

Managing for massasaugas

The eastern massasauga rattlesnake, a federally threatened species, plays an important role in biodiversity.

“Massasaugas serve as both predator and prey, which makes them a critical component in the environment,” says Mike McCuiston, vice president of physical resources at the Edward Lowe Foundation.

Because the massasauga’s primary diet consists of mice, voles and other small mammals, they help control rodent populations — which, in turn, helps reduce the tick population. The snakes also provide food for hawks, owls and other predators. “For biodiversity to thrive, you want as many native species as practical,” McCuiston explains. “If one plant or animal begins to decline, it can disrupt the balance of an entire ecosystem.”

Encouraging biodiversity

Although the Edward Lowe Foundation’s primary focus is entrepreneurship, it is also committed to land stewardship. Big Rock Valley (BRV), the foundation’s 2,000-acre property in southwest Michigan, features a broad variety of landscapes and ecosystems, with massasaugas adding to species diversity.

To encourage its massasauga population, the foundation’s environmental team engages in a number of practices, such as establishing grasslands near known habitats.

From fall through spring, massasaugas typically live in wetland areas. In summer months, however,



(Top) An eastern massasauga rattlesnake found at Big Rock Valley. (Inset) Mike McCuiston, vice president of physical resources, helps researchers find snakes to collect data for a longitudinal study.

some of the snakes often migrate to drier upland areas that can range from forest openings to old fields and prairies. Disturbances in these grasslands while snakes are foraging (e.g., mowing, haymaking or cultivation) can cause high mortality. To prevent that from happening, the foundation’s environmental team limits management in areas near known massasauga habitats to dates when the snakes are in hibernation.

The foundation also has converted many established cool-season grasslands to prairies. In contrast to cool-season grasslands, prairies offer greater diversity of height, texture and structure. Prairies generally support a much greater number of individual plant species (often 50 to 100) per acre than cool-season grasslands. The result:

Fields vary between tall, dense grasses and open areas with more light. This gives the massasaugas greater access to rodents — and makes it easier for them to regulate body temperature — while simultaneously protecting the snakes from birds or other predators.

Slowing down succession

To prevent trees and brush from taking over wetland areas and converting the habitat to woodlands, the foundation thins wetlands by hand and through prescribed burning. “Yet we conduct the burns in colder months when the snakes are hibernating,” McCuiston says. “In addition, we use back-burning techniques when practical to create slow moving flames so wildlife can escape.”

Education is also important to correcting misperceptions of

Best practices at BRV

The foundation encourages its massasauga population in a variety of ways:

- Establishing grasslands near habitats the snakes are known to frequent.
- Introducing more native prairie plants.
- Managing key habitats to slow down natural succession.
- Educating staff and neighbors about the importance of conserving eastern massasaugas.

massasaugas, and the foundation has hosted workshops on the massasaugas in conjunction with the Michigan Department of Natural Resources for its staff and the community. Although the eastern massasauga is venomous, it's a docile, nonaggressive species that rarely threatens humans. In Michigan few massasauga bites occur with no known fatalities in 40 years, according to the U.S. Fish & Wildlife Service.

Researchers at BRV

The foundation also promotes its massasauga population by hosting researchers on its property.

For example, while a graduate student at Central Michigan University, Matt Cross conducted a two-year study on how eastern massasaugas react to prescribed burns. Cross also found a hibernaculum in a woodland area with a full tree canopy — unusual because massasaugas like the sun.

After consulting with several massasauga experts, the foundation's environmental team began modifications to encourage the snakes in this area, such as creating a corridor to a nearby wetland and

thinning out trees and brush around the hibernaculum so the ground could heat up more quickly.

In 2009 the foundation forged a partnership with the Eastern

Massasauga Rattlesnake Species Survival Plan® (EMRSSP), a consortium of about 17 zoos. Since then, the group has been conducting an ongoing field study at BRV to collect genetic and demographic data — data that is being used for population modeling and to inform conservation plans.

“The partnership is important because few long-term datasets exist for this threatened species,” points out Lisa Faust, senior director of population ecology at the Lincoln Park Zoo in Chicago, who serves as EMRSSP's field conservation adviser. “To understand how a population is changing, you need a solid baseline of what that population used to be like.”

Armed now with 12 years of data, the researchers estimate that BRV has about 150 adult massasaugas — and the population seems to be healthy and have good reproductive rates. This is especially good news in light of a recent fungal disease. “There is some evidence of the disease being present at BRV, but we don't see it impacting the population in a meaningful way like in other sites,” Faust says.

In addition to its longevity, the BRV field study is also important because it takes place in the middle of the snake's geographic range, Faust adds. “Most massasauga studies have focused on areas in the extreme south or north. Because climate change is changing environmental conditions, having a study in the dead center of the massasauga's range is very helpful.” And in contrast to studies that look at declining snake populations, data from BRV's healthy massasaugas provides

context and a better understanding of what normal survival rates look like, she adds.

Eric Hileman, the EMRSSP's quantitative ecologist and an assistant research professor at Mississippi State University, has conducted several massasauga studies of his own at BRV, and the resulting data has been used to enhance the EMRSSP's annual findings. In one project, which leveraged data from BRV and 46 other sites, Hileman demonstrated how life history traits vary across the snakes' range, such as offspring being heavier in regions with higher annual precipitation.

In another project, Hileman developed a more precise tool for determining when snakes emerge from hibernation. In the past, April 15 was used as an arbitrary calendar date for emergence. Yet by leveraging soil probes and game cameras near hibernaculas at BRV, Hileman demonstrated that when soil temperatures at 30 centimeters and 60 centimeters invert and the shallower soil becomes the warmer temperature for a few days, snakes begin to emerge. This is important knowledge for land managers so they can better time prescribed burns.

Ongoing monitoring

Not many properties have habitat management and research activities going on at the same time, says Yu Man Lee, a conservation scientist with the Michigan Natural Features Inventory, which has partnered with the foundation on educational events and research.

Active monitoring is especially important when it comes to animal species, Lee points out, noting it's important to make sure management practices are effective and determine which techniques are better.

“When managing vegetation, you can tell what's happening,” she says, “but it's difficult to know what's happening to an animal species without actively monitoring them — especially massasaugas, which are hard to see.”

In search of snakes

Zoos conduct multiyear study on massasaugas at BRV

In 2009 the Edward Lowe Foundation partnered with the Eastern Massasauga Rattlesnake Species Survival Plan® (EMRSSP) to conduct research at Big Rock Valley (BRV), the foundation's home in southwest Michigan.

Like other SSPs sanctioned by the Association of Zoos & Aquariums, the EMRSSP is a collaborative science-based management program that strives to enhance the captive population of a particular species and promote its conservation in the wild. With members from about 17 North American zoos, the EMRSSP focuses on the eastern massasauga rattlesnake, a species that became federally listed as threatened in fall 2016.

Since 2009 EMRSSP members have been traveling to BRV each May to hold their annual planning meeting where they review breeding practices for massasaugas within member zoos, which are managed collectively. These snakes are not usually captured in the wild. They are typically bred in captivity, come from nature centers or have been rescued by law enforcement agencies that discovered the animals being illegally traded in the pet trade or held

in other circumstances.

"We discuss how many births we need to support the population, which snakes we want to breed, and with whom," says Lisa Faust, senior director of population ecology at the Lincoln Park Zoo who serves as the EMRSSP's field adviser and coordinates the group's work at BRV. "Then based on those recommendations, we move the animals around to different zoos."

A good portion of the group's time at BRV is spent outdoors, combing wetlands, woods and marshes in search of snakes — part of a longitudinal study that will determine, among other things, survival and reproduction rates. "The goal is to find as many massasaugas as possible and then follow them through time," Faust says.

Easy to say, hard to do, for the eastern massasauga is a shy snake that likes its privacy. In fact, during the group's first visit, EMRSSP researchers and foundation staff members found only 16 snakes — which took 275 man-hours to accomplish.

The foundation was selected for the EMRSSP study due to its known population of massasaugas. Comprised of 2,000 acres, BRV has a wide variety



Billie Harrison, a technician at the Milwaukee Public Museum, has been working on the massasauga study at BRV since the EMRSSP's inception in 2009. "The property is a gem," she says. "It has a spectacular variety of wildlife and has been so well managed, I really look forward to coming back every year."

of ecosystems and habitats, including wetlands, which are the massasaugas' preferred habitat. In addition, the foundation has an active management program to enhance its rattlesnake population. "That was also important because we wanted to go somewhere that had a healthy, stable population of snakes to study," says Faust.

When researchers find a massasauga, they first collect environmental data



Looking for massasaugas is tough work. Researchers spend hours combing through wetlands — a favorite habitat for the eastern massasauga — as well as woodlands and grasslands looking for the shy snakes.

about conditions in which snakes are found, such as humidity and temperature levels, both at ground level and six inches below. They also take GPS waypoints so they can return the snake to the same location it was found.

Then using large tongs, the researchers carefully lift the snakes and place them in special cloth bags inside large plastic containers, which are taken to the foundation's EcoLab. There, researchers measure and weigh the snakes. Sex is determined and blood samples are taken for future genetic, nutritional and disease analysis.

Because massasaugas have unique coloration patterns (known as saddles), they are photographed to help identify recaptures. Adult snakes have a small PIT tag inserted under their skin (the same type of microchip used in dog and cat identification tags). Newborn snakes, for whom PIT tagging would be too invasive, are marked with medical cautery units, which put a unique number on each snake's belly, similar to tiny tattoos.

Recaptures are essential to the research — not only to study survival rates but also so researchers can more accurately determine how large the snake population is.

Yet not all recaptures are taken back to the lab. If the discovered snake is an

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— Lisa Faust

adult that had been captured just a couple weeks before, researchers typically leave it undisturbed. “We take the new GPS coordinates, so we can learn about its movements, but we wouldn't be able to get any other data off the animal,” explains Eric Hileman, assistant research professor at Mississippi State University, who serves as the EMRSSP's quantitative ecologist. “With young snakes, however, their rate of growth is very rapid, so even a week

or so later, a recapture could provide valuable information.”

Twelve years into the project, the researchers have found and collected data from more than 950 unique individual massasaugas at BRV. “That sort of dataset is rare for any species other than long-lived mammals,”

Faust says. The data is being used to build computer models that could determine which life stages are more vulnerable — and other information that could help state and federal agencies enhance

conservation management practices for massasaugas.

“People don't always appreciate the fact there are some really important species in their own regions that are endangered,” adds Faust. “It's not just lions in Africa that warrant conservation.”

To learn more about the EMRSSP, visit www.emrssp.org. For more info about the Edward Lowe Foundation, visit www.edwardlowe.org.

Distinguishing the eastern massasauga from look-alikes

In Michigan there are several other regional species that appear similar to the eastern massasauga, such as the northern water snake, eastern fox snake, milk snake and hog-nosed snake. Although these species lack rattles, they can produce a buzzing sound similar to a rattle if found in leaf litter:

How to tell the real McCoy? Here are a few characteristics that distinguish the massasauga from its Michigan mimics:

- Medium-size, thick body (24 to 36 inches in length).
- Segmented rattle at the end of its tail.
- Triangular head.
- Large heat-sensing pits or openings between the nostrils and the eyes.
- Gray, gray-brown or brown background.
- Dark brown rectangular blocks down the back; two or three additional rows of dark spots along its sides with alternating dark and light bands along the tail.

Massasaugas usually hibernate in crayfish or small-mammal



burrows located in wetland areas. Yet the snakes have been known to use rock crevices, holes created by rotted tree roots, submerged trash and barn floors. Massasaugas usually return to the same site each year and hibernate alone or in small groups of two or three.