

Western Ecological Research Center

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Contact:

Dr. Jon E. Keeley

Phone:

559-565-3170

Email and web page:

jon_keeley@usgs.gov

<http://www.werc.usgs.gov/seki/keeley.asp>

Sequoia and Kings Canyon Field Station, USGS Western Ecological Research Center, 47050 Generals Highway #4, Three Rivers, CA 93271

Fire Dynamics of Foothill Pine in the Southern Sierra Nevada

Foothill, or gray pine (*Pinus sabiniana*) is widespread throughout the interior foothills of central and northern California, often occurring in a mosaic of vegetation patterns with chaparral and grassland.



Typical mosaic of chaparral and foothill pine in California foothills. Photo: J. Keeley, USGS.

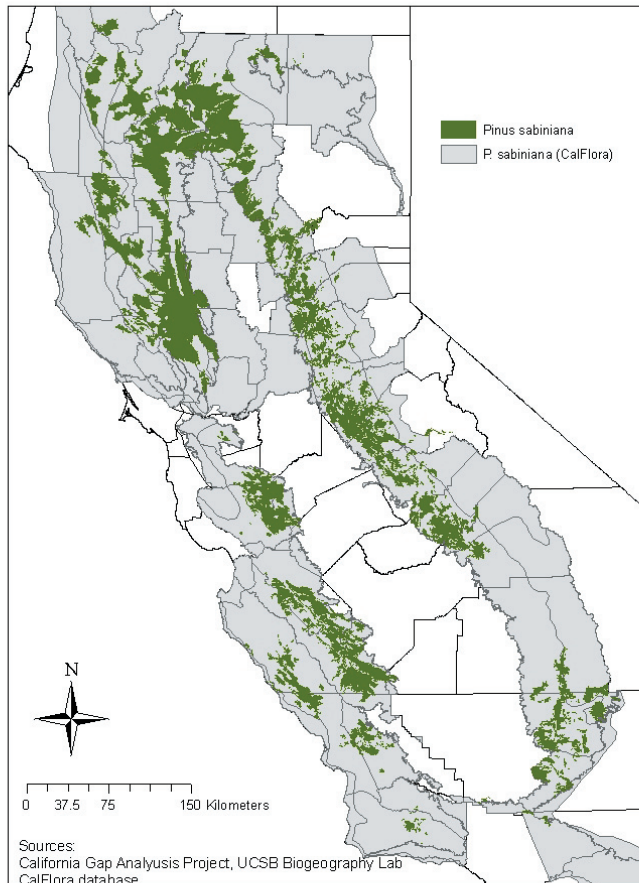
Management Implications:

- On shrubland landscapes subject to high-intensity fires, foothill pine populations are dependent on refugia, in the form of alluvial areas, grasslands, or rock outcrops.
- Management of this pine should not focus on sustaining populations but rather on retaining sufficient metapopulations on the landscape.

These fire-prone environments pose a challenge to resource managers concerned with maintaining sustainable populations of this uniquely Californian pine species. However, when this pine grows in chaparral, it is prone to crown fires because it does not generally self-prune lower branches. Consequently, these branches act as ladder fuels from the shrubs to the canopy, resulting in tree mortality. In a recent issue of *Madroño*, USGS research scientists Drs. Dylan Schwilk and Jon Keeley investigated the population structure of this pine following fire. Their studies shed light on the means by which this pine persists in fire-prone chaparral and also answer a long-standing question pertaining to a perplexing distributional anomaly of this species.

Foothill pine mortality following the 2002 McNally Fire in the southern Sierra Nevada was massive throughout much of the 25,000-ha burn, with the exception of broad alluvial fans and isolated rock outcrops. It was hypothesized that these refugia play an important role in the persistence of this pine on chaparral landscapes subject to periodic high-intensity fires. Thus, metapopulations play a critical role in providing source populations for recolonization following high-intensity

fires. In support of this idea, field studies on the McNally burn showed that the maximum age of foothill pine skeletons declined significantly with distance from alluvial areas, and the relationship was strongest on sites that had burned within the past 60 years prior to the McNally Fire.



Distribution map of foothill pine (dark green shading). Map: USGS.

This dynamic model of foothill pine and its relationship to fires has added value in that it explains the anomalous biogeographic pattern of distribution for this species. Although widespread throughout the interior foothills of central and northern California, it has a disjunct distribution in the southern Sierra Nevada, where it is absent from the Kaweah River watershed between 36° and 37° N but abundant in watersheds both north and south of the Kaweah. The authors propose a new hypothesis that couples unique features of this pine's response to fire with unique features of the southern Sierra Nevada topography. Between 36 and 37° N, the transition from the Central Valley to the Sierra Nevada is steeper and more abrupt due to an anomalous pattern of subsidence. As a consequence, the Kaweah is characterized by steeply faceted, mountainous topography with a narrow riparian zone that provides insufficient refugia from fire for the foothill pine.

Schwilk, D. W. and J. E. Keeley. 2006. The role of fire refugia in the distribution of Pinus sabiniana (Pinaceae) in the southern Sierra Nevada. Madroño 53:364–372.