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Forest Stress in the Rocky Mountains During the Last Interglacial Warm Period

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Growing season temperature is a key determinant of forest stress in the Western United States, which portends reductions in growth, including the possibility of regional forest die-off, as temperatures continue to rise. Here, we look at the ecohydrological effects of warming on Western US forests using interglacial-aged subfossil conifer wood samples from Colorado, USA. New downscaled climate model simulations for this period show canopy warming of ~2-4 degrees and an earlier retreat of snowpack, yet our analyses of the carbon isotopes and tree growth show little evidence of enhanced stress levels relative to today. Results from the oxygen isotope ratios in the sub-fossil cellulose show that an increased utilization of summer rain by the trees compensated for the detrimental forcing associated with higher temperatures. The study shows that changes in summer rain, which are notoriously difficult to model, can alter the trajectory of western US forests even in regions that fall outside of traditional monsoon regimes. A detailed analysis of root water uptake dynamics of conifers will be undertaken in the East River Watershed during the 2019 growing season using a new network of sap flow sensors and water isotope analysis.