Climate change driving Michigan mammals north

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Southern flying squirrel.

(PhysOrg.com) -- Some Michigan mammal species are rapidly expanding their ranges northward, apparently in response to climate change, a new study shows. In the process, these historically southern species are replacing their northern counterparts.

The finding, by researchers at the University of Michigan, Michigan State University and Ohio's Miami University, appears in the June issue of the journal *Global Change Biology*.

"When you read about changes in flora and fauna related to climatic warming, most of what you read is either predictive—they're talking

about things that are going to happen in the future—or it's restricted to single species living in extreme or remote environments, like polar bears in the Arctic," said lead author Philip Myers, professor of ecology and evolutionary biology at U-M. "But this study documents things that are happening right now, here at home."

What will be the ultimate impact of Michigan's changing mammal communities?

"We're talking about the commonest mammals there, mammals that have considerable ecological impact," Myers said. "They disperse seeds, they eat seeds, they eat the insects that kill trees, they disperse the fungus that grows in tree roots that is necessary for trees to grow, and they're the prey base for a huge number of carnivorous birds, mammals and snakes. But we don't know enough about their natural history to know whether replacing a northern species with a southern equivalent is going to pass unnoticed or is going to be catastrophic. It could work either way.

"What we can say is that the potential is there for serious changes to happen, and it would be really smart of us to figure it out, but that will require a lot of detailed, focused ecological research."

In the study, Myers and coworkers analyzed distribution and abundance records of opossums and eight species of small forest rodents. In addition to data collected by live-trapping animals over the past 30 years, the researchers relied heavily on specimens and notes in research museums including the U-M Museum of Zoology and the Michigan State University Museum.

"Museum collections have been underutilized in studying the effects of climate change," Myers said. "We're fortunate in Michigan to have an amazing resource in the U-M Museum of Zoology collection, which contains great records of thousands of Michigan species from hundreds

of locations, sampled over the past 100 years."

One study area proved especially valuable for long-term comparisons. The Huron Mountain Club, an 18,000-acre tract of pristine forest in Michigan's Upper Peninsula owned by a private association, includes a 6,400- acre research area where scientists are allowed to carry out field work. The non-profit Huron Mountain Wildlife Foundation has funded three animal surveys there: the first between 1939 and 1942, the second in 1972-1973 and the most recent in 2004-2005, when U-M graduate student Allison Poor Haraminac used methods and trapping grids like those used in the earlier studies.

Combining trapping data from Huron Mountain Club and other locations with museum material and road kill reports, the researchers ended up with a total of 50,000 records, 14,614 of which were for the nine mammal species in the study. When those records were analyzed, they painted a clear picture of mammals on the move.

Of the nine mammal species examined, four have established strongholds or increased in abundance, while five have declined. The increasing species—white-footed mice, southern flying squirrels, eastern chipmunks and common opossums—all are southern species, while the declining species—woodland deer mice, southern red-backed voles, northern flying squirrels, woodland jumping mice, and least chipmunks—are all northern species.

The south-to-north expansion pattern is what you'd expect if climate change is driving the advance, but could there be other explanations, such as forest regeneration or human influence?

"Clearly there's a lot more forest now than in the late 1800s and early 1900s, when logging and fires almost completely destroyed the forests of the northern Great Lakes region," Myers said. "But that doesn't work as

an explanation for the patterns we see, because the species that are moving in and becoming more common are actually ones that do very well when forests are cut over." What's more, the change is happening even in the uncut forest of the Huron Mountain Club.

Similarly, increases in human population and the changes in land use that go along with them can't completely explain the changing mammal distribution and abundance patterns, Myers said. For one thing, the mammal changes are not restricted to habitats that have been disturbed by human habitation. For another, they're seen both in the Lower Peninsula, where the human population has increased over the past 50 years, and in the Upper Peninsula, where the trend has been in the opposite direction.

That leaves warming climate as the likely cause. But has such warming actually occurred in Michigan? To investigate, the researchers downloaded maximum and minimum daily temperatures from the National Climate Data Center for 16 weather stations in the Upper Peninsula, where changes in the small forest rodent community have been especially pronounced. They then calculated monthly averages for minimum and maximum daily temperatures for each year between 1970 and 2007 for each station and for the region as a whole.

Across all 16 sites, average annual minimum daily temperatures increased significantly over the 37-year period. Average annual maximum daily temperatures also rose, although not as dramatically.

The research team's results and conclusions dovetail with those of other groups that have found northward expansions of particular species in Wisconsin and Ontario and a shift from lower to higher elevations in the Yosemite National Park.

Provided by University of Michigan (news : web)

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