Eating like a bird helps forests grow

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A survey of more than 100 experiments on birds, bats and lizards from four continents showed that small, interguild predators increase plant biomass by consuming herbivores and their insect predators. Credit: Christian Ziegler

Lions, tigers and bears top the ecological pyramid -- the diagram of the food chain that every school child knows. They eat smaller animals, feeding on energy that flows up from the base where plants convert sunlight into carbohydrates.

A new study examines complex interactions in the middle of the pyramid, where birds, bats and lizards consume insects. These predators eat enough insects to indirectly benefit plants and increase their growth, Smithsonian scientists report. "Our findings are relevant to natural communities like grasslands and forests, but also to human food production, as these insect-eating animals also reduce insect pests on crop plants," said Sunshine Van Bael, scientist at the Smithsonian

Tropical Research Institute.

Previous theory on food webs suggested that the effects of insect-eaters on plants would be weak, because animals like birds not only feed on herbivores - which is good for the plants- but may also benefit them by feeding spiders and predatory insects. If a bird eats a lot of spiders, for example, caterpillars could be "released" from spider predation and then consume more plant material. The authors found that previous theory did not hold true; in fact, the birds simply ate the spiders and the caterpillars.

The authors reviewed more than 100 studies of insect predation by birds, bats or lizards from four continents. They found that the identity of the predator didn't make much of a difference. Together, by eating herbivores and their insect predators, they reduced damage to plants by 40 percent, which resulted in a 14 percent increase in plant biomass.

"It's no longer apt to say that one 'eats like a bird'," said Van Bael, "Our study shows that birds, bats and lizards act as one big vacuum cleaner up in the treetops. Everything's on the menu."

Nevertheless, there is still a lack of experimental work on the overlap in diets of the insects that birds, lizards and bats are eating, and the insects that the predatory insects, themselves are eating. "Our study shows that birds, bats and lizards protect plants, underscoring the importance of conservation of these species in the face of global change," summed up lead author Kailen Mooney, professor of ecology and evolutionary biology at the University of California-Irvine.

More information: Paper: www.pnas.org/doi/10.1073/pnas.1001934107

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