

# **Tree Rings and People**

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# Spatio-temporal dynamics of forest-tundra ecosystems under climate change in the Polar Ural Mountains

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Significant climate-dependent changes in the composition and structure of open spruce-larch stands, in forest regeneration within the "subgoltsy belt" (treeline ecotone in mountains with very continental climate, synonym of the "subalpine belt") and shifts of the upper treeline have occurred during the last 1300 years on the eastern macroslope of the Polar Ural Mountains (66°45'–66°60'N, 65°30'–65°50'E). A special attention is paid to the study of forest-tundra ecosystem changes during the 20th century. Direct and indirect evidences such as mapped and dated wood remnants, longevity and calendar life span of dead and living trees, density and age structure of stands, variability of ring widths and ring-width indices, old photographs, geobotanical maps and descriptions were used to carry out a detailed reconstruction of these changes.

The highest altitudinal position of the treeline, maximum regeneration and intensive tree growth were observed from the 10th to the end of the 13th centuries as a result of a warming during the summer months. From the end of the 13th to the beginning of 20th centuries the climate was mainly cold and the degradation of forest-tundra ecosystems occurred. From the 1920s up to the present the climatic conditions were favorable for tree growth and regeneration. During this period the younger larch and spruce generations formed. The degree of regeneration increased 2.2 times (taking into account the area under light and closed forests), the density and biomass of stands increased 2 to 5 times, the upper treeline and timberline shifted upward up to 20–40 m in altitude and up to 2 km along the gentle slopes.

## Editorial Keywords

spatio-temporal dynamics, climate change, upper tree line, stand structure, forest-tundra ecosystems, climate reconstruction, *Larix* sp., *Picea* sp., Polar Urals, Russia

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