Contrasting water use strategies to climate warming in white birch and larch in a boreal permafrost region

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The effects of rising atmospheric CO\textsubscript{2} concentrations (C\textsubscript{a}) with climate warming on intrinsic water-use efficiency (iWUE) and radial growth in boreal forests are still poorly understood. We measured tree-ring cellulose $\delta^{13}$C, $\delta^{18}$O, and tree-ring width in \textit{Larix dahurica} (larch) and \textit{Betula platyphylla} (white birch), and analyzed their relationships with climate variables in a boreal permafrost region of northeast China over past 70 years covering a pre-warming period (1951-1979; base period) and a rapid-warming period (1980-2018; warming period). We found that white birch but not larch significantly increased their radial growth over the warming period. The increased iWUE in both species was mainly driven by elevated C\textsubscript{a} but not climate. White birch but not larch showed significant positive correlations between tree-ring $\delta^{13}$C, $\delta^{18}$O and summer maximum temperature as well as vapor pressure deficit in the warming period, suggesting a strong stomatal response in the deciduous birch but not in the conifer larch to climate warming. The climate-warming induced radial growth enhancement in white birch is associated with a more ‘conservative’ (low $g_{s}$, constant A) water use strategy than in larch (constant $g_{s}$, high A), suggesting an advantage for the former than the latter in a warming world in the permafrost regions.