Northern moths may fare better under climate warming than expected

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Lycia hirtario (Käherämittari in Finnish, Brindled Beauty in English) is one of more than 300 species of moths that Dartmouth and Finnish researchers studied for their temperature sensitivity. Credit: Anu Valtonen

Moths in northern Finland are less susceptible to rising temperatures than expected, suggesting high latitude moth populations around the world may be partly buffered from the effects of rapid climate warming, according to a new Dartmouth-Finnish study based on the most extensive analyses yet conducted of seasonal patterns in forest animals.

The results are important because moths are a key food source for birds, bats and many other predators, and (in their caterpillar stage) are one of the planet's most abundant plant-eating animals and most voracious agricultural pests. The findings also underscore the value of long term ecological monitoring.

The results appear Sept. 24 in the journal *Global Change Biology*. A PDF of the study is available on request. The study was conducted by researchers at the University of Eastern Finland, Finnish Environment institute, Kainuu ELY Centre and Dartmouth.

Climate change is influencing natural systems worldwide by altering the annual timing of biological events among many plants, animals and insects, especially toward the poles where temperatures are increasing more rapidly and ecological effects from planetary warming are most pronounced.

The Finnish and Dartmouth researchers analyzed sensitivity to temperature of multiple populations of 334 moth species distributed over 600 miles of latitude from southern to northern Finland (about the same latitude as southern to northern Alaska). Their results show that temperature is the dominant control on most moth life cycles but that some species are more strongly controlled by day length, while others are controlled by a combination of temperature and day length. They found that climate dramatically affects when caterpillars are feeding and adults are flying, with the majority of species flying up to a month earlier in warm summers than cool summers. This is especially significant in regions where the summer lasts only a few months.

The findings show that climate warming alters ecosystems by changing the seasonal rhythms of moth species, which may create a mismatch in the timing of when caterpillars are feeding and birds that feed upon them are nesting. Birds are considered more rigid than insects in their

seasonality because of migration and physiological controls from day length. The results showed moth populations living farther north – though they still fly much earlier in warm years than cool years—are less physiologically responsive to warming than their low latitude counterparts.

The study was based on 20 years of data from the Finnish Moth Monitoring Scheme Nocturna, which, which with the help of a network of volunteers, monitors populations of night-active moths at more than 40 forest sites distributed over more than 60,000 square miles. The project, one of only three in the world that monitors nocturnal insects on such a large scale, has records of more than six million individual moth captures.

Provided by Dartmouth College

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