

Title: Understanding the interplay of rooting strategy and plant hydraulic traits on the response of forest stands of CZ2 to climate variation of Southern Sierra California

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Project Abstract: Extreme droughts such as occurred in the 2012-2015 California drought are a major determinant of ecosystem disturbance and consequent impacts from and feedbacks to climate change, however these events are poorly represented in current Earth system models. Here we use a plant hydraulics model to explore ecosystem responses to the 2012-2015 California drought, in comparison with observations, for a site in the southern Sierra Nevada that experienced widespread tree mortality during the drought. We explore model parameter control of rooting depth and leaf hydraulic strategies, to identify how different plant water sourcing and photosynthetic strategies lead to different responses during normal and drought conditions. We find that deep roots are needed to match seasonal cycles of ET and GPP in normal years, and that deep-rooted strategies also show large reductions in ET and GPP during droughts when the deep soil reservoir is depleted, in agreement with observations. We show that anisohydric leaf stomatal strategies lead to greater productivity during normal years as compared to isohydric stomatal control, but lead to high risk of xylem embolism during long-term droughts such as the 2012-2015 drought. These results show the importance of resolving plant water sourcing strategies in order to represent drought impacts and feedbacks in models.