

Facing modern forest management challenges: mitigation, adaptation

9 July 2012



Invasive species, such as the Japanese stiltgrass shown, are among factors stressing forests.

Whether you can see the forest for the trees, the big picture of woodlands in the eastern United States shows a besieged ecosystem, according to an expert in Penn State's College of Agricultural Sciences.

Forests are under stress, warned James Finley, Ibberson Professor of Forest Resources and director of the University's Center for Private Forests. They confront a wide range of challenges, from exotic [insect pests](#) and [invasive plants](#) to environmental conditions.

"Insects and diseases brought to Eastern forests from other places have, in a relatively short time, taken from us important tree species and threaten others," he said.

"One hundred years ago, chestnut blight from China began extirpating American chestnut across its range. Soon, American elm was added to the list of species impacted by an imported disease. Then, in the 1930s, the [gypsy moth](#) began to take its toll on our oak forests."

In recent years, other problems have come to our

forests, Finley said. Pennsylvania's state tree, the Eastern hemlock, struggles with hemlock woolly adelgid and elongate scale, which in a few years will greatly reduce the presence of this important species that shades streams and provides important habitat.

"Similarly, [emerald ash borer](#) is rapidly extending itself across our forests and likely will eliminate all native ash species," he said. "The next major threat to many tree species is the Asian longhorned beetle, which will play havoc with oak and maples. In sum, there are mounting issues affecting individual tree species."

The invasion of exotic, competitive plants adds to the mix of issues affecting forests, Finley said. Across much of the East, it is difficult to remember or to imagine what our woodlands looked like without multiflora rose, bush and Japanese honeysuckle, autumn and Russian olive, [barberry](#) and privet adding their touches of green and, occasionally, colorful flowers.

Canopies, especially along woodland edges, are filled with native grapes and Oriental bittersweet. Invasive tree of heaven, paulownia, mulberry and buckthorn are now common, especially along forest edges, roadsides and old fields. They even make up many of the stems in some forested tracts, Finley said.

"Consider how our spring woods now take on displays of color that only a few years ago were uncommon," he said. "There is the white of garlic mustard flowers, the purples and lavenders of dame's rocket, and the soft greens of Japanese stiltgrass.

"Later in the year, other shades of green compete for light and space with native plants. Increasingly, Japanese knotweed and mile-a-minute weed, or tearthumb, fill in forest openings and provide little but aggravation."

Together, Finley noted, the loss of native trees, competition from native and non-native plants, and changing weather conditions are affecting the composition of our forests and their health. Clearly, the complexity of native plants is changing because of these influences. In the end, this leads to a simplification of forests -- there are fewer native species.

Simplicity may mean that some plants will move into voids left by the loss of a given species, Finley explained. For example, in the early 1970s, red oak was the most common tree in Pennsylvania. Then, for a myriad of reasons, red maple took over as the No. 1 tree species.

"Over time, as species composition becomes simpler and these fewer species dominate more of the landscape, resilience changes," he said. "An insect -- for example, Asian longhorned beetle -- comes to the forest, its opportunity to wreak havoc is high, and overall resilience wanes as yet another species enters a spiral of decline and there are fewer species to fill the niche that has opened."

Even the weather and seasons seem to be changing, opening one more front in the battle to keep forests healthy, Finley suggested. Climate change may well be one more factor influencing forest health and species diversity.

"Is global climate change real? Is it human caused? The arguments advanced by both sides of the debate are complex and divisive," Finley said. "However, whether you believe the climate is changing or if humans are causing change is not important. If you are a woodland owner or just enjoy our woods for their many values, know that our forests are truly under stress."

To maintain forest health, it is important to adapt to changing conditions, according to Finley. Forest landowners and forest managers will have to adjust to a landscape that is being imposed upon them. They must consider how they can, through management, help forests adapt to change.

"What can we do to help threatened species," he said. "How might we guide the replacement of one tree species with one or more native species that fit

into our changing conditions? If one of the variables is climate change, what tree species -- maybe one on the edge of its range -- might be introduced that would flourish in the [forest](#)?"

Active participation in adaptation logically leads to making mitigation decisions. In the forests, some activities will mitigate some threats, leading to better conditions and increased resilience. The mitigation activity might focus on a specific threat.

Eastern hemlock decline might provide a mitigation scenario, Finley said. To protect streams that are losing hemlock cover and are threatened with increased water temperatures and detritus from non-native plants -- which do not "feed" native stream insects -- a mitigation step would be to increase native white pine regeneration, while maybe introducing another [species](#), such as rhododendron, to provide cover and shading for streams.

"Mitigation might extend further by making social decisions about how you might reduce your carbon footprint to address climate change, even if you are uncertain about its reality," Finley said. "Your individual decision might not seem to make much of an impact, but it could be simply a statement about your stewardship of the forests and the environment."

"Stewardship, in its simplest form, is living in a way today that helps conserve resources and options for future generations."

Provided by Pennsylvania State University

APA citation: Facing modern forest management challenges: mitigation, adaptation (2012, July 9)
retrieved 19 January 2020 from <https://phys.org/news/2012-07-modern-forest-mitigation.html>

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