



## ADJUSTING THE LENSES OF PAST, PRESENT AND FUTURE TO BRING INTO FOCUS THE ROLE OF FREQUENT FIRE IN DRY FORESTS

RESEARCH BRIEF 19 • SPRING 2019

The fire regime of a forest ecosystem describes the landscape context for the pattern, frequency, and severity of wildland fire interacting with vegetation, climate, and topography. Over the last century, fire regimes of the western United States have been altered by many factors including climate, intensive grazing, and fire suppression. As a result, ecological processes have been disrupted and combustible biomass availability and connectivity across the landscape have increased. Areas that once burned with frequent, low- to mixed-severity fire are now burning infrequently with increasing probabilities of high-severity fire. An understanding of how historical fire regimes functioned is critical to reinitiating a more beneficial role of fire on the landscape, especially in a changing climate which promises more frequent fire.

In this study, the authors characterized historical fire return intervals, seasonality, and relationships with local and regional factors for 13 sites representative of southwestern Oregon dry forests on ridges and midslopes in the Rogue Basin of the Klamath Ecoregion. They used dendrochronology (cross-dated fire-scars from trees) to develop fire histories. Then using a systematic literature review, the authors were able to link local fire histories to a regional dataset and evaluate the data relative to more intensively studied conifer/hardwood forest types in California.



Finished fire scar sample. Courtesy of Carl Skinner, US Forest Service Pacific Southwest Research Station.



Arrows showing fire scars in a standing trunk. Courtesy of Kerry Metlen, The Nature Conservancy

### KEY FINDINGS

- Historically, dry forest stands of the Rogue Basin burned frequently, with median fire return intervals of 8 years and 90% of stands burning again within 3–30 years of the previous fire.
- Fire regimes were first disrupted between 1850 and 1906, with fire regime disruption occurring earlier near Euro-American settlements and corresponding with forced removal of Native Americans.
- Half of all historical fires burned in the spring or fall, in contrast to contemporary fires which mostly burn in the summer.
- Regional weather and herbaceous fuels drove widespread fire years.

The Northwest Fire Science Consortium is a regional fire science delivery system for disseminating knowledge and tools, and a venue for increasing researcher understanding of the needs of practitioners.



## RESULTS

### Cross-dated fire-scars

Cross-dated fire-scar samples from 106 trees, scarred by more than 200 fires, revealed that from the 1600s to the 1900s the sampled dry mixed conifer, moist mixed conifer, yellow pine, and mixed evergreen forest stands of the Rogue Basin in southwestern Oregon experienced frequent fire. The median fire return interval within each of the 13 sites ranged from five to 14 years with an overall (among site) median fire return interval of eight years. Detected fire return intervals varied within the 13 sites, but 96% were under 30 years.

### Historical fire-periodicity

Fire regime disruption began between the 1850s and the 1910s for the Rogue Basin sites. Euro-American settlement and associated forced removal of Native American populations – along with the introduction of agriculture and widespread, intensive livestock grazing – were closely linked to changing fire regimes across the region. The record of fire regime disruption was earliest at sites closest to Euro-American settlements, but fire exclusion was pervasive across these sites by 1906.

### Seasonality of burning

Lightning can occur in any month, and Native Americans utilized all seasons to accomplish varied and specific cultural and ecological objectives. Using the location of fire scars in different parts of the tree's annual growth rings, the authors determined the season of the burn. Seasonal fuel curing largely drove burn seasonality in the Rogue Basin dry forests because ignitions were historically abundant and not limiting. Wetter sites had more dormant season fires and dry sites had a higher proportion of growing season fires. While nearly half of historical fires were recorded in the summer months, which we currently associate with the burn season, the fire scar record suggests that nearly one third of historical fires were in the late summer/fall and nearly a quarter actually occurred in the spring or early summer. The condensed contemporary fire regimes reflects changes in human use of fire and fire suppression, and suggests a contemporary deficit of early and late season burns.

### Fires controlled by both local and regional forces

More than a quarter of historical fires were recorded at individual sites in the Rogue Basin and those fires were independent of weather patterns. This suggests a strong role of local conditions, such as fuel development, for determining fire occurrence. In addition, regional drought was associated with more widespread fire years highlighting the importance of regional factors for variation in the fire regime. The most widespread fire years were associated with a positive

El Niño two years prior to the large fire year. This pattern points to the build-up of herbaceous fuels as an added mechanism behind regional control on fires.

### Regional similarities

Across the Klamath Mountains, South Cascades, and Northern Sierra Nevada ecoregions, fire scars tell similar stories of frequent, stand-scale fire. Dry mixed conifer, mixed evergreen, and yellow pine historical fire regimes were all reported to have had median fire return intervals under 10 years. Also, variability in these intervals rarely spanned decades between fires. In moister mixed conifer and red fir forests fire return intervals tended to be less frequent and more variable, but still with median fire return intervals of 13 and 14 years. Across this large geography, earlier burning in drier forest types and later burning in more moist forest types suggests strong local controls, driven by fuel curing, on when fires burned. Similarly, fire regime disruption has been clearly documented across these ecoregions, beginning in the late 1800's and becoming pronounced in the early 1900's, initiating the fire deficit that has driven regional trends toward increasing forest density.

## MANAGEMENT IMPLICATIONS

Though geopolitically linked to forests of the Pacific Northwest, forests of southwestern Oregon have fire regimes quite similar to forests of northern California. With local controls (e.g. fuel availability, etc.) on fire regimes disrupted by land management practices, the influence of broad regional fire controls (e.g. climate) is increasing. Conceptually, this favors more severe fires in systems developed with frequent low severity fire. Therefore, greater understanding of fire regimes and forest conditions that historically supported frequent fire, and incorporating frequent fire or other disturbance, is critical to long-term success of land management in dry forests. It is prudent to adapt these forest systems to a changing climate. This can be accomplished by emphasizing land management strategies that restore open forest structure with ecological thinning and fuels reduction to set the stage for more controlled burns in cooler spring and fall months, and less severe wildfires.

## MORE INFORMATION

**This brief is based on the following article:**

Metlen, K.L., C.N. Skinner, D.R. Olson, C. Nichols, and D. Borgias. 2018. Regional and Local Controls on Historical Fire Regimes of Dry Forests and Woodlands in the Rogue River Basin, Oregon, USA. *Forest Ecology and Management* 430: 43-58. Available at: <https://www.fs.usda.gov/treearch/pubs/56923>.

**Contact:** [nw.fireconsortium@oregonstate.edu](mailto:nw.fireconsortium@oregonstate.edu)

---

*This research brief was funded by the Joint Fire Science Program.*