CALIFORNIA FIRE SCIENCE CONSORTIUM

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Research Brief for Resource Managers

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Resprouting Chaparral Dies from Postfire Drought

Pratt, R.B., A.L. Jacobson, A.R. Ramirez. A.M. Helms, C.A. Traugh, M.F. Tobin, M.S. Heffner, and S. D. Davis. 2014. Mortality of resprouting chaparral shrubs after a fire and during a record drought: physiological mechanisms and demographic consequences. Global Change Biology 20(3):893-907.

California's chaparral plant community composition can change when fire is followed by intense drought. By measuring postfire population demography coupled with physiological measurements during a severe drought, Pratt *et al*. were the first to directly link resprout mortality to mechanisms of drought stress and show how chaparral may be affected in the future by the increased frequency of fires combined with drought.

After the Sherwood Lake Fire (July, 2006) in Los Angeles County, CA a burn and a control plot were established in the chaparral at an elevation of 400m. The resprouts of six obligate and facultative resprouter species were tagged and measured for survival every two to three months until October 2008, and then less often until January 2013. Lignotuber diameter (plant size), % live crown, plant height and browsing damage were recorded.

The seedlings of these resprouting species were also counted three times postfire: Dec. 1, 2007, October 11, 2008 and January 12, 2013, along with the seedlings of one nonsprouting shrub species. Resprout mortality in this study was compared to published literature from 19 studies and the authors own unpublished data.

Management Implications

- Drought following fire can cause increased mortality in some resprouting chaparral shrub species and cause shifts in relative abundance compared to pre-fire levels.
- The levels of postfire resprout mortality shown to be related to mechanisms of drought stress are among the highest ever reported. Drought stress is therefore likely to be a more potent force than other factors known to affect initial resprout success such as fire intensity, lignotuber size, or time since fire.
- Observed species-specific postfire population shifts are related to life history and physiological traits. In this study, the drought lead to a decline in abundance of some resprouting species and an increase in a drought tolerant obligate seeder species. In the case of the faculatative seeder, *Adenostoma fasciculatum,* seedling recruitment made up for most of the resprout mortality losses. However, in future fire and drought scenarios seedling recruitment may also be affected, causing additional shifts in chaparral community composition.

In addition, physiological measures were collected for three of the resprouting species to determine how they survived postfire. These measures included water status, vulnerability to cavitation, percentage loss of conductivity (PLC, calculated with vulnerability to cavitation curves and daily water potential data), net carbon assimilation, stomatal conductance and leaf area index. All these measures were analyzed using ANOVA, with the independent variables being species, treatment and time. General linear models assessed the relationship between survival, plant size, and species.

The drought period of the study was considered to be from the time of the fire in July 2006 to January 2008.

All six resprouting species survived the early summer fire, but the following drought caused significant mortality via cavitation, embolism, and stomatal closure for *C. spinosus*, *A. fasciculatum*, and *H. arbutifolia.* In addition, carbohydrate depletion was observed for *A. fasciculatum*, and *H. arbutifolia*. Of these three resprouters, the plants with larger lignotuber diameters and >90% postfire crown survival were more likely to withstand the drought. The nonresprouting species, *C. crassifolius*, was of course, completely eradicated by fire. However, because of fire cued seedling germination, there was a 60.9% increase in its population density which "more than offset the average decline in shrub density due to resprout mortality, which was about 21.5%".

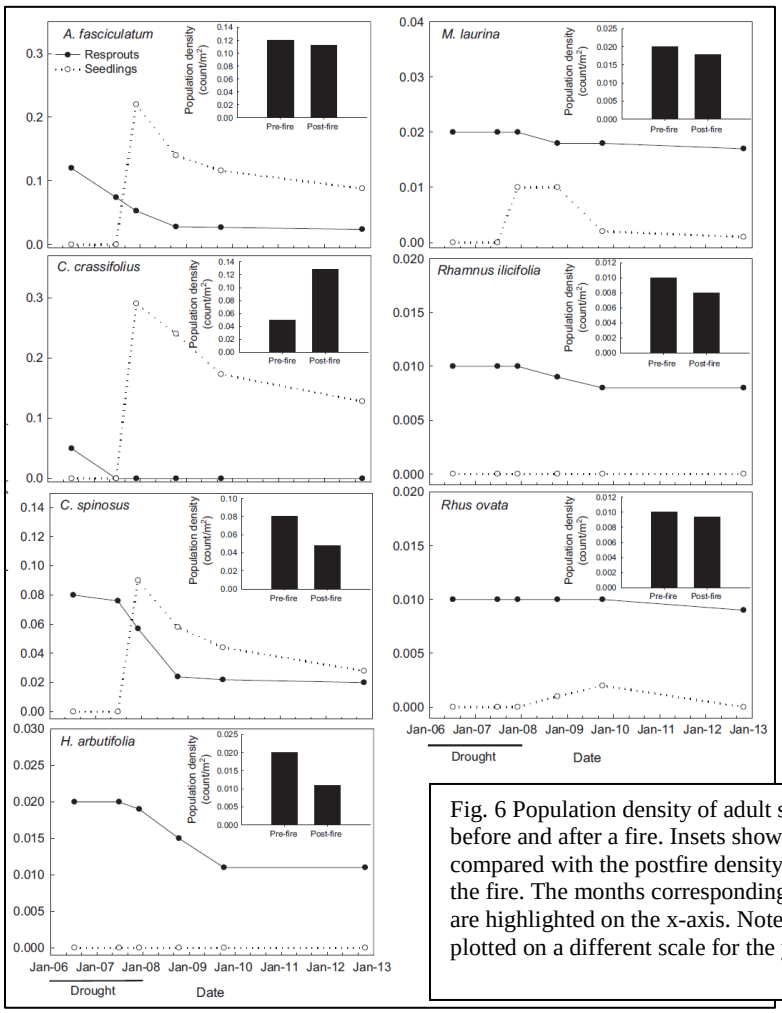

Fig. 6 Population density of adult shrubs and seedilngs before and after a fire. Insets show the prefire density compared with the postfire density about 5 years after the fire. The months corresponding to the drought period are highlighted on the x-axis. Note that each species is plotted on a different scale for the y-axis.