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Abstract

Green alder (Alnus alnobetula (Ehrh.) K. Koch = Alnus viridis (Chaix) DC) is an early successional shrub species that is widely distributed at the alpine treeline ecotone in the northern hemisphere. Due to changes in land management green alder is currently the most expanding shrub species in the Alps. As it forms dense monospecific thickets which are known to impair establishment and development of trees, a better understanding of how climate affects growth of green alder is therefore essential for improved predictions of forest dynamics at the alpine treeline under climate change. Here, we make use of ring width data from >50 A. alnobetula stems sampled from 8 plots at the treeline ecotone on Mt. Patscherkofel (2246 m asl., Central Tyrolean Alps, Austria) to identify the main climate drivers of radial stem growth and to determine the influence of climate warming on growth. As expected, response function analysis revealed that radial stem growth of A. alnobetula is primarily controlled by temperature during the growing season. However, no strong response to climate warming during the period 1991–2020 is discernible from ring width time series, most likely indicating that carbon is preferably used to promote clonal propagation, i.e., formation of root suckers and adventitious shoots rather than stem growth. A comparison of growth rates with those of co-existing Swiss stone pine (Pinus cembra) and the evaluation of time series of aerial photographs confirms this interpretation, because A. alnobetula shows strikingly lower radial growth rates than P. cembra but has spread rapidly within the study area since the 1980s (c. 370 m2 ha-1 decade-1), respectively. We conclude that the preference for clonal growth over stem growth turns out to be an advantageous strategy at the alpine treeline ecotone, where height growth is increasingly constrained by low air temperature.

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