Small Beginnings: The Post-fire Sequoia Seedling Niche

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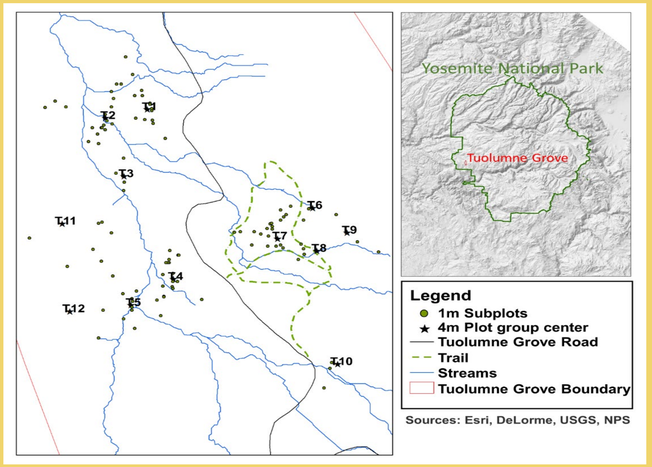
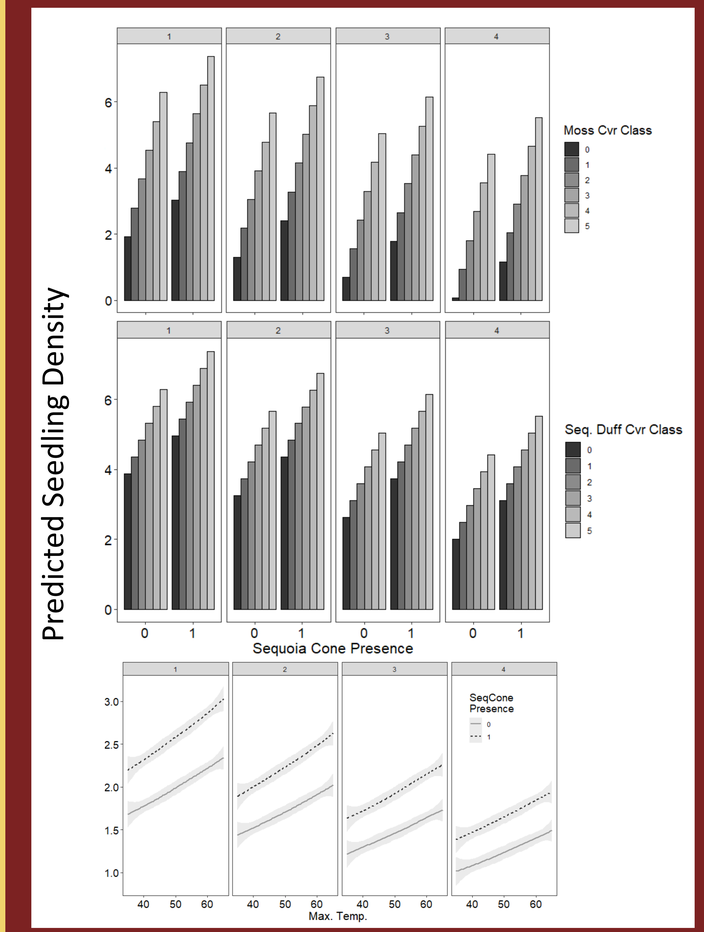
Background

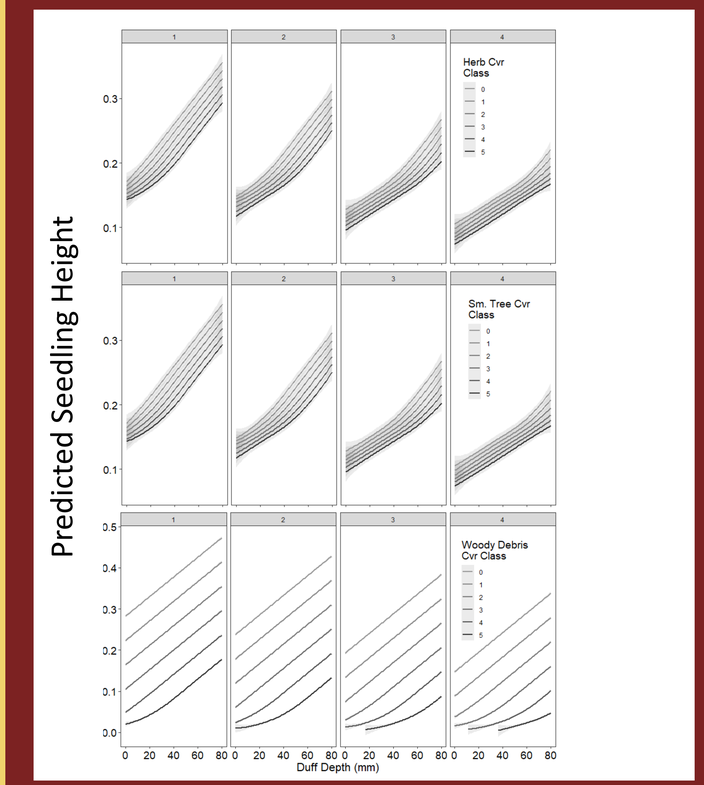
Giant Sequoia (*Sequoiadendron giganteum* [Lindl.] Buccholz) are a fire-dependent California endemic. Altered fire regimes are presumed to be driving decreasing Sequoia seedling recruitment. Prescribed burns open serotinous cones and clear canopy gaps. However, microhabitat around seedlings is highly variable, and little work has explored how this seedling niche influences post-fire seedling regeneration. We used backburn operations applied in Tuolumne Grove in Yosemite National Park to ask which microhabitat variables best predict seedling density and growth relative to burn severity.



Field Methods

In areas back-burned during the Rim fire, we established plots in canopy gaps and quantified burn severity using the NPS Fire Monitoring Handbook. We counted and measured seedlings and measured microhabitat using both cover estimates and HOBO pendant dataloggers. Cover estimates included percent cover Sequoia duff, moss, shrubs, small trees, rock, and bare ground. HOBO data included temperature and lux (total light).





Microhabitat, cone aggregation, and burn severity drive post-prescribed burn Sequoia seedling regeneration.

Statistical Methods

We built negative binomial regression models of seedling density and height using all measured variables as predictors. Because o the large number of predictors, models were built separately for HOBO microhabitat variables and for percent cover variables. We used stepwise model reduction and then combined models for final predictions.

Cover variables were coded as Daubenmire cover classes (1-5) and Sequoia cone presence was coded as presence/absence (1/0). Burn severity was coded from 1-4 with 1 being high severity, and 4 being low severity (no burn).

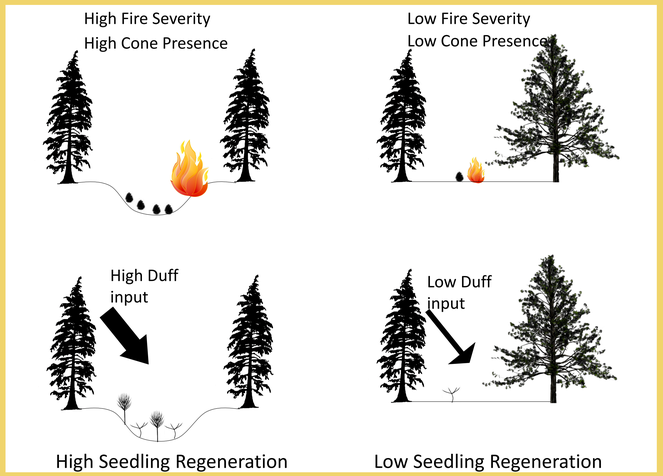
Results

Seedling density was significantly positively correlated with **Sequoia cone presence, moss cover, Sequoia duff cover, temperature**, and **burn severity**.

Seedling height was significantly positively correlated with **herbaceous cover, small tree cover, wood debris cover**, and **duff depth.**

Predictor	β	Std.Error	z	*p*
Intercept	-6.077	1.635	-3.716	<0.001
Sequoia Cone Presence	1.100	0.437	2.518	0.012
% Cover Seq. Duff	0.482	0.158	3.048	0.002
% Moss Cover	0.871	0.198	4.392	<0.001
Severity (Substrate)	-0.619	0.305	-2.03	0.042
Max. Temp.	0.046	0.025	1.805	0.071

The significance of cone presence and Sequoia-specific duff show that microtopographical variation (such as “cone collection swales”) and potentially distance to parent trees drive seedling density. High duff recharge (either due to high needle cast following high severity burns, high presence of adult Sequoias or both) should also be an identifying feature of zones targeted for prescribed burns.



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