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Using stable isotopes and functional wood anatomy to identify underlying mechanisms of drought tolerance in different provenances of lodgepole pine

Miriam Isaac-Renton (1,2,3), David Montwé (1,2), Andreas Hamann (1), Heinrich Spiecker (2), Paolo Cherubini (3), and Kerstin Treydte (3)

(1) Department of Renewable Resources, University of Alberta, Edmonton, Canada, (2) Chair of Forest Growth and Dendroecology, Albert-Ludwigs-Universität-Freiburg, Freiburg, Germany, (3) Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland

Choosing drought-tolerant seed sources for reforestation may help adapt forests to climate change. By combining dendroecological growth analysis with a long-term provenance trial, we assessed growth and drought tolerance of different populations of a wide-ranging conifer, lodgepole pine (Pinus contorta). This experimental design simulated a climate warming scenario through southward seed transfer, and an exceptional drought also occurred in 2002. We felled over 500 trees, representing 23 seed sources, which were grown for 32 years at three warm, dry sites in southern British Columbia, Canada. Northern populations showed poor growth and drought tolerance. These seed sources therefore appear to be especially at risk under climate change. Before recommending assisted migration of southern seeds towards the north, however, it is important to understand the physiological mechanisms underlying these responses. We combine functional wood anatomy with a dual-isotope approach to evaluate these mechanisms to drought response.