CALIFORNIA FIRE SCIENCE CONSORTIUM

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Research Brief for Resource Managers

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Modeling How Fire Frequency Alters Species Composition

Franklin, J., A. D. Syphard, H. S. He, and D. J. Mladenoff. 2005. Altered fire regimes affect landscape patterns of plant succession in the foothills and mountains of southern California. Ecosystems 8:885-898.

Fire-scar dendrochronology records provide us with a valuable record of how fire frequency can alter forest composition. Crown-fire shrublands lack such records and scientists are forced to explore alternative means of addressing questions of fire frequency impacts on species persistence. Janet Franklin and colleagues used LANDIS, a landscape disturbance and succession model to investigate how short, moderate and long fire return intervals (FRI's) in southern California affect persistence of different shrub life histories.

Their simulations included fire regimes for the low to moderate elevation foothill shrublands, which they believed each represented 1) natural, 2) current, and 3) very long FRIs of 90, 30, and 150 years, respectively. In addition, they considered these same three fire regimes for higher elevation forests, estimated as FRIs of 30, 150, and 500 years, respectively.

Their simulations predicted that in shrublands with a 30 year FRI there would be a greater success of resprouting species and less success of obligate seeding shrubs. This latter life form, which comprises most of the species in *Arctostaphylos* and *Ceanothus,* the two most diverse genera of chaparral shrubs, was favored under natural FRIs of 90 years. The low elevation tree *Pinus coulteri*, a tree widely planted by the USFS, was predicted to be extirpated under current 30 year FRIs. Not surprisingly, long FRIs that resulted in high intensity fires did not have negative impacts on the persistence of most shrub life forms. In forests with a mixed fire regime their models predicted resilience to a wide range of FRIs.

Overall, their model supports the idea that the greatest threat to chaparral community structure is the increase in human caused fire frequency. Shrublands in the foothills and mountains of southern California are sensitive to short fire return intervals whereas conifer forests in this region appear to be resilient to a range of FRIs, both short and long fire return intervals.

Management Implications

- The model predicts that natural FRI's of about 90 years sustainably balance obligate seeder with obligate resprouter plant populations.
- It is also predicted that the current, normal FRI of about 30 years will result in a species shift toward the replacement of obligate seeders with obligate resprouters.
- Unlike pines in surface fire regimes, *Pinus coulteri* burns in crown fire regimes and cannot recover from frequent fire (30-year FRI) in the model.