49th FEFCO

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Hydraulic traits plasticity of boreal tree species along a latitudinal climate and permafrost gradient in northwestern North America

Boreal forests cover about one third of the world's forested area and undergo rapid changes in composition, structure, and function in response to environmental changes. Here we investigated the inter- and intra-specific variability and plasticity of boreal tree hydraulic traits along a 2000-km latitudinal climate and permafrost gradient. The study area is located in northwestern Canada and includes forests with no permafrost, over isolated, sporadic and discontinuous, to continuous permafrost, spanning from the southern- to the northern edge of the boreal forest ecozone. Focusing on the region's dominating boreal tree species, namely, black spruce (Picea mariana) and larch (Larix laricina), we monitored growing-season sap flow of ~200 individuals. Sap flow data were used to characterize crown-level water conductance and were combined with leaf-level measurements of stomatal conductance to water for selected individuals across the study domain. By jointly analyzing crown- and leaf-level water use strategies, together with the prevailing environmental and micrometeorological conditions along the gradient, we were able to provide a detailed quantification of black spruce and larch inter- and intra-specific hydraulic trait variability across and within sites. Moreover, species-specific water use strategies were revealed and associated with tree morphological and architectural characteristics across sites. This analysis allowed us to obtain a better understanding of boreal forest functional trait plasticity and resilience to the ongoing environmental changes.

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