Researchers learn why invasive plants are spreading rapidly in forests

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Japanese stiltgrass (Microstegium) is spreading rapidly in Pennsylvania forests.

(PhysOrg.com) -- Invasive plants are advancing into Eastern forests at an alarming rate, and the rapid spread has been linked by researchers in Penn State's College of Agricultural Sciences to forest road maintenance and the type of dirt and stone used on roads.

Perhaps predictably, according to David Mortensen, a professor of weed ecology who has been studying the spread of invasive plants for nearly two decades, humans are unwittingly accelerating the relentless march of invasives into even isolated forests. The findings are especially significant in the face of massive forest road-building efforts expected to support greatly expanded natural-gas drilling operations into the Marcellus shale formation. Hundreds or even thousands of gas wells could be established in Eastern forests in the next few years, depending on the market price of gas.

In a paper titled "Forest Roads Facilitate the Spread of Invasive Plants," published in the August 2009 issue of *Invasive Plant Science and Management*, Mortensen detailed some eye-opening revelations about the process by which invasive plants advance so quickly.

"Roads can play a profound role in the spread and growth of invasive species by serving as corridors for movement and by providing prime habitat for establishment," Mortensen explained. "For example, forest managers have reported that the borders of hundreds of miles of forest roads have been invaded by Japanese stiltgrass in a period of less than 10 years."

As part of his research, Mortensen -- who was assisted by post-doctoral researcher Emily Rauschert and doctoral candidate Andrea Nord -- performed a large-scale survey of the presence and abundance of 13 invasive plants and found that the most abundant species, Microstegium (Japanese stiltgrass) is strongly associated with proximity to roads. He then focused his attention on trying to determine the reasons and devise a strategy to slow the spread.

The researchers discovered, to their amazement, that Japanese stiltgrass on its own does not spread quickly. To better understand why the invasive plant is achieving such a high rate of spread in Eastern forests, they deliberately introduced Microstegium patches in a forested site similar to the one in which the survey was conducted and allowed patches to naturally expand over four years before controlling all patches.

"Through this multi-year study, we found the natural spread rate was surprisingly slow, several orders of magnitude slower than that observed by the forest managers we work with," Mortensen said. "We also found that spread was greatest in habitats adjacent to forest roads.

"It is clear that the rates of spread occurring in forests throughout the study region are aided by management practices such as road grading, which is employed frequently to maintain the dirt and gravel roads."

Japanese stiltgrass seed becomes mixed with the dirt and gravel and then is carried along as graders push the crushed stone to fill holes and smooth road surfaces. Mortensen also suspects invasive plant seeds may be picked up and transported by equipment, so he suggests spread could be limited by carefully cleaning the undersides of construction vehicles and other machines before they travel from one road job to another.

"Management of this troublesome invasive can be enhanced with a multifaceted, integrated approach," he said. "Particular attention should be paid to infestations that serve as sources for seed dispersal into uninvaded or environmentally sensitive areas. The primary vectors of long-distance dispersal, such as road maintenance activities or vehicle traffic, should be identified and mitigating steps taken. Finally, it is important to minimize road-edge disturbance to the extent possible, as such disturbance provides an ideal seedbed for the newly dispersed Microstegium seed."

Perhaps the most startling finding of Mortensen's research relates to the nature of dirt and gravel on forest roads that enables invasive plants such as Japanese stiltgrass to thrive.

"The crushed limestone used to surface many forest roads and to line culverts and drains along those roads are creating ideal conditions for the invasives to spread rapidly," he said. "The high alkalinity sediment from the stone, mixed with water running off the roads during storms, eventually spills out into the forests, carrying invasive plant seeds and creating areas for them to grow quickly. The high alkalinity prevents native plants that have become adapted to acidic forest soils from growing, and invasives such as Japanese stiltgrass fill the void."

Ironically, the crushed limestone is being used on many forest roads and in ditches and drains that parallel mountain streams precisely because the material leaches a high-alkalinity slurry that improves the productivity and water chemistry of the streams. That benefits the wild trout and other aquatic organisms that have suffered in many mountain streams after decades of acidic atmospheric deposition (acid rain).

"That only complicates the battle against the spread of invasive plants into Eastern forests and shows the interconnected nature of ecosystems," Mortensen said. "But measures need to be taken to slow the spread of invasive plants such as Microstegium, because over the long run they will change the nature of our plant communities by outcompeting native plants."

Provided by Pennsylvania State University (news : web)