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Scots pine response to short-term dry conditions after long-term soil moisture manipulation experiment

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Transpiration fluxes from land to the atmosphere hinge significantly on the degree to which trees opt to open their stomata to trade off water for CO2. Yet, the terrestrial ecosystem response to the changes in the atmosphere (CO_2, VPD, etc.) and the redistribution of water on land in an era of change are largely unknown. In addition, the effects of such long-term changes in trees' adaptation strategies and resilience under short-term dry conditions are not yet fully understood. To address this issue we determined stable water isotopologues within a long-term (20-year) irrigation experiment in a drought-prone Scots pine-dominated forest in one of the driest areas of Switzerland, Pfynwald. Our sampling included plots with trees growing under naturally dry conditions (control), irrigated (from 2003 to present), and previously irrigated (irrigation stop; irrigated from 2003–2013; control condition since 2014). We have installed an in-situ high-frequency isotope measurement system in the field to sample stable water isotopologues (^{2}H and ^{18}O) in different soil depths, tree xylem, and in the atmosphere and to track tree water uptake dynamics at the control, irrigated, and irrigation stop plots. The sampling was complimented with manual extraction of soil and xylem water samples at the three treatment plots for isotope analysis in the lab. Our preliminary findings support the hypothesis that pine forests adjust their carbon allocation strategies during long-term wet periods, establishing a deeper rooting system to access deeper water sources. This adaptive mechanism enhances their resilience during short-term dry periods.