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Rooted in Research

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Saving Eastern Oak Forests: Prescribed Fire Impact on Timber Quality

Concerns About Oak

Before European settlement of what is now the eastern United States, the region's vast forests were dominated by oak species (*Quercus* spp.). As the country expanded, white oak (*Quercus alba*) became one of the most important tree species for timber. White oak wood is particularly durable and is a favorite for furniture, flooring, construction timber, liquor and wine barrels, and countless other products.

But America's oak forests are not what they used to be. There is increasing concern about the future of oak-dominated forests, which rely on periodic surface fire and occasional, more significant disturbance to spur successful oak regeneration and growth. Deer browsing, nonnative invasive species such as gypsy moths (*Lymantria dispar*), and fire exclusion have all interfered with oak regeneration.

Mixed species oak stand. USDA Forest Service photo by Patrick Brose.

KEY MANAGEMENT CONSIDERATIONS

- Oak-dominated ecosystems in the eastern United States rely on periodic fire to create forest-floor conditions that are conducive to oak regeneration.
- Driven in part by fire suppression and a belief that any kind of fire will damage forest resources, many eastern U.S. oak tree populations are in decline.
- A team of Northern Research Station scientists, foresters, and ecologists is collaborating to assess timber quality by inventorying trees across multiple national forests that have varied prescribed fire histories. Their findings indicate that economic damage to overstory timber value from prescribed fire is usually minimal, particularly compared to the costs of regenerating oak by other methods such as tree planting and controlling competing vegetation with herbicide and mechanical cutting.
- This research is helping land managers and forest owners differentiate between uncontrolled wildfires and beneficial, low-intensity fires, and to calculate the economic advantages and disadvantages of prescribed burns in different forest stands.

Decades of Research

A team co-led by Jan Wiedenbeck, a Northern Research Station research forest products scientist based out of Princeton, West Virginia, is conducting research with the goal of improving oak regeneration in eastern oak-dominated forests. According to Wiedenbeck, "In the last few decades, scientists with the Northern and Southern Research Stations, along with many research partners and collaborators, have been evaluating prescribed fire with repetition, in combination with other management activities, to keep invasive species and other interfering factors at bay. This hopefully will provide better management options for red and white oak regeneration."

Some of Wiedenbeck's latest research can be found in a March 2020 Journal of Forestry article entitled, "Evaluating Economic Impacts of Prescribed Fire in the Central Hardwood Region." The article notes that although surface fires can help with oak regeneration, there are concerns about potential fire damage to overstory timber. Along with Northern Research Station research forester Dan Dey, Wiedenbeck worked with partners from Purdue University, the Joint Fire Science Exchange Program, the Ohio Department of Natural Resources, and staff at four national forests to evaluate how prescribed fire affects timber volume, grade, and value.

Minimal Loss from Prescribed Fire

According to the article, prescribed fire in mature, mesic stands of the Central Hardwood region usually caused less than a 3 percent loss in oak sawtimber volume or value. The percentage of loss rises slightly following repeated burns and in drier areas. And in a 2019 study in the Hoosier National Forest, Wiedenbeck and her collaborators found that burned oak stands experienced less than 10 percent sawtimber volume loss, regardless of the number of prescribed fires over a 25-year period. It may be a low price to pay for improved oak regeneration, especially compared to the costs of alternative treatments and regenerating oak by tree planting to sustain oak forests and resources into the future.

Wiedenbeck notes that many factors are involved in evaluating economic impact of prescribed fire. "Some of the things we're looking at are burn frequency and the timing of harvesting," Wiedenbeck says, adding, "There's a Northern Research Station computer tool called SILVAH—short for Silviculture of Allegheny Hardwoods—that recommends management approaches based on user objectives and site characteristics. What we're doing is incorporating an economic perspective that can be combined with SILVAH and similar tools, making them more valuable to land managers." Research Forester Dan Dey adds, "There are other values besides timber products to be gained by using prescribed fire. For example, periodic burning creates more open forest conditions, which we often call woodlands or savannas. These habitats promote increases in diversity and abundance of grasses and broad-leaved plants, which in turn provide quality habitat for insects, mammals, and songbirds, including many species of conservation concern such as the brown-headed nuthatch (*Sitta pusilla*) and red cockaded woodpecker (*Leuconotopicus borealis*). A minimal loss in timber value may be greatly offset by increases in other ecosystem values. Timber production and management for other resources are not mutually exclusive; they both can be had with wise, science-based management."

Fuels management in national forests incorporate prescribed fire findings from the Northern Research Station. USDA Forest Service photo by Kelly Bridges.

A researcher looks for damage to oak boards sawn from logs removed from a national forest following a prescribed fire. USDA Forest Service photo by Kelly Bridges.

Addressing Misconceptions

Dey also reflects on the catastrophic wildfires that burned across large areas of the eastern United States following widespread logging during the early 20th century. These fires, which burned through heavy logging debris, caused extensive damage to remaining trees due to wood decay that followed fire injury. According to Dey, "Modern-day prescribed fires, done under controlled conditions and times of the year, are not the same as the wildfires of 100 years ago and can be done with minimal damage to timber. The value of trees that are injured can be recovered by removing the trees in subsequent harvests before wood decay advances over 20 to 30 years."

At Wayne National Forest in southeast Ohio, forest ecologist Jarel Bartig is optimistic about the research. "Fire can be a complex and emotional topic, yet it's integral to oak-dominated forests in this part of the world," Bartig says, adding, "This research is important because it will help us to address the misconception that any kind of fire will damage our forest resources."

A crew gathers to measure damage to oak trees following prescribed fire. USDA Forest Service photo.

Project Leads

Dan Dey is a research forester and project leader at the Northern Research Station in Colombia, Missouri. Additional information on Dan and his research can be found at https://www.nrs.fs.fed.us/people/Dey.

Jan Wiedenbeck is a research forest products technologist and project leader at the Northern Research Station in Princeton, West Virginia. Additional information on Jan and her research can be found at https://www.nrs.fs.fed.us/people/jwiedenbeck.

FURTHER READING

Dey, D.; Schweitzer, C. 2018. A review on the dynamics of prescribed fire, tree mortality, and injury in managing oak natural communities to minimize economic loss in North America. Forests. 9(8): 461. 22 p. https://doi.org/10.3390/f9080461.

Mann, D.P.; Wiedenbeck, J.K.; Dey, D.C.; Saunders, M.R. 2020. Evaluating economic impacts of prescribed fire in the Central Hardwood Region. Journal of Forestry. 118(3): 275-288. https://doi.org/10.1093/jofore/fvaa004.

Stanis, S.; Wiedenbeck, J.; Saunders, M.R. 2019. Effect of prescribed fire on timber volume and grade in the Hoosier National Forest. Forest Science. 65(6): 714-724. https://doi.org/10.1093/forsci/fxz039.

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–Jarel Bartig, Forest Ecologist, Wayne National Forest

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