Gypsy Moth Management Made More Efficient, Cost-Effective

April 2 2008

Gypsy moth mothers lay their eggs on a tree. Once the young caterpillars are born, they will munch on the tree's leaves and may persist until the entire tree is defoliated. Credit: Katriona Shea, Penn State

A computer model that provides land managers with a more efficient and cost-effective approach for controlling gypsy moths and other invasive pests has been created by biologists at Penn State University and the University of Cambridge in the United Kingdom. Gypsy moths, which were introduced to North America in the late 1860s, are responsible for the defoliation of over a million acres of forest land each year and the loss of tens of millions of dollars.

In a paper to be published later this month (April 2008) in the journal

Ecological Applications, the team's results indicate that the best strategies for managing the destructive pests include eradicating medium-density infestations and reducing high-density infestations, rather than reducing spreading from the main infestation.

"Our model is state dependent, which means that it recommends different management strategies depending on the situation," said Katriona Shea, Penn State associate professor of biology and the team's leader. "Most managers currently use the same strategy in all situations, but our model suggests that by tailoring their approach to a particular situation, managers can be more effective in slowing the spread of invasive species."

Saving time and money is of the utmost importance with gypsy moths, which have by now spread throughout the northeastern United States and into the Midwest. "Some people argue that it's just a matter of time before the moths spread across the entire United States, so why bother trying to slow them down?" said Shea. "But we see it differently. We hope that by slowing their spread we can buy some time to find a better way to deal with them."

Although the model has little to offer those states that already have succumbed to infestation, it does have the potential to slow or halt the moths' spread into new areas. States that stand to benefit the most include North Carolina, Virginia, West Virginia, Ohio, Indiana, Illinois, and Wisconsin.

"Where I live in Pennsylvania, it's too late to slow the moths' spread because they already are prevalent across the entire state," said Shea. "It's so bad here that, at certain times, if you stand in the forest and listen, it sounds like it's raining, but what's raining is their excrement." Nevertheless, she added, "It's not too late to try to control their abundance in Pennsylvania. There is still a lot that can be done."

The model's results allow managers in those states where the moths are actively spreading to select a management strategy based on the number of medium-density and high-density infestation patches within their jurisdictions. The model ignores smaller patches because they often go extinct by themselves and, if they escape extinction as small patches, they will be detected in the model as medium patches. For example, if an area contains 20 medium patches and 20 large patches, the model suggests that managers should focus their energy and money on reducing some of those large patches to medium patches. This strategy, ultimately, would be the most effective means of controlling gypsy moths in that particular circumstance. "The model allows us to determine an exact optimal solution to a management problem," said Tiffany Bogich, a member of the reserach team who formerly was an undergraduate student at Penn State and now is a graduate student at the University of Cambridge.

"We really think this model, tailored to particular locations, could be quite useful to land managers," said Shea. "After all, we're not doing this research just to learn about the biology and ecology of gypsy moths. We want to use what we learn to make the world a better place."

This research received financial support from the U. S. Environmental Protection Agency STAR Fellowship and the U. S. Department of Agriculture.

Source: Penn State