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# Boise State Researcher Studies Link Between Ants and Rare Plants

**By Cindy Salo**


A Boise State University researcher is studying the link between Owyhee harvester ants and the decline of slickspot peppergrass, a rare plant found only in southwestern Idaho, as part of a study funded by the U.S. Fish and Wildlife Service.

Ian Robertson, an entomologist in the Department of Biological Sciences, is monitoring both the plants and ants in order to understand what factors allow the insects to increase in population enough to impact the small flowering mustard.

“The ants are a threat to slickspot peppergrass because they collect and eat large numbers of the plant’s seeds within their foraging area,” said Robertson, who along with former graduate student Joshua White (M.S. Biology, ’09) was the first to identify seed predation as a potential factor in the peppergrass’ decline.

Slickspot peppergrass is listed as threatened under the Endangered Species Act. “By understanding the role harvester ants play in the plant’s ability to propagate, public officials will be in a better position to make land management decisions that will help ensure the plant’s survival,” Robertson said.

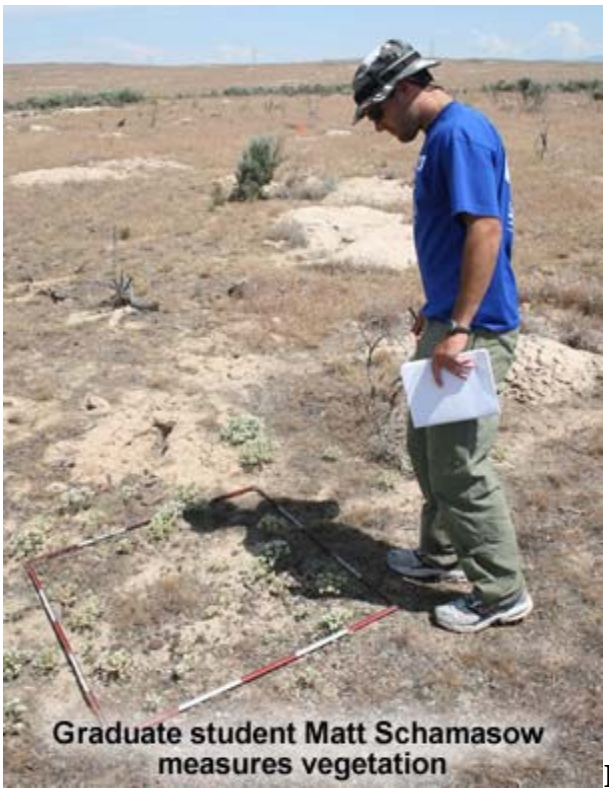
**A unique habitat**

Slickspot peppergrass, which produces tiny clusters of white flowers in late spring, grows in “slick spots,” shallow depressions lined with clay and salts that retain water longer than surrounding areas of sagebrush and grasses. Because slickspot peppergrass grows only in certain types of soil, the plant’s habitat is limited to an arc from the foothills of the Boise Front across the Snake River to the Owyhee Plateau southeast of Bruneau. “Given that the plant has such a limited range, it probably has never occurred in very large numbers,” said Robertson. “Add habitat loss and fragmentation from wildfires and cheatgrass to the mix, plus the development going on in southwest Idaho, and slickspot peppergrass populations are in trouble.”

Small fragmented populations raise other concerns. Each plant’s flowers need to receive pollen from another individual; when there are only a few plants cross breeding in an area they become more and more closely related.

“We've found evidence of inbreeding depression in slickspot peppergrass,” Robertson said. “This is a concern because inbred plants produce fewer seeds and those seeds, in turn, produce smaller plants. It shows that we're losing genetic diversity in these populations, and that can be a sign of dangerous decline.”

**Research sites monitored**


Graduate student Matt Schamasow measures vegetation

Robertson, along with graduate student Matt Schmasow, is currently locating and marking the locations of all ant colonies and slick spots containing the plant at research sites across the plant's range. They will complete this monitoring twice each summer season to identify both short- and long-term changes

in the number of ant colonies, which can increase by as much as 25 percent within one season. Collecting these data over several years will reveal how quickly ant numbers are growing throughout slickspot peppergrass' range, and whether the ants are a serious threat to the plant's long-term viability.

In order to understand how changes in vegetation relate to changes in ant populations, Robertson and his crew also are measuring the cover of sagebrush and understory vegetation at each site in order to identify which aspects of habitat degradation allow the ants to increase.

"We don't understand all the changes that occur after sagebrush and native grasses are removed and cheatgrass invades an area," Robertson said. "The organisms in sagebrush steppe habitats are linked in complex ways and changes in some species can have far reaching effects. For instance, harvester ants may benefit from the changes whereas slickspot peppergrass appears to suffer. We don't know what changes may result if slickspot peppergrass is lost. "

**Identifying ants' role**

Robertson's current research builds on his earlier studies of slickspot peppergrass. In 2005 Robertson was studying insect pollinators of the plant

Peppergrass near an ant colony, marked with a red flag

when he noticed Owyhee harvester ants collecting seeds. Graduate student Joshua White followed up on these preliminary findings and determined that the ants are capable of collecting and eating a large percentage of the slickspot peppergrass seeds found within the 20-yard foraging radius around a colony. White won Boise State's 2009 Distinguished Master's Thesis award for his work, which was later published in the scientific journal Écoscience. He now works as range management specialist and invasive species coordinator for the Wallowa-Whitman National Forest in eastern Oregon.

Harvester ants use several techniques to gather peppergrass seeds. Before the pods have completely ripened the ants clip them from the plants and carry the pods into their nest. After the pods have ripened the ants prefer to remove the seeds directly and leave the empty pods on the plant. They also scavenge seeds that fall from plants. Robertson and his colleagues are currently conducting studies to further measure the impact of

seed scavenging on the reproductive success of peppergrass.

“Our data suggests that seed predation by Owyhee harvester ants may be a serious threat to slickspot peppergrass,” Robertson said. “These ants appear to be the only animal that eats the seeds on a regular basis, because few seeds disappear from plants growing outside of the ant’s foraging area or from plants that we protect from ants.”

Documenting seed predation of slickspot peppergrass by ants provided the link between two familiar ecological patterns. Scientists and managers knew that harvester ants, in general, tend to increase after fire removes native sagebrush stands in the Intermountain West. Rare plant botanists knew that slickspot peppergrass decreases after native vegetation is degraded and the site is invaded by nonnative plants, such as cheatgrass. Robertson and White were the first to recognize that ants contribute directly to the loss of peppergrass. Discovering this relationship has helped clarify our understanding of how habitat degradation leads to slickspot peppergrass decline.

**Rigorous field work**

Robertson and his field crew will be working at sites between Glenns Ferry and Kuna this summer, monitoring ant colonies and the peppergrass, as well


Shamasow collects ants

as conducting controlled experiments aimed at improving our understanding of the ant’s diet. Field work means long days in sweltering heat because the researchers must collect a year’s worth of data over the relatively small window of time when the peppergrass seeds are available. But the work doesn’t stop there. Samples collected in the field are returned to the lab for further study and analysis, and data collected in the field must be entered in the computer and analyzed. “It makes for a very busy summer and fall,” says Schmasow.

Robertson's work with slickspot peppergrass is helping land managers better understand the complex ecological relationship among the plants and animals in sagebrush steppe.

“Slickspot peppergrass is a good example of how habitat degradation can lead to a cascade of changes in an ecosystem,” Robertson said. “When cheatgrass and other weedy plants move into an area after a fire, harvester ants increase in number, which in turn may have detrimental consequences for slickspot peppergrass.”

**Photos courtesy Ian Robertson**