited by water scarcity up to an elevation of more than 1700 m a.s.l. in our study area except for unusually wet years. Our 4-year measurements were confirmed by dendro-climatic analysis of stem cores taken at five sites (the three original ones plus two additional sites at 1070 and at the forest line at 2250m) covering the last 50 to 150 years. Year ring widths were lower and highly correlated to precipitation at the lowest sites, and overall highest at the 1990 m site. Our results show that the growth of *Larix decidua*, which is often considered as more drought resistant than e.g. *Picea abies*, is limited by water availability at dry conditions in the Alps which might affect its distribution range and forestal use in the future.