



## Research Brief for Resource Managers

**Release:**  
October 2016

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### Increased fire area and severity in the Sierra Nevada warrant fuels reductions and wildland fire use

Mallek, C., Safford, H., Viers, J., and J. Miller. 2013. Modern departures in fire severity and area vary by forest type, Sierra Nevada and southern Cascades, California, USA. *Ecosphere* 4(12): 153. DOI: 10.1890/ES13-00217.1

Human suppression of fire in the western United States has resulted in major ecological changes in many ecosystems. Such changes must be central to our considerations of restoration goals and activities, but comparative assessments of the nature and degree of change across different forest types have been lacking. With respect to wildfire, theory suggests that modern departures from pre-Euroamerican settlement patterns should be most pronounced in forests that historically support frequent low-severity fires, such as low and middle elevation pine and oak forests. At the same time, higher elevation and moister forest types should theoretically remain closer to the historical range of variation in fire activity, since fire suppression has had relatively less impact on the fire regime.

In order to empirically test these theories, Mallek *et al.* assessed relative and absolute changes in wildfire area and severity in seven forest types arrayed along an elevational gradient in the Sierra Nevada and adjacent forested mountains. They quantified departures in fire area and severity,

#### Management Implications

- There is a major fire “deficit” in the greater Sierra Nevada Region, across all major forest types. However, the nature of this deficit differs among forest types.
- In mid- and low-elevation forests the deficit is overwhelmingly expressed in low and moderate severity fire; there is little to no deficit in high severity fire.
- In higher elevation forests, fire severities have not changed much from pre-settlement conditions.
- Expanded use of managed wildland fire will be vital to forest restoration, but at lower and middle elevations strategic fuels management is also necessary.
- Current fire trends portend great risk for old forest habitats, but will benefit species adapted to early seral habitat.

comparing the pre-Euroamerican period (1500–1850) and modern period (1984–2009). The study was conducted in the area of the Sierra Nevada Forest Plan Amendment, which encompasses 11 National Forests and three National Parks (Fig 1.). A synthesis of the literature provided information on pre-settlement fire area and severity. Modern fire perimeters came from CAL FIRE’s fire history database and fire severity was calculated as the relative difference normalized burn ratio (RdNBR). Bayesian statistics were used to

assess differences between modern and pre-settlement fire characteristics.

Mallek *et al.* found that modern rates of burning are far below pre-settlement levels for all forest types analyzed, but the nature of these departures was very different across forest types. Low and middle elevation forests that historically experienced low severity fire (oak and yellow pine, mixed conifer) are burning at much higher severity than under pre-settlement conditions, whereas higher elevation forests (red fir, subalpine) show little to no change in fire severity patterns. Importantly the study made clear that there is no deficit in high severity fire in yellow pine and mixed conifer forests, rather the major departure in fire area is expressed in the low and moderate severity categories.

Mallek *et al.* conclude that there is a critical need for forest and fire restoration in low and middle elevation forests. Given the scale of the issue, expanded use of managed wildland fire will be a vital tool. However, active management of forest fuel in strategic locations will likely be a necessary prerequisite because the right combinations of weather and fuels conditions are rare (in addition to the major complication of human habitation and infrastructure in such forests). At the same time, expanded use of managed wildland fire in higher elevation forests is clearly warranted. Mallek *et al.* finish by noting that current climate and fire trends portend great risk for old forest and old forest species in the study area, but species adapted to severely disturbed sites will benefit as early seral habitats expand.

Figure 1. Distribution of modern fires sampled throughout the study region. Each fire was assessed for burn severity (inset). The study area encompasses the Sierra Nevada Forest Plan Amendment Project.

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