Mt. St. Helens Recovery Slowed by Caterpillar

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When Mount St. Helens erupted in 1980, it destroyed every living thing around it. Gas, ash and rock, heated to over 1000 degrees Fahrenheit, sterilized a 60-kilometer square area, leaving a gray lunar-looking landscape devoid of plants and animals.
Within a year, the first plant life had started to return, just as ecologists predicted it would. But a new study shows that things are happening differently from what ecologists have long thought of as the norm. It seems that a small insect is slowing down a piece of the Mount St. Helens recovery process.

“Typically ecologists have thought of the plant recovery process as interactions just between plants," said William Fagan, a University of Maryland theoretical ecologist and lead author of a paper that will appear in the December issue of The American Naturalist. "Classical studies of primary succession have de-emphasized the importance of insects for the spatial spread of plants, but we found that insects are having a major impact on the recovery of plant life at Mount St. Helens," an impact that appears to be slowing the rate of the spread of plant recovery.

"This is an example of ecological interactions that runs counter to conventional wisdom," said Fagan. The paper suggests it is an example that could help scientists better understand the dynamics of species recovery at Mount St. Helens and, in other contexts, the place of biological control agents in limiting the spatial spread of pest species.

Lupines Lead the Way

Together with John Bishop of Washington State University, Fagan began looking at the ecological processes influencing the Mount St. Helens recolonization more than a decade ago, following in the footsteps of ecologists who had conducted research immediately after the volcano's eruption.

They found that insects are damaging lupine -- Lupinus lepidus -- the first plant to recolonize the denuded landscape. Lupine is a low growing, short-lived perennial that is native to the region. A nitrogen fixing plant, lupine can thrive in poor soil at the same time it adds nutrients to it, enriching and modifying soil for other plant species to take root. Lupine seeds spread, and new plants sprout, expanding the recolonization area.

"Lupine are ecosystem engineers," said Fagan. "Their presence influences many other species. But we've also seen tremendous impacts of insects on the lupine, which suggests that insects are also modifying the volcanic landscape, but doing so indirectly, through their effects on the plants."

Bug Zappers

Much of the lupine damage was attributable to caterpillars of Filatima sp. moths, herbivores that feed on the lupine. The caterpillar ties lupine leaves together in silken masses to feed on the green tissue, dramatically reducing the number of seeds produced by lupines and, consequently, the rate at which the lupine population can expand.

"An unusual feature of this system," said Fagan, "is that the herbivory, or feeding on plants, is much more intense in areas where lupines are growing at low densities. In contrast, in areas where lupines are abundant, and growing under crowded conditions, herbivory is rare."

Synthesizing data from observational and experimental studies of the lupine-Filatima interaction, Fagan and his colleagues constructed a theoretical model of the dynamics between the insects and the plants. "We found that the herbivores are slowing down the lupine expansion by a factor of four. This demonstrates that the intensity of the herbivore population on a low-density plant population can determine whether the plant will spread across a landscape, or is prevented from doing so by the insects."

A Long-Term Affair

"Our model looks at just one aspect of the long-term successional process at Mount St. Helens," said Fagan, "but the general message is relevant to a wide variety of systems in which plant-eating insects could influence recovery of habitats experiencing fires and other disturbances.

"One of the neat things about Mount St. Helens is the spatial scale. It's such a big area, and we are just seeing the first steps of the recovery process. It’s fascinating that little insect herbivores could be playing such a big role.”

Other authors on the paper are Mark Lewis, University of Alberta; Michael G. Neubert, Woods Hole Oceanographic Institution; Craig Aumann, University of Maryland; and Jennifer Apple and John G. Bishop, Washington State University, Vancouver.

Source: University of Maryland