Shedding light on trophic interactions: A field experiment on the effect of human population across latitudes on herbivory and predation patterns

Inés María Alonso-Crespo[1] and Juan Antonio Hernández-Agüero[2]

[1]Leuphana Universitat Luneburg
[2]Senckenberg Gesellschaft fur Naturforschung

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Abstract

The interactions between different species in an ecosystem, such as predation and herbivory, are crucial for maintaining the ecosystem's functioning, including pest control and nutrient cycling. Unfortunately, human activities are increasingly affecting these trophic relationships, contributing to the current decline in biodiversity, particularly due to urbanization and climate change. The intensity of trophic interactions is also affected by latitudinal gradients, which may be further impacted by urbanization, such as the urban island heat effect. This study aimed to investigate the hypothesis that the impact of human pressure on trophic interactions varies across different latitudes. To test this hypothesis, we selected 18 study sites at two latitudes (i.e., ˜53°N and ˜50°N) with varying human population density. We used artificial caterpillars placed on European beech branches to assess bird predation and took standardized pictures of the leaves to estimate insect herbivory. Remote sensing techniques were used to estimate human pressure. We found that the intensity of both bird predation and insect herbivory varied in response to human pressure, with opposite trends observed depending on the latitude. At the upper latitude, bird predation increased with human impact, while the opposite was observed at the lower latitude. All types of herbivory in both latitudes increased with urbanization. Moreover, at lower latitudes, species may face a disadvantage due to the urban heat island effect, as they tend to be relatively sensitive to temperature changes. Conversely, at higher latitudes, some species may benefit from a softer winter. Overall, this study highlights the complex and dynamic nature of trophic relationships in the face of human-driven changes to ecosystems. It also emphasizes the importance of considering both human pressure and latitudinal gradients when assessing the ecological consequences of future climate change scenarios, particularly in urban environments.

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