

Northern Research Station

Rooted in Research

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Black Cherry: Evolution of a Species

For the last century black cherry (*Prunus serotina*) has comprised a significant portion of the tree canopy across the Allegheny National Forest, and its fruit and seed were abundant. But black cherry's rise to prominence has a complicated history. When 20th-century settlers harvested overstory trees to build ship masts and cleared additional trees to produce other goods, the openings in the forest canopy encouraged pioneer species such as black cherry to thrive. Industrialization later increased the amount of nitrate present in the air, and the new environmental conditions further enhanced the dominance of this nitrogen-demanding species.

Black cherry offers some of the most reliable wildlife habitat and nutrition in the Northeast, while being unpalatable to deer and exempt from their browsing. For years, the timber industry benefited from an abundance of the most in-demand tree species available. This changed in the early 2000s, when the establishment, growth, and survival of black cherry began to diminish. Researchers at the U.S. Department of Agriculture, Forest Service's Northern Research Station (NRS) and partners are studying what caused this dominant population to decrease. The researchers are also investigating possible methods to slow the species' decline to reduce cascading effects in the ecosystem.

Evaluating the Transition

Alejandro Royo, a research ecologist with NRS, recently led a team of scientists and land managers to assess black cherry's evolving response to environmental stressors. The team used a combination of Forest Inventory and Analysis (FIA) data, land managers' field experiences, and previous Forest Service studies to investigate contributing factors to the species' decline.

The FIA program conducts the Nation's forest/tree census, a nationally consistent, annualized inventory with a core set of variables. Data are routinely collected on public and private forestland across the United States. Information including ownership, land status, forest type, habitat type, tree species, tree diameter, and crown class is collected on every plot. Additional data collected on a subsample of plots provides information on soils, understory vegetation, tree crown conditions, down woody material, and invasive species.

FIA data confirmed long-held field-based suspicions of a fading population. "We could point to places where changes have been happening for a longer period of time, or where the degree of change

KEY MANAGEMENT CONSIDERATIONS

- To keep black cherry trees in the mix, managers can consider a targeted approach to fertilizing seedlings with nitrogen.
- Fertilizer is expensive and is best used where there are cherry seedlings present that can benefit from the treatment.
- Fertilization to release black cherry seedlings is most effective if applied when the overstory is about to be removed or has just been removed.

was greater," said Lance Vickers. Vickers, an assistant professor in the Department of Forestry and Natural Resources at the University of Kentucky, led the FIA data analysis for the project. An overview paper, published in *Bioscience* in February 2021, highlights the study.

According to Royo, the strongest evidence the team gathered suggests two co-occurring factors have caused the most damage: a sharp decline in nitrogen deposition and widespread fungal pathogen infestation. He and his team suspect the immense black cherry population came to resemble a monoculture. Just like growing the same crop year after year increases the risk of pests on a farm, "monocultures of tree species can increase disease risk to trees," said Royo. Fungal pathogens targeting black cherry have taken advantage of the circumstances to creep into the soil at higher rates.



Ninety-year old black cherry trees in the Allegheny National Forest. USDA Forest Service photo.

Meanwhile, thanks to Clean Air Act Amendments in 1990, there are less nitrogen compounds in the air. While the chemical compounds in air pollution have many broad-reaching negative effects, nitrogen compounds can increase the growth of black cherry trees. “We are losing nitrogen at a time when black cherry is also getting hammered by pathogens,” said Royo. He calls this phenomenon a “double whammy” for the trees.

At the same time, black birch (*Betula lenta*) is capitalizing on the decline of black cherry, expanding its presence across the Allegheny. The fast-growing tree outpaces other species in the competition for sunlight. “Black birch doesn’t have a large seed, nut, or fruit like a cherry. From a wildlife perspective, black birch has little forage value,” said Royo, “and the timber market value is low.” Hyper dominance by any species, let alone a less valuable one, is a cycle worth interrupting, “We can’t accept a black birch monoculture.”

Fertilizing for Forest Diversity

Emerging research examined potential mechanisms for land managers to support black cherry growth through strategic nitrogen fertilization. This is particularly important considering the new dominance of black birch. Research by NRS research ecologist Todd Ristau suggests that manager-led fertilization offsets the shortage of nitrogen, which may minimize the effects of pathogens impacting black cherry.

Fertilization is most effective under certain conditions, such as during the early stages of development, when black cherry seedlings are contending for resources. In one case study, said Ristau, researchers split a recent overstory removal stand in two and treated one half of the stand with fertilizer while leaving the other half untreated. “In 3 years, many cherry seedlings [in the fertilized half] were greater than 5 feet in height,” said Ristau. “It seems the quick growth from fertilizer allowed cherry to be tall enough to remain competitive.”

Strategic fertilization not only affects black cherry growth; it also impacts other species. Ristau’s team found that applying 25 pounds/acre of nitrogen fertilizer each year to a 1-acre plot—a process they replicated at five locations—suppressed birch establishment. “That’s why when cherry seedlings are present, fertilizer is worth doing,” said Ristau.

A Forest of Unintended Consequences

Early settlers and industrialization inadvertently created unbalanced ecological conditions in the forest stands. Species dominance that initially seemed like a positive shift for black cherry, slowly revealed the unfavorable effects that can result from a species monoculture. Enabling any species to grow at an unsustainable rate until its health and numbers dim has cascading effects on an ecosystem.

Royo suspects black cherry’s decline represents a larger issue. “What is going to happen to forests that respond like black cherry to nitrate?” said Royo. Understanding black cherry’s succession history could help researchers and managers zero in on solutions for other at-risk tree species to get ahead of concerning patterns before they unfold.



A stand on the Allegheny National Forest taken in 1978 near the Little Arnot Creek in Warren County, 50 years after harvest. Basal area per acre had reached 125.8 square feet, with 661 trees per acre. Relative density was 94 percent, and merchantable medial diameter was 9.7 inches. Black cherry, sugar maple, and basswood dominated the stand’s basal area, with black cherry representing 65.3 square feet of basal area per acre. Medial diameter of merchantable black cherry was 9.4 inches. USDA Forest Service photo.

In the meantime, land managers can consider what they can reasonably and sustainably do to soften ecological blows to black cherry, reflected Royo. “We were fortunate to end up with an important species with black cherry, but we should always be managing to promote diversity to the highest extent we can.”

Project Leads

Alejandro Royo is a research ecologist with the Sustaining Forests in a Changing Environment unit. Learn more about Royo’s work at <https://www.nrs.fs.usda.gov/people/aroyo>.

Todd Ristau is a research ecologist with the Sustaining Forests in a Changing Environment unit. Learn more about Ristau’s work at <https://www.nrs.fs.usda.gov/people/tristau>.

Lance Vickers is an assistant professor of forest dynamics and management in the Department of Forestry and Natural Resources at the University of Kentucky. Learn more about Vickers work at <https://forestry.ca.uky.edu/lance-vickers>.

FURTHER READING

Long, R.P.; Ristau, T.E. 2020. [Changes in black cherry seed production: is stand age a factor?](#) *Northeastern Naturalist*. 27(2): 281–298. <https://doi.org/10.1656/045.027.0210>.

Royo, A.A.; Vickers, L.A.; Long, R.P.; Ristau, T.E.; Stoleson, S.H.; Stout, S.L. 2021. [The forest of unintended consequences: anthropogenic actions trigger the rise and fall of black cherry](#). *BioScience*. 71(7): 683–696. <https://doi.org/10.1093/biosci/biab002>.

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