Snakes, Salamanders and Other Creatures Thrive in Areas with Higher Deer Populations

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Ohio State doctoral student Katherine Greenwald, seen here with the hellbender salamander, is studying how human disturbance to the environment affect different types of salamanders. Hellbenders are the third largest aquatic salamander in the world, weighing 3 to 5 pounds on average. Credit: The Ohio State University

Reducing the number of deer in forests and parks may unexpectedly reduce the number of reptiles, amphibians and insects in that area, new

research suggests.

A recent study by researchers at Ohio State University and National Park Service found that higher deer activity is modifying forest ecosystems in unexpected ways. Out of several species of snakes, salamanders, and invertebrates studied, a greater diversity of animals were found in areas with deer populations than were in areas with no deer activity.

The study, which comes at a time when many states have begun to selectively control deer populations, challenges previous research that has suggested deer populations can negatively impact forest ecosystems through eating plants that many smaller animals may depend on.

Instead, researchers found that high numbers of deer may in fact be attracting a greater number of species. This may be because their waste creates a more nutrient-rich soil and as a result, areas with deer draw higher numbers of insects and other invertebrates. These insects then attract larger predators which thrive on insect lava such as salamanders, and the salamanders in turn attract even larger predators such as snakes.

The results, which were published recently in The *Journal of Wildlife Management*, highlight how recent attempts to control deer populations in and around forests may indirectly affect other animals in the forest.

"By just reducing the number of deer in the forest, we're actually indirectly impacting forest ecosystems without even knowing the possible effects," said Katherine Greenwald, co-author of the study and doctoral student in evolution, ecology, and organismal biology at Ohio State.

"Smaller creatures like salamanders and insects are all part of the base of a larger food web that can be affected by small changes."

Research was conducted in Cuyahoga Valley National Park, a 51-square-mile park in northeastern Ohio with an estimated deer population of 2,300 to 4,600. The park's large population of deer and varying landscape made it an ideal place to test for the effects of these animals, she said.

Researchers studied the forest by pairing 12 unfenced sites with 12 fenced sites, called exclosures, based on similar habitat type, forest cover, soil type, and slope. The exclosures, which are used frequently to test for differences in plant growth between grazed and untouched areas, prevent deer from grazing in certain areas. Both unfenced and fenced areas measured 10 meters by 10 meters (approximately 33 feet by 33 feet).

Five square wood boards measuring almost one square foot (30 centimeters square) were placed in random spots in each fenced and unfenced site. These boards are placed on top of the soil and act as rocks or other ground cover for salamanders, slugs and other animals to hide under for protection.

The researchers then counted the number of invertebrates and vertebrates under each board every three to four weeks from May through December in 2004 and monthly from May through September the following year.

They identified a variety of species during the study including snakes, salamanders, earthworms, slugs, spiders, ants, beetles, and many more invertebrates. Species diversity was determined by comparing the variety of insect groups and invertebrates found in each area.

The results, Greenwald said, were completely unexpected.

"We thought the salamanders especially would be very sensitive to areas

with deer because in those areas the whole undergrowth is basically gone. So we thought these creatures were going to be much more abundant in the fenced exclosures because it is just bursting with plants and other studies have shown that amphibians prefer damp, covered areas," she said.

Instead, they found that many of the species studied favored the unfenced areas where deer grazed frequently. Pill bugs, centipedes, millipedes, and beetles were found equally in grazed and fenced areas, but many other creatures were found in greater numbers in grazed areas.

Researchers found nearly three times as many red-backed salamanders and five-and-a-half times more snakes in sites with deer than those without deer. Among invertebrates, snails were 11 percent more abundant in grazed areas than in exclosures and the diversity of arthropods was also 14 percent greater in these areas.

Greenwald speculates that the areas with higher deer populations may appear to lack the high variety of low-lying plants found in exclosures, but the deer may be creating a richer soil mixture through their droppings. This rich soil may be benefiting some plants in the area, which in turn is attracting a larger diversity of insects and invertebrates.

Salamanders and snakes may then be following these creatures, creating a more diverse animal population overall in areas with deer.

"Another possibility is that we are observing a 'refuge effect,' where animals in the grazed areas are more likely to use the cover objects than animals in the ungrazed areas. If the ground in the exclosures really is more favorable, as we originally thought, maybe the animals there just have no need for our artificial cover boards," Greenwald said.

But no matter what the reason, she cautions that the take-home message

of the study is that officials need to understand the forest ecosystem before making decisions about wildlife management.

"We need to be aware of what's happening in these forest ecosystems. Culling deer may cascade into affecting plants, salamanders, and other creatures in ways we can't even imagine. So before we start removing deer we should study what's really happening in these areas because there are a whole host of other issues that go along with culling," she said.

Source: Ohio State University