

Spatio-temporal difference in Siberian larch physiological response to climate change in the southern limit of Taiga

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The distribution of larch trees in northern Mongolia is considered to be limited by moisture condition, where patchy permafrost exists. However, there is still uncertainty how trees respond to past climate change in climatic sensitive areas.

In this study, tree-ring widths and stable carbon isotope ratios were analyzed for past 112 years (1900-2011) in order to understand the spatio-temporal difference in physiological responses of trees to climate change. We selected three forest sites; Terelj (47N, 107E) in central forest area, Tsagaannuur (51N, 99E) and Hatgal (50N, 100E) near Khuvsgul Lake in the north-western forest area.

Our results suggest that tree response to climate change has been different among three sites. Tree-ring width and carbon isotope ratio at Terelj showed negative and positive correlations with temperature, and positive and negative correlations with precipitation in previous and current summer, respectively. It is thus suggested that carbon assimilation and tree growth are mainly controlled by changes in stomatal conductance. The relationship between ring widths and precipitation in previous summer was relatively stronger than that in current summer. The long-term variation in ring widths and carbon isotope ratios over the past 112 years indicated a decreasing trend in tree growth and stomatal conductance due to severe drought events in recent years. In contrast, ring widths at Tsagaannuur and Hatgal showed weak positive correlation with temperature and precipitation in current and previous summer, respectively, and carbon isotope ratio showed positive correlation with temperature in previous and current summer. We observed characteristic differences of past tree response to climate change between central and north-western areas, probably due to differences in moisture conditions.