

4,000-year study supports use of prescribed burns in Southern Appalachians

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A new study reconstructing thousands of years of fire history in the southern Appalachians supports the use of prescribed fire, or controlled burns, as a tool to reduce the risk of wildfires, restore and maintain forest health and protect rare ecological communities in the region's forests.

Duke University researchers used radiocarbon analysis of 82 soil charcoal samples dating from 1977 to more than 4,000 years ago to reconstruct the [fire](#) history of a 25-acre site in the Nantahala National Forest in western North Carolina. Their study, the first of its kind, appears on the cover of the current issue of the peer-reviewed journal *Ecology*, published March 31.

"These are the first hard data showing that fires have occurred relatively frequently over much of the last 4,000 years and have played an important role in the health, composition and structure of southern Appalachian forest ecosystems," said Norman L. Christensen Jr., professor of ecology at Duke's Nicholas School of the Environment. "Prior to this study, people presumed fire had long played an important role, but tree rings were the only available tool to study it, and they allowed us to look back only a few hundred years."

Analysis of soil charcoal samples demonstrated that fires became more frequent about 1,000 years ago. This coincides with the appearance of Mississippian Tradition Native Americans, who used fire to clear underbrush and improve habitat for hunting, Christensen said.

Fires became less frequent at the site about 250 years ago, following the demise of the Mississippian people and the arrival of European settlers, whose preferred tools for clearing land were the axe and saw, rather than the use of fire. Active fire suppression policies and increased landscape fragmentation during the last 75 years have further reduced fire frequency in the region, a trend reflected in the analysis of samples from the study site.

The relative absence of fire over the past 250 years has altered forest composition and structure significantly, Christensen said.

"The vegetation we see today in the region is very different from what was there thousands or even hundreds of years ago," he said. "Early explorers and settlers often described well-spaced woodlands with open grassy understories indicative of high-frequency, low-intensity fires, and a prevalence of fire-adapted species like oak, hickory and chestnut, with pitch pines and other (low-moisture) species on ridgetops. Today we find more species typical of moist ecosystems. They've moved out of the lower-elevation streamsides and coves, up the hillsides and onto the ridges."

The study was funded by the U.S. Forest Service. It was conducted at the Wine Spring Creek Ecosystem Management Area on the western slope of the Nantahala Mountains, at elevations between 1280 and 1430 meters.

Aside from historic and scientific interest, knowing more about pre-settlement fire regimes in the region may help [forest](#) managers today understand the likely responses of species to the increased use of prescribed fire for understory fuel management, Christensen said.

However, he cautioned that because of widespread changes that have occurred in the forests as a result of centuries of fire suppression and

other human activities, as well as climatic changes, "prescribed burns may or may not behave similarly to fires that occurred in the past. Fires today likely would burn hotter and more intensely than fires did in the past.

"Also, although history tells us what could be restored, it doesn't tell us what should be restored," he added. "That depends on which species, habitats and ecosystem services we wish to conserve."

The study was co-authored by Kurt A. Fesenmyer, a former student of Christensen who is now a geographic information systems (GIS) specialist with Trout Unlimited in Boise, Idaho.

Christensen is working now to develop more sophisticated tools that will allow him to analyze the microscopic anatomy of soil charcoal samples - including one dating back more than 10,500 years that was collected at the Wine Spring Creek site but excluded from the current study. This analysis, he hopes, will allow him to identify the species of plant the samples come from, and the intensity and behavior of the fires that created them.

More information: "Reconstructing Holocene fire history in a southern Appalachian forest using soil charcoal," Kurt A. Fesenmyer and Norman L. Christensen Jr., *Ecology*, March 2010.

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