

Project Summary: Silent straws: understanding water demands from woody encroachment in California's oak woodlands

The loss of oak woodlands and rangelands to native woody encroachment is a major conservation concern in California, resulting in associated losses of wildlife habitat, traditional uses, and biodiversity. Previous studies have demonstrated many of the deleterious effects of encroachment on terrestrial ecosystems, including oak mortality, severe decreases in (and often complete loss of) herbaceous cover and richness, and important changes to fuels and fire behavior. However, the interactions between conifer encroachment, soil moisture, and stream flows remain largely unstudied in California's oak woodlands. The last several years of drought have magnified the connections between forest densification, water availability, and tree health and mortality across the state, prompting important questions about the impacts of encroachment on the region's limited water supplies, and on the natural and human communities that they support.

With this new research, we propose to do the following:

1. Quantify the effect of conifer removal treatments on soil moisture and water availability in North Coast deciduous oak woodlands, using three sets of paired sub-watersheds (treated and control) on private ranchlands in the Yager Creek watershed in eastern Humboldt County. Methods would be similar to those used by Jones et al. (2003¹) to assess aquatic ecosystem response to conifer removal treatments in aspen.
2. Using air photos, develop a detailed map of conifer encroachment across the 90,000 acre Yager Creek watershed, and use the map to scale up our understanding of water demands of fast-growing encroachment.
3. Investigate the economic tradeoffs of managing for conifers versus oak woodlands/rangelands, accounting for benefits of oak restoration (e.g., increased stream flow, restored herbaceous material for livestock grazing, reduced fuels) and the costs associated with conifer removal treatments and long-term treatment maintenance.

For this project, we have the unique opportunity to design and implement conifer removal treatments, taking advantage of a new 5-year, multi-million dollar oak woodland restoration grant program that is being funded by the Natural Resources Conservation Service (NRCS) and led by UCCE-Humboldt. The grant program brings significant matching funds to this proposal, and will allow for targeted treatments and a rigorous study design. Additionally, we at UC have strong relationships with livestock producers in the Yager watershed and a solid working knowledge of that landscape—essential ingredients for the success of the proposed project.

This research naturally bridges two Strategic Initiatives: Sustainable Natural Ecosystems and Water Quality, Quantity, and Security. As shown in previous ANR-funded research, the North Coast is experiencing rapid compositional shifts from woodlands and rangelands to forest; this project will provide new, much-needed information about the implications of these shifts for water supplies and for local producers, whose watersheds are increasingly conifer dominated, densely stocked, and vulnerable to drought and fire. This information would also help policy makers incentivize woodland restoration efforts. The project will also elucidate tradeoffs in the ecosystem services and economic benefits associated with managing for conifers versus woodlands/rangelands—an important theme for producers in the North Coast, who have an increasingly complicated menu of management options associated with their oak woodlands. And though specific to the North Coast, this project will provide critical insight across California—a state plagued by a backlog of natural fire, overstocked and unhealthy forests, and limited water resources.

We anticipate the following deliverables as outcomes of the proposed project:

- The first watershed-scale assessment of water demand by conifer encroachment into Oregon white oak and California black oak woodlands, with accompanying analysis of economic and environmental benefits associated with oak woodland restoration;
- Communication of results to landowners, land management agencies, and other stakeholders through field tours; workshops, and webinars;
- Publications, including peer-reviewed papers, fact sheets, and contributions to the ANR Oak Woodland website;
- Science-based decision support tools for landowners, land managers, and policy makers that integrate environmental and economic findings and help them navigate their priorities in the context of ecosystem and climate change.

University of California has long been a leader in issues of oak woodland management and restoration, and landowners and land management agencies look to UCCE for technical support on these issues. Our attention to conifer encroachment over the last several years has deepened our understanding of the issues and furthered UC's ability to provide answers and guidance for these systems. However, significant knowledge gaps remain, and UC now has a unique opportunity to leverage federal implementation dollars to better understand and explain the connections between conifer encroachment and water availability as well as the economic realities surrounding oak woodland restoration.

¹ Jones, B.E., Krupa, M., and Tate, K.W. 2003. Aquatic ecosystem response to timber harvesting for the purpose of restoring aspen. PLoS ONE: 8(12).