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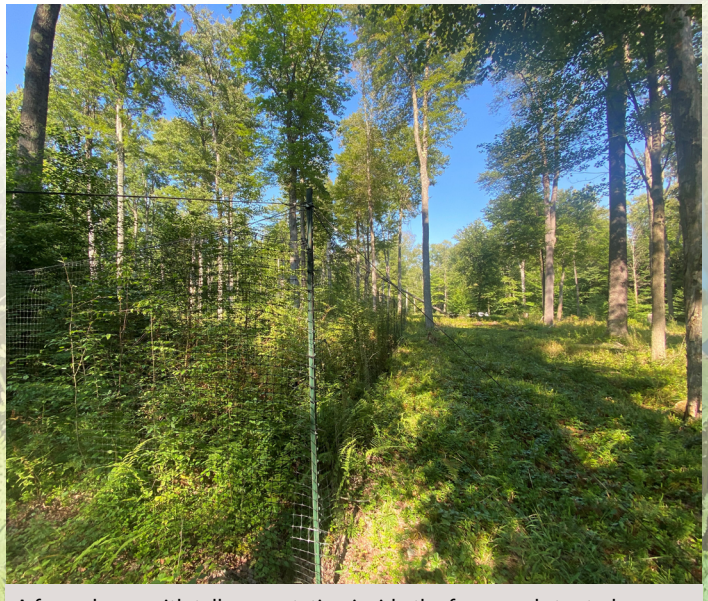
Deer Exclusion Fences Help Hybrid Chestnut Seedlings Thrive

American chestnuts (*Castanea dentata*) were once abundant in the eastern United States, until the non-native diseases chestnut blight fungus and ink disease devastated their numbers in the 19th and 20th centuries. By the 1950s, American chestnuts were functionally extinct, meaning that the species no longer plays a viable role in the ecosystem. Today, 10 percent of the original population remains, and most trees are small sprouts that often die young.

Scientists have spent more than a century developing blight-resistant chestnut trees. Now researchers are tackling another threat: white-tailed deer, which are known to reduce forest growth, change forest structure, and alter plant species composition.

Cornelia (Pinchot) Wilson, research ecologist with the U.S. Department of Agriculture, Forest Service, Northern Research Station, and several colleagues examined deer browse and its impact on efforts to restore the American chestnut. They shared their findings in a recent paper published in Forest Ecology and Management.



A fenced area with taller vegetation inside the fence and stunted vegetation outside shows the effect of deer browse on plants in a forest. USDA Forest Service photo by Cornelia Wilson.

Building on an extensive body of work showing that seedlings grown inside deer exclosures (fenced areas) have higher rates of success, Wilson and collaborators, including the University of Tennessee Tree Improvement Program and the Allegheny National Forest, set out to learn more about how fences could affect the survival rates, growth, and competitive status of American chestnut hybrids.

The researchers planted hybrid chestnut seedlings inside 2.4-meter-tall deer exclosures, which were built for another study led by USDA Forest Service, Northern Research Station research ecologist Alejandro Royo, to examine deer browse and overall forest vegetation changes. Two years after Royo's study began, Wilson and her team planted 360 chestnut seedlings from two backcross hybrid families inside and outside the exclosures.

KEY MANAGEMENT CONSIDERATIONS

- Researchers planted 360 hybrid chestnut seedlings at 15 northern hardwood forest sites in Pennsylvania. Seedlings were placed both within and outside 2.4-meter-tall exclosures to examine deer browse impacts.
- After 6 years, hybrid chestnut seedlings planted inside deer exclusion fences were 65 percent taller on average than those outside the fences, and about half had grown to over 180 cm, a height at which they were no longer considered susceptible to deer browse.
- In year 3 of the study, about 10 percent of chestnut seedlings inside fenced areas had been damaged by deer browse, compared to 80 percent of seedlings outside fenced areas.
- In year 6 of the study, chestnut seedlings inside fenced areas had nearly twice as many leaves as seedlings outside fenced areas.
- Even though the competing seedlings and stump sprouts were taller and faster growing inside the fences at the time the chestnuts were planted, many of the fenced chestnuts were able to grow quickly enough to keep up with the vegetation over time.
- Fencing did not improve the overall chestnut seedling survival rate, likely because deer browse can limit growth but usually does not kill the tree within the timeframe of this study.

They chose 15 forest sites in the Allegheny Plateau in northern Pennsylvania for the experiment.

Exclusion Fences Benefit Chestnuts

The chestnut seedlings averaged 33 cm in height when they were planted. Six years later, seedlings planted inside the exclosures averaged 65 percent taller than those outside and had 60 percent more leaves. The average height of these seedlings was about 142 cm, and about half had grown to over 180 cm, a height at which they are considered no longer susceptible to deer browse. The tallest seedling reached an impressive 403 cm in height with a basal diameter of 20 mm.

Many of the chestnut seedlings in exclosures were able to compete with seedlings and sprouts of other species. "It's amazing to see the drastic difference in height and species composition in the fenced areas," Wilson says. "Species that deer prefer thrive inside the fences, while plants outside the fences are shorter and made up of unpalatable or browse-tolerant species."

Interestingly, the fences did not affect the survival of chestnut seedlings. "Deer don't eat the entire tree—they leave the root system and part of the actual tree itself, allowing the chestnuts to resprout," Wilson says. "For those first six years, at least, deer browse didn't kill them." In unfenced areas, deer browse reduced the height of all vegetation and gave an advantage to slower growing tree species.

Six years after planting, a chestnut seedling in a fenced area shows robust growth. USDA Forest Service photo by Cornelia Wilson.

Management Implications

Several studies have shown that excessive deer browse can shift species composition and reduce tree species diversity. Wilson's study indicates that restoring American chestnut is challenging in areas where deer populations are high but possible if the seedlings are protected.

In areas with high deer densities, protecting planted chestnuts from deer browse helps the seedlings grow quickly and compete with other tree species such as birch, red maple, pin cherry, black cherry, and serviceberry. Controlling competing seedlings can also help American chestnuts grow to maturity and become dominant in the forest canopy. But these solutions are not easy or cost-effective.

"Fencing is expensive and labor-intensive," Wilson says. "Most of the fences in this study were damaged by bears, porcupines, or deer, so they had to be checked and repaired regularly. But consider the investment into creating blight-resistant chestnuts—over 100 years of breeding—and it's not done yet. Millions and millions of dollars have gone into these trees, and we need to do more than plant them in a forest and hope they live. Fencing and other means of controlling browse, such as using tree shelters or reducing deer populations, are absolutely critical. Restoring a species is an investment in the future."

PROJECT LEADS

Cornelia (Pinchot) Wilson is a research ecologist with the Restoration and Conservation of Rural and Urban Forests research work unit at the Northern Research Station.

FURTHER READING

Pinchot, Cornelia C.; Royo, Alejandro A.; Stanovick, John S.; Schlarbaum, Scott E.; Sharp, Ami M.; Anagnostakis, Sandra L. 2022. Deer browse susceptibility limits chestnut restoration success in northern hardwood forests. Forest Ecology and Management. 523(10): 120481. https://doi.org/10.1016/j.foreco.2022.120481.

Royo, Alejandro A.; Kramer, David W.; Miller, Karl V.; Nibbelink, Nathan P.; Stout, Susan L. 2017. Spatio-temporal variation in foodscapes modifies deer browse impact on vegetation. Landscape Ecology. 32(12): 2281–2295. https://doi.org/10.1007/s10980-017-0568-x.

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