CALIFORNIA FIRE SCIENCE CONSORTIUM

Research Brief for Resource Managers

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Parsing Ecosystem Responses: Divergent Fire-Climate Patterns for California Landscapes

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Management Implications

- Because of the unique fire regimes of forests, grasslands and shrublands, and their differences in response to seasonal climate, management responses to climate change may require different approaches.
- Conifer forest fires are strongly influenced by seasonal climate impacts on fuel moisture. Climatic factors, however, have changed over time. Fire activity was heavily influenced by precipitation in the first half of the 20th century, but has been dominated by spring and summer temperatures in recent decades.
- In contrast, grassland and shrubland fires are less tied to current year temperatures and precipitation. The former are markedly influenced by prior year rainfall that enhances herbaceous fuel production. Fires in shrublands are limited by human ignitions during severe weather.

In an era of concern over climate change, a new paper hypothesizes fire-adapted ecosystems in California fall into one of three response categories: 1)*Flammability-limited ecosystems*, such as high elevation montane forests, are the most climate-limited fire regimes; 2)*Fuel-limited ecosystems* like grasslands and savannas are most vulnerable to fires when high rainfall increases herbaceous fuels, and thus are less sensitive to droughts and high temperatures; and 3) *Ignition-limited ecosystems* like southern CA shrublands that experience the worst fires when anthropogenic ignitions initiate fire events under the worst weather conditions. These ecosystems are expected to respond differently to future climate changes.

The conclusions drawn in this paper are based on historical studies of fire and climate relationships in different California climate divisions comprising montane USFS lands, and foothills and valleys protected by Cal Fire, for the years 1910 to 2013 (Fig. 5; North Coast, Central Coast, South Coast, North Interior, and Sierra Nevada). Least squares regression models were generated for both USFS and Cal Fire lands, which encompass flammable grasslands, shrublands, oak woodlands, and conifer forests. With these analyses, five important fire-climate patterns emerged:

1) On low elevation, mostly non-forested grassland and shrubland areas, fire activity is

not strongly linked to annual temperature variations.

2) Fires in high elevation montane forests are most strongly affected by spring and summer temperatures, but not by winter and fall temperatures (Fig.5a,b,c).

3) Higher elevation USFS lands are strongly influenced by current-year (winter, spring, summer and autumn) precipitation throughout the state. However, on lower elevation Cal Fire lands, seasonal precipitation has been important primarily in the northern part of the state.

4) For grass dominated ecosystems in the foothills and valleys, prior-year rainfall is the most significant factor affecting area burned, hypothesized to be related to annual grass growth (not shown here).

5) Fire–climate relationships have changed over time. In Sierra Nevada conifer forests precipitation was a significant controller of fire activity in the first half of the century, but was replaced by spring and summer temperature in the second half. In the southern part of the state there was little or no significant relationship between fire and climate in the first half of the 20th century, but over the last five decades prior-year precipitation has become significant, perhaps due to substantial type conversion from shrublands to grasslands in the latter part of the 20th century in this region.

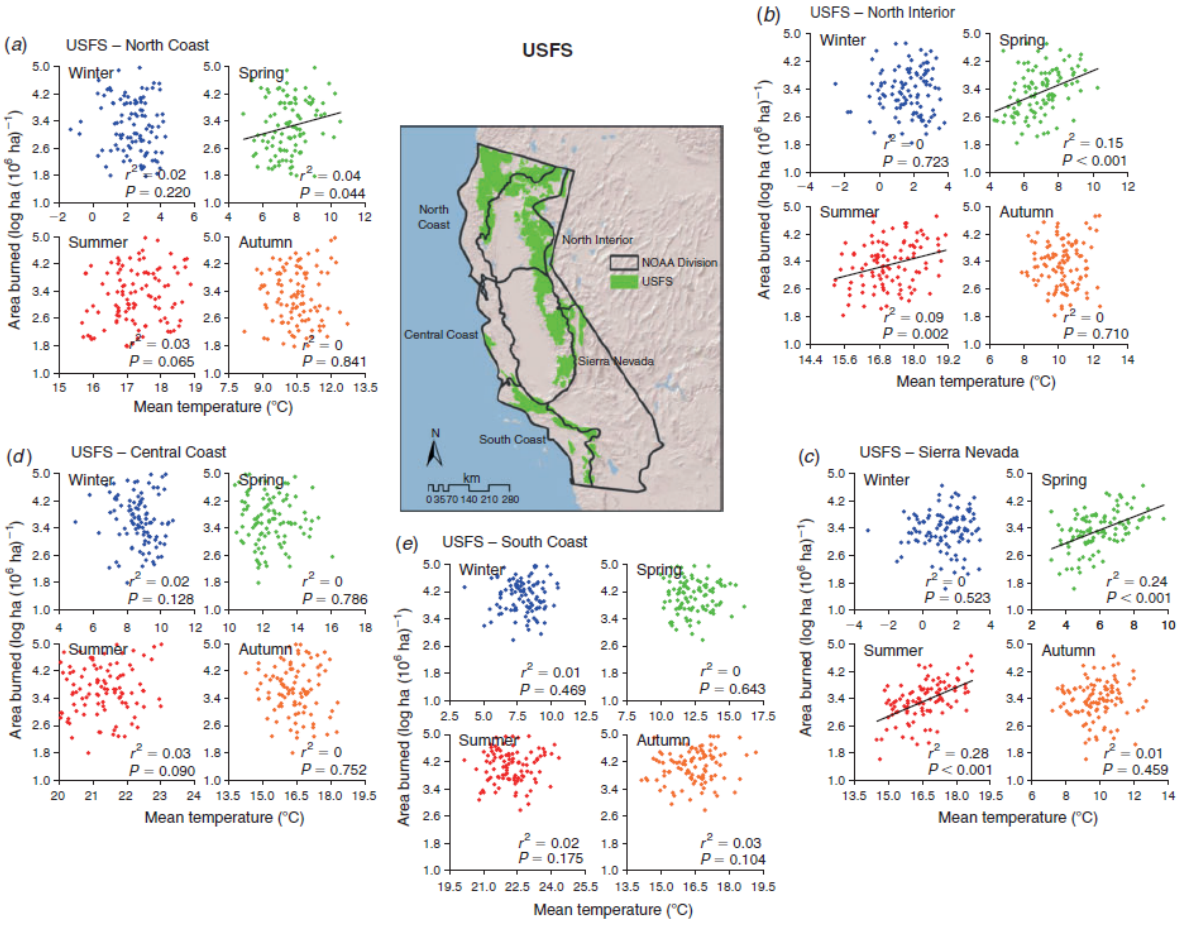

Fig. 5. Relationship of area burned and mean seasonal temperature for USFS lands (1910–2013) by climate division: winter = December–February; spring = March–May; summer = June–August; autumn = September–November.