



# Past to Present Human Influences on Fire Regimes: Lessons Learned From Missouri

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**F**ire regimes are defined by the frequency, severity, intensity, seasonality, type, and extent of wildland fire on the landscape. These characteristics are often described at time scales spanning decades to centuries and spatial scales covering sites to regions (Parisien and Moritz 2009). Fire regimes are primarily affected by climate, topography, and ignitions, but humans have shown their ability to overwhelm the relative importance of each of these factors, not only in the past but also in the present.

## HUMAN IMPACTS ON FIRE REGIMES

Fire suppression since the early 20th century is an example of the potential for humans to alter fire regimes

One of the most studied regions in the world for fire regimes and human/fire associations is in the Ozarks of southeastern Missouri.

*Section of a shortleaf pine from the Missouri Ozark region that was cut in the early 1900s. Fire scars from when the tree was young date to the late 1500s. Shortleaf pine is considered fire adapted based on many characteristics, including a unique ability to resprout following topkill when small. Photo: Michael Stambaugh.*

at a continental scale. In the fire suppression era of the 20th century, regional differences in the type of fire activity, such as prescribed fire or arson, illuminated cultural and land use differences. The role of human influences on fire regimes prior to the era of fire suppression is less well understood, but evidence exists. In recent years, an emerging theme of fire research has been historical human influences, traditional ecological knowledge, and social sciences (Roos and others 2014; Senos and others 2006; Taylor and others 2016).

Apart from the Southeastern United States, humans are thought to be the primary ignition source for fire regimes in the Eastern United States (east of the Great Plains). Early documents contain numerous examples and fire uses by American Indians and early settlers from Europe. Many of the historical purposes for burning continue to be relevant, although some are not. For this reason, it is important to consider the purpose for burning when interpreting historical fire regimes and not assume associations between fire regimes and vegetation without careful attention to fire ecology.

Many proxy fire data are available for understanding historical fire regimes and the potential for human influences. These data exist at a range of overlapping scales. Charcoal and pollen provide centuries to millennia of records about climate, vegetation, fire, and human influences. The long charcoal records,

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often dated with decadal accuracy, inform more precise fire scar records that often span centuries and can be pinpointed by year and precise location. Fire scar records inform documents such as early surveys and journals, which often contain highly descriptive accounts. Finally, modern experiments and records of fire events provide observable data about fires and their environmental contexts. Each of these types of data about fire events influences modern management and policymaking.

### OZARK FIRE REGIMES

One of the most studied regions in the world for fire regimes and human/fire associations is in the Ozarks of southeastern Missouri. The region is an ancient eroded mountain dome containing some of the oldest rocks in North America. Here exists a wealth of human/fire information from a range of sources, including:

- Charcoal in sediments (Nanavati and Grimm 2019);
- Fire scars on trees (Stambaugh and Guyette 2008);
- Early surveyor notes (Hanberry and others 2014);
- Cultural fire histories (Guyette and others 2002);
- Fire incident reports;
- Prescribed fire experiments (Dey and Hartmann 2005; Knapp and others 2015);
- Remote sensing and landscape models (Yang and others 2008); and
- Large-scale ecosystem restoration projects (Thompson and others 2018).

Each of these information sources serves to improve our understanding of fire regimes, fire effects, fire management, and the changing role of humans.

Charcoal records going back for 2,000 years show a constant fire presence.

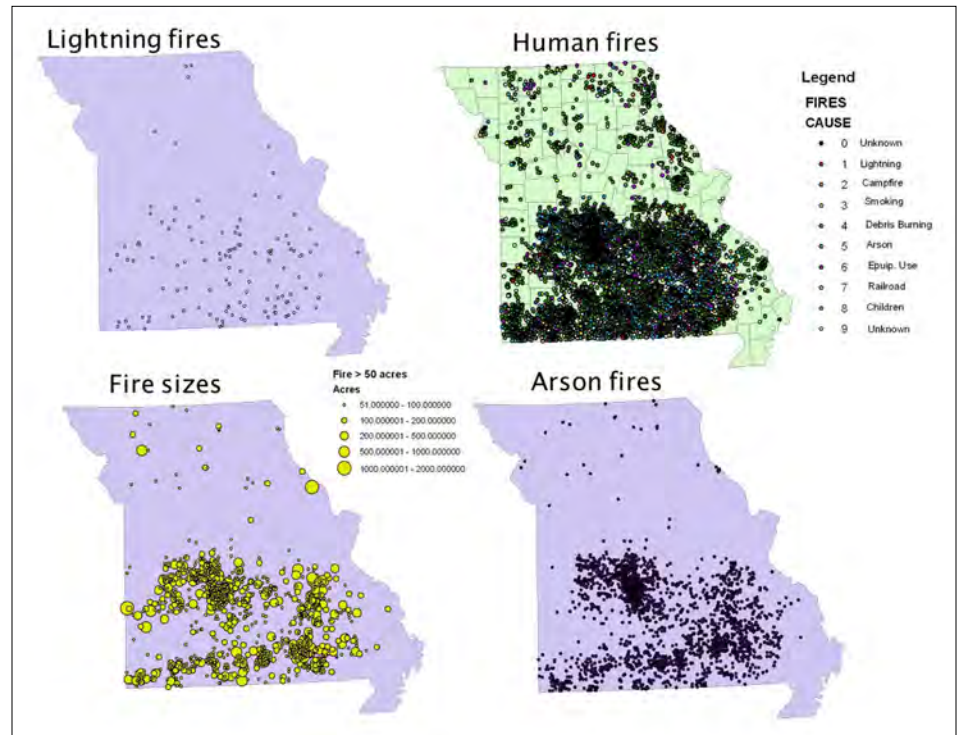
Shortleaf pine, a fire-adapted resprouter, has been present the entire time but declined to about 10 percent of its range before European settlement due to logging and fire suppression. A major feature of the charcoal and fire scar records is a rise in fire activity from about 1600 to 1850 associated with populations of American Indians in the region. Fire scars reflect changes in the frequency and spatial extent of fire with changes in human populations and cultures. Fires were generally frequent, low-severity, and dormant-season events. Extensive historical fire years in Missouri coincided with those in Arkansas and Oklahoma, leading to estimates of millions of acres burned during extreme drought years.

The spatial pattern of historical fires in the Ozarks related to the spatial

pattern of vegetation. Historical fire frequency gradients aligned with species composition and structures (Batek and others 1999). When the Ozarks were first surveyed in the mid-1800s, surveyors often found no trees to mark section corners due to the open conditions. Most of Missouri was in open woodland conditions, not dense forests. Many of these areas have transitioned to dense forests only in the last century; accordingly, many dense forests still have a legacy of sun-loving prairie flora in the soil seedbank and root bank.

### HUMAN FIRE USE IN THE OZARKS

A distinct characteristic of fire regimes in the Ozarks is strong evidence for fire attribution to humans. For at least 500 years, American Indian as well as European cultural groups used fire to manage the land for benefits and survival. A clear progression of anthropogenic fire regime stages occurred through time, repeated in regions around the globe.



*Fire occurrences in Missouri from 1986 to 2003 based on rural fire department records and the National Fire Occurrence Database. The Ozark region generally covers the bottom half of the State, outlined by the dense pattern of human fires.*



## Fire suppression since the early 20th century is an example of the potential for humans to alter fire regimes at a continental scale.

Although the 20th century was primarily a period of fire suppression, in recent decades, humans rekindled fire management through prescribed burning. In Missouri and other parts of the Ozarks, 100,000 to 300,000 acres (40,000–120,000 ha) of forests are burned annually to manage the land for fire-dependent communities of plants and animals. The use of prescribed fire is an extension of centuries of anthropogenic fire regimes.

In the 21st century, the focus of management has been on ecological restoration for ecosystem health, economic benefits, biodiversity, and wildlife habitat. Recent land management has increasingly become for multiple uses compared to past management, which focused on single natural resource values (such as timber or game species).

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