

Ants rise with temperature

March 23 2013, by Mary A. Durlak



(Phys.org) —Warm nights might be more important than hot days in determining how species respond to climate change. "Rising *minimum* temperatures may be the best way to predict how climate change will affect an ecosystem," said Robert Warren, assistant professor of biology. "Cold extremes that once limited warm-adapted species will disappear in a warming global climate."

Global Change Biology published a study conducted by Warren with Ph.D. candidate Lacy Chick of the University of Tennessee-Knoxville. The study shows that the lowest —not the highest—temperatures are critical in determining the migration of warmth-loving ants, *Aphaenogaster rudis*, to higher elevations.

As they migrate, *A. rudis*—a reddish ant with light-colored legs—displace *Aphaenogaster picea*, a dark ant with dark legs. *A. picea* thrive at temperatures about 2°C colder than *A. rudis* can tolerate. *Aphaenogaster* ants are the dominant woodland seed dispersers in eastern forests. "So it's possible that the displacement of *A. picea* may affect the spread of seeds produced by early spring ephemerals," said Warren.

By comparing data collected in 1974 to current data, Warren and his team were able to compare the percentage of *A. rudis* and *A. picea* at different elevations in the Southern Appalachian Mountains in Georgia. In 1974, *A. rudis* accounted for less than 60 percent of the two [species](#) at 500 meters and less than 20 percent at 700 meters. At 900 meters (nearly 3,000 feet), *A. rudis* were almost nonexistent.

From 1974 to 2012, regional mean and maximum temperatures remained steady, but the minimum temperature increased by about two degrees Celsius (3.6 degrees Fahrenheit). In 2012, *A. rudis* approached 90 percent at 500 meters, nearly 60 percent at 700 meters, and more than 20 percent at 900 meters.

"As climate change occurs, we expect species to migrate," said Warren. "However, we need evidence to establish that [climate change](#) caused that movement."

To obtain that evidence, Warren's team collected a total of 755 [ants](#) from 191 colonies. In the lab, researchers conducted thermal tolerance tests. Loss of righting response was used to indicate intolerance to low and high temperatures.

"Both species tolerated high maximum temperatures," said Warren, "but *A. rudis* can tolerate a higher minimum temperature than *A. picea*." (The cold-tolerant *A. picea* are viable as long as minimum temperature is at least -0.5° C; *A. rudis* requires a minimum temperature of 2.0° C.)

As the minimum temperature rises, the warm-tolerant *A. rudis* can migrate to higher elevations, displacing *A. picea*. "This suggests that rising temperatures may not necessarily kill or stress species directly," said Warren. "Instead, it might be that higher minimum temperatures allow warm-adapted species to outcompete cold-adapted species."

Because *A. picea* break dormancy at cooler temperatures than *A. rudis*, they become active earlier in the spring when certain forest ephemerals such as *Erythronium americanum* (trout lilies) bloom. The absence of *A. picea* may affect the spread of seeds produced by early-flowering woodland plants.

Warren said, "What seems like a small difference—just two degrees—is having a big impact."

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