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Site- and species-specific treeline responses to climatic variability in eastern Nepal Himalaya

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Abstract

Alpine treelines act as bio-indicators and bio-monitors of environmental change impacts in high elevation forests. This dendro-ecological study carried out in treeline ecotones in the Sagarmatha (Mt. Everest) National Park (SNP), eastern Nepal Himalaya, aimed to assess treeline dynamics and to understand the response of treeline forming *Abies spectabilis* (D. Don, Mirb) and *Betula utilis* (D. Don) to environmental change. At three treeline sites we placed two to four belt transects (size: 20 m wide, variable length) which bisected the treeline as well as the tree species limit. The results revealed spatio-temporally heterogeneous regeneration with a higher regeneration of *A. spectabilis* compared to *B. utilis*. Warm temperatures during summer (JJA) growing seasons combined with sufficient moisture favored the growth of *A. spectabilis* while moisture stress during spring seasons (MAM) mainly limited the growth of *B. utilis*. The regeneration of *A. spectabilis* was favored by high temperatures throughout the year with sufficient moisture. The climatic response of the regeneration of *B. utilis* was spatiotemporally different and variable. Results predict a changing community structure in the treeline in response to future environmental change. During the past 200 years, *A. spectabilis* shifted upward by about 0.93 m/yr and *B. utilis* by 0.42 m/yr,