SOUTHWEST FIRE SCIENCE CONSORTIUM
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# An Evaluation of Fire Regime Reconstruction Methods

## Forest Restoration

The Society for Ecological Restoration International defines ecological restoration as an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability. Restoration attempts to return an ecosystem to its historic trajectory.

Most frequent-fire forests throughout the Intermountain West have been degraded during the last 150 years. Many of these forests are now dominated by unnaturally dense thickets of small trees, and lack their once diverse understory of grasses, sedges, and forbs. Forests in this condition are highly susceptible to damaging, catastrophic fires and increased insect and disease epidemics. Restoration of these forests centers on reintroducing frequent, low-severity surface fires, often after thinning dense stands and reestablishing productive understory plant communities. One way that fire practitioners can determine how best to apply fire to the landscape is by looking at the historical fire regime. , also called the fire regime.

## What is a Fire Regime?

A fire regime is a pattern, frequency and intensity of fire in an area. Because fire is an ecologically fundamental  process a powerful agent of change in terrestrial ecosystems, understanding the role of fire on a landscape is critical for managing fire and forests for biodiversity, ecosystem function, and resilience to changes in climate. To better understand the role fire can play in forests today, researchers and managers have found it useful to reconstruct characteristics of historical fire regimes before the onset of fire exclusion.

Information about past fire regimes can be a helpful reference to guide and inform land managers about current and future fire regime characteristics. The attributes for determining fire regime are:

- **Frequency**: how often fires occur in a stand

- **Seasonality**: time of year
- **Severity**: ecological effects of fire
- **Type**: surface or crown fire
- **Size**: area burned
- **Spatial complexity**: pattern of severity within fire perimeter

## How Is Fire Regime Determined?

There are several methods for determining fire regime. Scientific application of these methods can create an accurate map of the historic fire regime. Using multiple methods builds a high level of confidence in the determination of fire regime and the precision of maps and evaluations made for restoration. Current methods include:

- **Historical documents and photos**
- **Dendrochronology:** fire-scar data, tree age, death and growth data
- **Forest structure data**
- **Plant traits**
- **Charcoal**

(see back side for table of methods)

## Conclusion

Historic fire regime information is useful in informing current fire and forest management practices. Resource managers have to weigh a great number of variables and conditions in policy and decision-making processes . By using multiple, reliable and robust research methods to determine fire regime the best knowledge is made available for research, management and health and safety.

**This fact sheet and associated working paper are available online at swfireconsortium.org**

# An Evaluation of Fire Regime Reconstruction Methods

| | **Historical documents and photos** | **Fire scars** | **Tree age, death & growth data** | **Forest structure data** | **Plant traits** | **Charcoal** |
|---|---|---|---|---|---|---|
| Pro | Contemporary to time when forests were not altered by a century or more of fire exclusion | Precise to year (and sometimes season) of fire; most utility in reconstructing surface fire regimes; pointspecific | Most utility in reconstructing high-severity fire regimes | Can be broad scale across large regions; evidence from time before modern fire exclusion | Plant traits (and lack of traits) indicate success or lack of success in a particular fire regime; | Long reconstructio ns; most utility in reconstructin g mixed-severity or high-severity fire regimes. |
| Con | Limited to availability of old photos & documents; not available everywhere; recorders could have been biased or poorly skilled. | Time period limited by oldest wood; not all fires scar trees; limited to forest types where trees form scars; sampling scheme can result in biases; MFI interpretation influenced by sample size and area sampled. | Often can only reconstruct last stand-replacing fire. Dating of fires not precise because regeneration may not be immediate after disturbance; small-scale fires difficult to reconstruct. | "Snapshot" of forest structure from the time the surveys were completed or photos taken; in surveys, sampling intensity low (small number of trees per square mile). | Fire regimes can change (and have changed) over millennia; traits can't be pinned to an evolutionar y "reason"-could have evolved for other reasons. | Not precise to year of fire; less utility for low-severity fire regimes; cannot reconstruct exact spatial pattern of fire in the watershed (not point-specific) or area burned |
| Uncertainty | Uncertainty about how applicable photo or description is to larger area; sometimes uncertainty about exact location. | No uncertainty at point scale: a fire scar indicates fire happened at that point, but some uncertainty about fire extent between point samples. | Uncertain disturbance event unless accompanied by fire scars; uncertain dating of fires unless accompanied by fire scars. | Uncertainty about size/ age relationships; uncertain disturbance event unless accompanied by other evidence. | Uncertainty about whether traits evolved as an adaptation specifically to fire, even if useful now for fire. | Uncertainty about specific years of fires |
| Direct or indirect evidence of historical fire | Direct | Direct | Indirect | Indirect | Indirect | Direct |