Researchers tap into social networks of endangered Indiana bat to aid in habitat management

June 16 2014, by Lynn Davis

Determining roosting and foraging patterns of the endangered Indiana bat, pictured, will aid habitat management.

(Phys.org) —Depending on habitat availability, the endangered Indiana bat may be able to use its social connections to survive a certain amount of roost destruction, according to research by scientists at Virginia Tech and The Ohio State University.

Alexander Silvis of Lynchburg, Ohio, and Andrew Kniowski of Boones Mill, Virginia, both doctoral students in Virginia Tech's College of Natural Resources and Environment, made findings from Ohio State field studies highly visual by applying graphic and spatial approaches to the data.

"Social dynamics are important to bat roosting behavior," said Silvis, who is studying fish and wildlife conservation. "And now, looking at results of a study of roosting and foraging activity in a new light, we have evidence that Indiana bats make social contacts during foraging."

"An improved understanding of Indiana bat social structure and roosting behavior could greatly benefit efforts to minimize impacts of human land use on the species and provide insight into habitat management efforts," said Associate Professor W. Mark Ford of Virginia Tech's Department of Fish and Wildlife Conservation, who leads the Virginia Cooperative Fish and Wildlife Research Unit and advises both Silvis and Kniowski.

Silvis, Kniowski, and Ford, along with Stanley D. Gehrt, associate professor and wildlife extension specialist at The Ohio State University, co-authored an article on their research that appears in the May 9, 2014, issue of *PLOS ONE*.

Indiana bats form maternity colonies in summer beneath the bark of live trees or standing dead trees known as snags. The Ohio State researchers, which included Kniowski, then a master's student advised by Gehrt at Ohio State, conducted their study in Pickaway County, Ohio, which is dominated by cropland with only 9 percent woodland.

They captured and radio-tagged bats from maternity colonies in 2009 and 2010, tracked their activity to determine foraging areas and roosts, and counted bats as they exited roosts. They captured 23 Indiana bats in

2009, of which 14 were adult females and the rest juveniles. They captured 26 bats in 2010, 20 of which were adult females.

Doctoral student Alexander Silvis looks at Indiana bat roost network maps.

Tracking the radio-tagged bats to roosts, they observed that the female bats didn't always return to the same roost. Applying their new approach to the data, "We were able to map a network of connections between the roosts," said Kniowski, who is in the interdisciplinary geospatial and

environmental analysis program at Virginia Tech and works out of the Department of Fish and Wildlife Conservation.

A comparison of the 2009 and 2010 network maps revealed a dispersed roost area in 2009 and a dense network in 2010, with only the most central roosts reused in the second year. The roost area for the entire colony was more than 6.5 square miles in 2009 and less than a square mile in 2010, whereas the foraging area was about 14 square miles both years.

Some flexibility is to be expected in terms of roosting, given the transitory nature of snags, the researchers note in the article. "Roost conditions are very fleeting," said Silvis, who also did his master's research at Ohio State under Gehrt.

But the substantial dispersion of the roosts in 2009 could have been dangerous for the bats. The researchers simulated the removal of roosts to determine the robustness of the colony. Removal of only 5 percent of roosts in 2009 would have resulted in fragmentation of the network, whereas it would have required removal of half of the roosts to fragment the tightly knit network of 2010.

The researchers suggested in the article that they may have witnessed colony behavior changes associated with roost deterioration. In 2009, the colony may have been scattered, seeking a suitable primary roost, following abandonment of a primary roost the previous year. Then in 2010, the colony concentrated roosting activity in the proximity of the new, most suitable roost.

"There is evidence that the colony was using a different primary roost two years prior to our study," they wrote. "In areas with greater amounts of forest or roosting resources, bats may not need to disperse as far in search of new roosts allowing a more stable roosting area."

"We happened to catch the bats at a time when a tree probably became 'ideal,'" said Kniowski.

Doctoral student Andrew Kniowski holds a captured Indiana bat.

"Indiana bats do not select the most stable environment for their roosts," said Silvis, "which makes it all the more critical that we understand their social dynamics and how to manage the conditions of their habitats."

The team also observed greater foraging area overlap than expected, "which does not necessarily equate to association, and further may be an artifact of the location of the highest quality foraging habitat," they

cautiously noted. "However, a high level of overlap should be positively related to the potential for association."

They optimistically suggest, that in cases of roost loss, "foraging area overlap supports the idea that social connections could be re-established during foraging bouts."

"The study highlights a level of complexity in both roost and roosting area use that has not been previously described and raises questions about the resiliency of Indiana bats to roost loss," said Ford.

"Identifying the similarities and differences in colony structure across an array of geographic locations and habitat configurations would provide insight into the biological and ecological factors influencing colony behavior," Ford continued. "However, reductions in population size due to white-nose syndrome, a disease that has significantly impacted the Indiana bat and other bat species, probably preclude such opportunities, making the social dynamics revealed by Kniowski, Silvis, and Gehrt all the more profound."

More information: Silvis A, Kniowski AB, Gehrt SD, Ford WM (2014) "Roosting and Foraging Social Structure of the Endangered Indiana Bat (Myotis sodalis)." *PLoS ONE* 9(5): e96937. DOI: 10.1371/journal.pone.0096937

Provided by Virginia Tech