



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Rocky Mountain Research Station Science You Can Use *(in 5 minutes)*

MARCH 2021



It Is Crowded in Here: How Open Forests Have Disappeared and Why We Should Bring Them Back

When we envision a forest, we usually imagine an area with wall-to-wall trees—but the past state of some forests was decidedly less crowded. “What we think of as normal forests today often have more trees than in the past,” explains RMRS research ecologist Brice Hanberry, whose recently published work took a detailed look at the historical trajectory of “open forest” ecosystems that were once common in most of eastern North America.

What defines a forest as “open”? Open forests generally have two layers—a fire-tolerant tree species in the overstory with an herbaceous ground layer—and range from nearly treeless savannas to open and closed woodlands. In their reviews of current science on these ecosystems, Hanberry and her colleagues, including Don Bragg, a researcher with the Forest Service Southern Research Station, describe the attributes and importance of open forests, factors that have led to their exclusion in the landscape, and the benefits of bringing open forests back.

Open forests—then and now

Open forests dominated by oaks and pines used to be the dominant ecosystem across much of the eastern United States. What most of these forests had in common—and one factor that helped maintain their openness—were frequent, low- to mixed-severity fires (2–25 year return interval) that limited tree regeneration and viability. This fire regime helped create a fairly stable condition where an overstory of fire-tolerant oaks and pines coexisted with a diverse herbaceous understory.

Starting at the time of European settlement and ramping up with the widespread implementation

of conventional forestry practices in the early 20th century, open forests in the eastern United States started disappearing. Fire exclusion, land-use changes, commercial forest management, and habitat fragmentation were among the factors that contributed to closed canopy forests becoming the “new normal.”



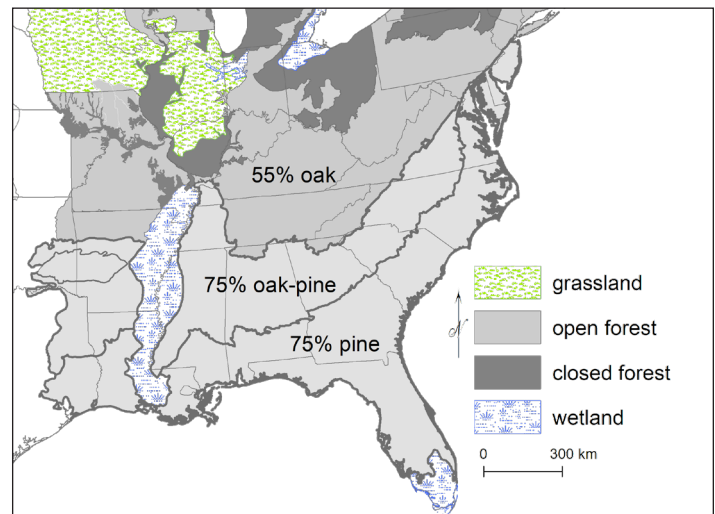
Open forests with a layer of trees and herbaceous grasslands in (top) southern pines and (bottom) central oaks of the eastern United States. (Top: USDA Forest Service photo by Don Bragg; bottom: USDA Forest Service photo by Carter Kinhead).



This transition has come at a considerable cost to plant and animal biodiversity. Hanberry says, “The greatest extinction rates have probably been in the rich herb layers of these forests, which are critical resources for pollinators and other insects.” Many rare and declining vertebrates also depend on open or early successional forests. For instance, many birds that nest in open areas—about 130 species in North America—have experienced particularly sharp declines in recent decades.

Managing for open forests

Management for early successional forest conditions may be helpful to some declining species that rely on open forests. But unlike open forests, early successional forests are transient and result from a myriad of disturbances. Restoration of open forests for the long term, in contrast, focuses on management of the herbaceous layer, continuity of the overstory, and limiting tree regeneration. Bragg, Hanberry, and colleagues recently published a review of silvicultural techniques for accomplishing this that include fire, thinning, and herbicides. They recognized that establishing a robust overstory and herbaceous layer monopolizes resources that might otherwise be used for tree regeneration, helping to perpetuate



This is the estimated historical extent of open forests in the eastern United States. (USDA Forest Service graphic by Brice Hanberry).

this open-forest state. Large-scale restoration of open forests may not be possible because of the current land uses and the economics of timber harvesting, but where possible, it may help to restore rare conditions and declining species.

PROJECT LEAD

[Brice Hanberry](#) is a Research Ecologist who studies historical ecosystems of open forests maintained by fire, tree biomass simulations under climate change, and juniper tree encroachment in grasslands and shrublands.

KEY MANAGEMENT CONSIDERATIONS

- Open forests, once common in the eastern United States, are defined by a fire-resistant overstory of trees and a diverse herbaceous layer that can be maintained by frequent low-intensity fires.
- These forests started disappearing with land-use changes and widespread management practices and are now rare in the landscape; many species associated with these forests have been lost or are on the decline.
- Restoration of open forests for the long term includes management of the herbaceous layer, continuity of the overstory, and managing tree regeneration, which can be accomplished with fire, thinning, and herbicides.
- When open forest restoration is possible, it may help to restore rare ecosystem conditions and declining species.

FURTHER READING

- Hanberry, Brice B.; Bragg, Don C.; Alexander, Heather D. 2020. [Open forest ecosystems: An excluded state](#). Forest Ecology and Management. 472: 118256.
- Hanberry, Brice B.; Abrams, Marc D.; Arthur, Mary A.; Varner, J. Morgan. 2020. [Reviewing fire, climate, deer, and foundation species as drivers of historically open oak and pine forests and transition to closed forests](#). Frontiers in Forests and Global Change. 3: Article 56.
- Bragg, Don C.; Hanberry, Brice B.; Hutchinson, Todd F.; Jack, Steven B.; Kabrick, John M. 2020. [Silvicultural options for open forest management in eastern North America](#). Forest Ecology and Management. 474: 118383.

The Rocky Mountain Research Station is one of seven units within USDA Forest Service Research & Development. RMRS maintains 14 field laboratories throughout a 12-state geography encompassing parts of the Great Basin, Southwest, Rocky Mountains, and the Great Plains. While anchored in the geography of the West, our research is global in scale. RMRS also administers and conducts research on 14 experimental forests, ranges and watersheds and maintains long-term research databases for these areas. Our science improves lives and landscapes. More information about Forest Service research in the Rocky Mountain Region can be found here: <https://www.fs.usda.gov/rmrs/>.

[Click Here To](#)
SUBSCRIBE
[To Future SYCU](#)