Biodiversity higher in the tropics, but species more likely to arise at higher latitudes

November 22 2013

A new study of 2300 species of mammals and nearly 6700 species of birds from across the globe helps explain why there are so many more species of plants and animals in the tropics than at higher latitudes. In a study supported by the National Evolutionary Synthesis Center in North Carolina, researchers found that while the tropics harbor a greater diversity of species, the number of subspecies—potential stepping stones in the process by which one species becomes two—is actually greater in the harsher environments typical of higher latitudes.

The surprising results suggest that the latitudinal diversity gradient may be due higher species turnover—a higher potential for speciation counterbalanced by a higher potential for extinction—towards the poles than near the equator, the researchers say.

Scientists have known for more than a century that species diversity increases towards the equator. Think tropical rainforests—which house two thirds of the world's species—teeming with buzzing insects, screeching birds and howling monkeys, versus the frigid tundra, where life is largely limited to scattered trees and only a few dozen kinds of mammals, such as caribou and foxes.

Numerous hypotheses have been proposed to explain this pattern. One idea is that tropical regions harbor greater biodiversity because they are especially fertile grounds for the formation of new species—i.e., "cradles of diversity." Another idea is that biodiversity hotspots are less likely to lose the species they already have.

"There's a lot of controversy over what explains the global pattern of biodiversity," said lead author Carlos Botero of North Carolina State University.

In a study to appear in the November 22 issue of *Molecular Ecology*, Botero and colleagues assembled a data set of climate and weather patterns across the globe, and combined it with genetic data other information for nearly 50% and 70% of all mammals and birds known to be alive today.

The team was surprised to find that while the number of bird and mammal species increases closer to the equator, the number of genetically distinct groups within each species—known as subspecies—is greater in the harsher environments typical of higher latitudes.

"These are environments that are colder and drier, and where the differences between the hottest and coolest months are more extreme," Botero explained.

Animals in these environments are more likely to freeze during cold winters or die during usually hot summers. "If extreme weather events wipe out a population every now and then, but don't wipe out an entire species, the populations that survive will be geographically separated and could start to diverge from one another," Botero said.

The results are consistent with a 2007 study by researchers at the University of British Columbia suggesting that—contrary to conventional wisdom—species arise faster in temperate zones than in the tropics. "It may be that species come and go more frequently in the temperate zones," Botero said.

Comparing biodiversity in the temperate zones with that in the tropics is

like comparing the coins in your pocket with the coins in your piggy bank, he added. "There are usually more coins in your piggy bank than in your pocket. But you're always spending the coins in your pocket, and receiving new coins in the form of change. The coins in your piggy bank turn over less often, but over time they add up."

More information: Botero, C., et al. (2013). "Environmental harshness is positively correlated with intraspecific divergence in mammals and birds." *Molecular Ecology*. dx.doi.org/10.5061/dryad.sb175

Provided by National Evolutionary Synthesis Center (NESCent)

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