

A Case of Unusual Seedling Presence and Growth 10 Years After Fire in the Southern Coast Redwood Range, Santa Clara County, CA

Rachel Lazzeri-Aerts San Jose State University, Department of Environmental Studies

Background

Recent literature presents mixed impacts of current—and future potential—climate change on coast redwoods (*Sequoia sempervirens*). These impacts range from increased growth rates in northern forests to declining fog and increasing drought stress in central and southern forests. Several studies predict shrinking ranges and availability of suitable habitat for coast redwoods, particularly in the southern extent of the species' range. Coupled with the recent increase in wildfire activity, these climate change effects have the potential to negatively impact coast redwood trees and their associated communities. It has been predicted that seedlings and young trees will be affected more than mature trees. It is well documented that coast redwoods typically have low seed viability and germination, and that the majority of mature trees originate from basal sprouting. In 2008, a fire burned 103ha within Mt. Madonna County Park, Santa Clara County, CA. Lazzeri-Aerts and Russell (2014) found that one year after this fire there was an unusually high number of coast redwood seedlings. Two other southern coast redwood forests experienced fire in 2008 and 2009, and these forests had few to no coast redwood seedlings germinate one year post-fire. The Mt. Madonna site was re-sampled in 2018 with the goal of examining seedling survivorship, growth, and on-going germination.

Methods

--30 5m radius plots sampled 1 (2009) and 10 (2018) years post-fire
--Variables measured: slope, aspect, percent canopy cover, percent ground cover, soil moisture, duff depth, number, size, and species of all trees, number of seedlings in 3 size classes (small: <0.5m, medium: 0.5-1.0m, large: >1.0m) by species, size and species of tallest seedling of each plot



Figure 1. Coast redwood seedling 1 year post-fire.



Figure 2. Coast redwood seedling 10 years post-fire.



Figure 3. Coast redwood seedlings 10 years post-fire. Second growth trees with basal sprouts in background.

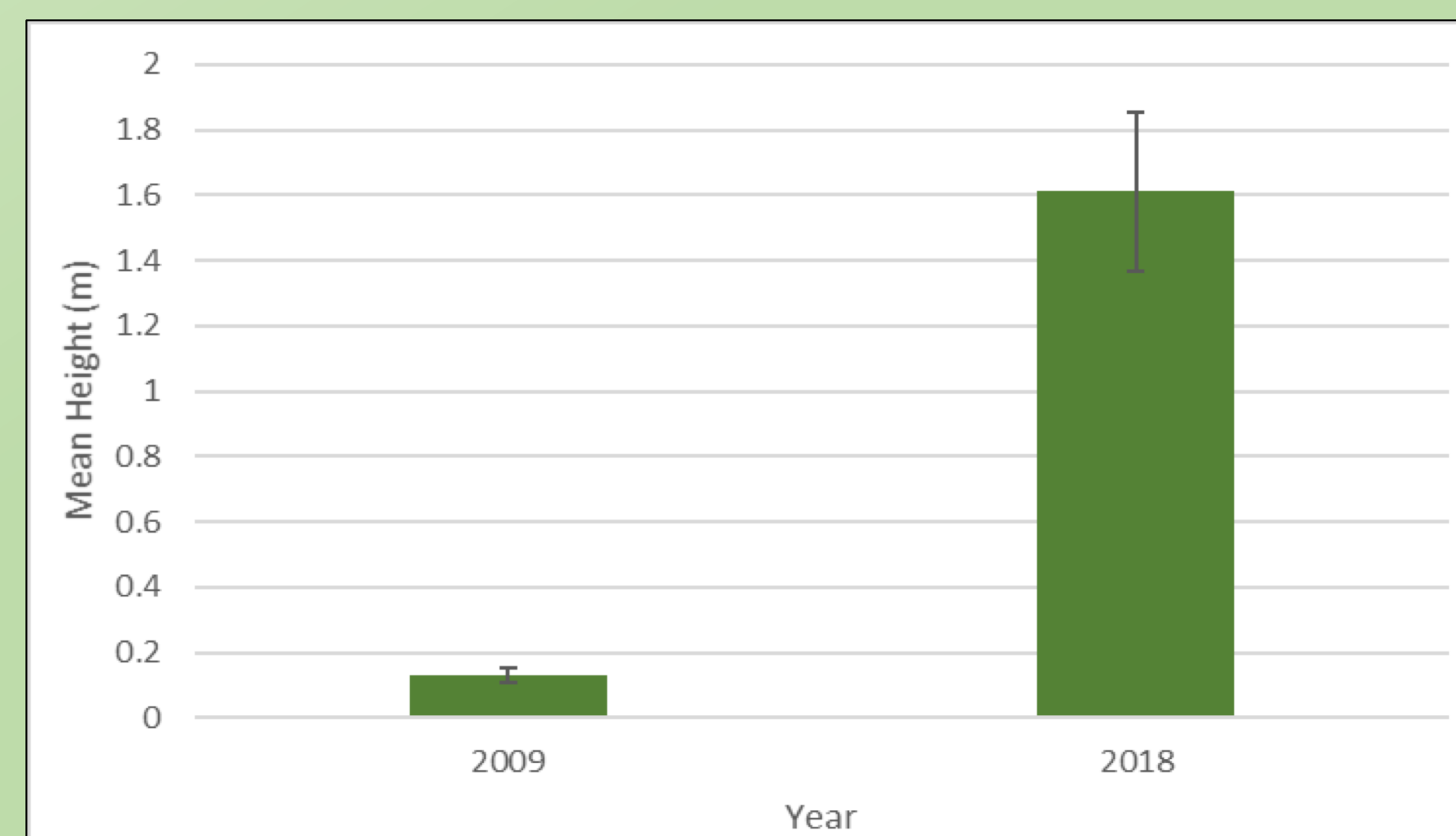


Figure 4. Mean (+/- SE) height of tallest seedling of plot 1 and 10 years post-fire ($p=2.9 \times 10^{-5}$).

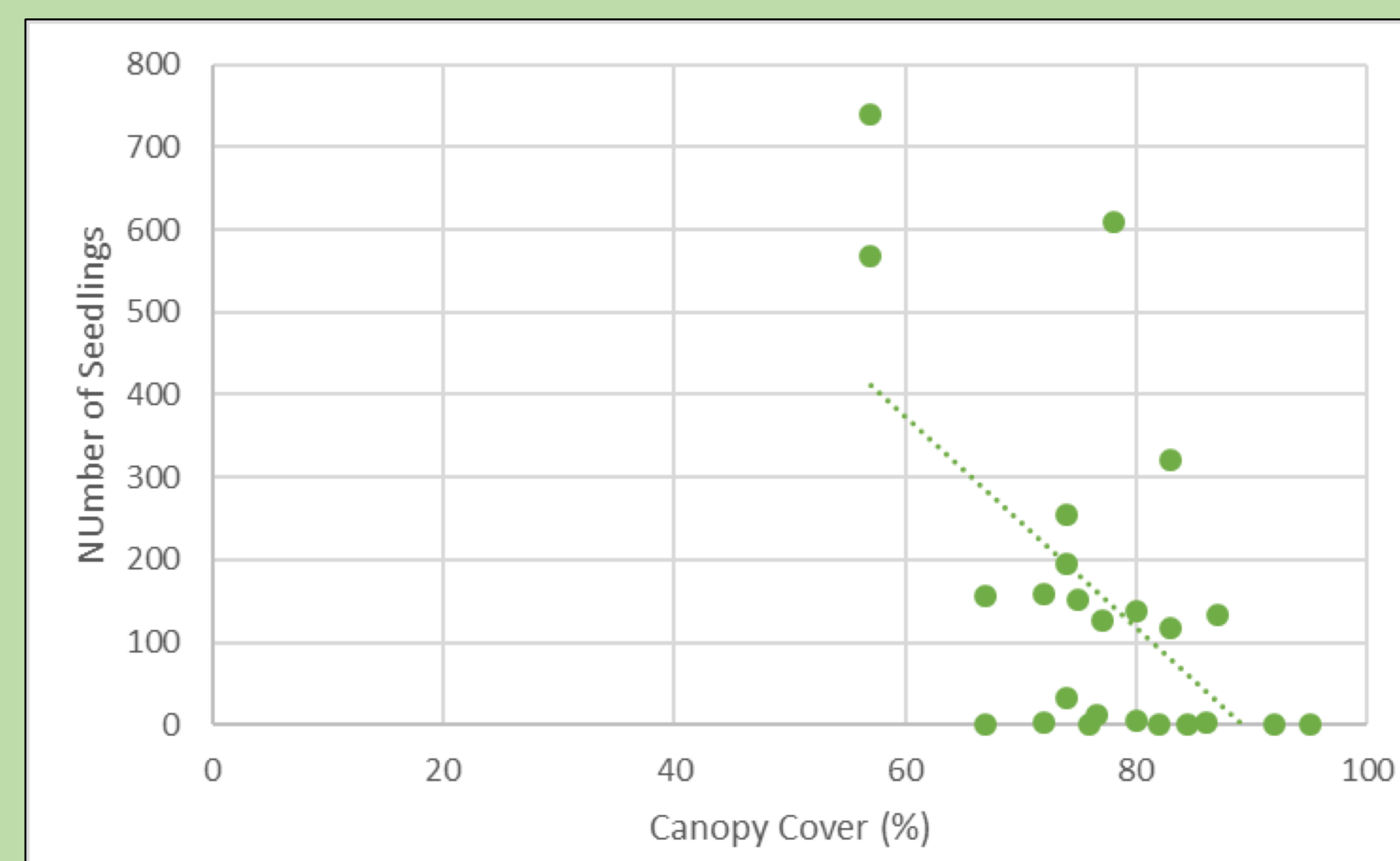


Figure 5. Relationship between percent canopy cover and number of coast redwood seedlings 10 years post-fire ($p=0.003$, $r^2=0.322$).

Results & Conclusions

--Significantly ($p=0.035$) fewer seedlings in 2018 than 2009
--Significantly ($p=1 \times 10^{-8}$) more redwood seedlings than seedlings of other tree species.
--2009: all redwood seedling were in the smallest size class and most were only a few centimeters tall (Fig. 1)
--2018: 20% of seedlings were in the medium size class and 31.9% were in the large size class (Fig. 2 & 3)
--Mean +/- SE height of the tallest seedling plot was 1.61 ± 0.2 m (Fig. 4)
--Tallest redwood seedling: 3.35m
--10 years post-fire percent canopy cover and number of redwood seedlings had a significant but weak ($p=0.003$, $r^2=0.322$) relationship (Fig. 5)
--No other variables examined (slope, aspect, soil moisture, percent ground cover, duff depth, number of redwood trees, number of trees of any species, and number of non-redwood seedlings) had a relationship with number of redwood seedlings.

This site provides an interesting example of prolific coast redwood germination after disturbance. While no clear explanation for this unusual occurrence was found, in the face of ongoing climate change, it is worth continued study. Suggested next steps are genetic analysis and seed germination studies.