

Publication**A test of the growth-limitation theory for alpine tree line formation in evergreen and deciduous taxa of the eastern Himalayas****JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)****ID** 83690**Author(s)** Shi, P.; Koerner, C.; Hoch, G.**Author(s) at UniBasel** [Körner, Christian](#) ; [Hoch, Günter](#) ;**Year** 2008**Title** A test of the growth-limitation theory for alpine tree line formation in evergreen and deciduous taxa of the eastern Himalayas**Journal** Functional ecology**Volume** 22**Number** 2**Pages / Article-Number** 213-220**Keywords** altitude, carbon, source-sink balance, tree line, low temperature

1. Whether the global high elevation tree line phenomenon is associated with a low-temperature-induced limitation of sink activities (i.e. direct impact on meristems and thus, growth) or by a limitation of the trees' carbon source activities (net photosynthesis) still awaits detailed tests across a range of taxa and regions, especially for deciduous species in a short growing season. 2. Here, we test the sink limitation hypothesis in the highest tree lines of Eurasia at altitudes up to 4700 m. We assessed growth and tissue concentrations of non-structural carbohydrates (NSC) as a measure of the carbon source-sink balance in needles and branchwood of *Abies*, *Juniperus* (evergreen), *Betula* and *Larix* (deciduous). 3. The mean soil temperature in deep shade (a proxy for mean air temperature) across the growing season at tree line in this region is around 6.6 degrees C, which is consistent with the threshold temperature found at the natural climatic limit of the tree life-form worldwide. Mean tree height and stem diameter decreased significantly towards the upper tree line in all species studied. 4. Air temperature measurements at an inverted tree line site (valley bottom) indicate strong and rapid oscillations between nighttime freezing and mild daytime temperatures during late winter, which apparently eradicate *Abies* and select for *Juniperus*, offering potential explanations for the inferiority of *Abies* also at the upper Tibetan tree line. 5. At none of the four altitudinal transects studied did we observe a significant depletion of NSC (carbon limitation) at tree line. Instead, NSC increased in the majority of cases, suggesting direct (meristematic) low temperature constraints of growth. These results for these highest Eurasian tree lines suggest a common mechanism of alpine tree line formation for evergreen and deciduous species.

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