New study shows humans have more impact on tropical nitrogen levels

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A new paper co-written by four University of Montana researchers finds that humans have more than doubled tropical nitrogen inputs.

Benjamin Sullivan, a researcher working with UM College of Forestry

and Conservation Professor Cory Cleveland, led the team that looked at the nitrogen cycle in tropical rain forests. Sullivan and his colleagues used a new method to demonstrate that biological nitrogen fixation in tropical rain forests may be less than a quarter of previous estimates.

Nitrogen is an essential nutrient for plant and animal life. It's required in many basic molecules, like DNA and amino acids. Nitrogen enters the environment either through a microbial process called biological nitrogen fixation or through human activity, such as fertilization and fossil-fuel consumption.

Too much nitrogen, however, leads to dead zones, pollutes air and drinking water, contributes to a number of human illnesses, and can affect ecosystems negatively. That could be a problem, given the high biodiversity of tropical rain forests and their important role in the global carbon cycle and the Earth's climate.

"This research fundamentally changes our understanding of the tropical nitrogen cycle," said Sullivan. "It shows that few ecosystems on Earth have escaped the impact of human activity."

He notes that human impacts on the nitrogen cycle typically are greatest where biological nitrogen fixation is low and human inputs of nitrogen are high – like in many parts of North America, including Montana.

Past research has assumed that tropical rain forests have high levels of biological nitrogen fixation and that humans add relatively little nitrogen to tropical ecosystems. In fact, by reducing estimates of naturally occurring nitrogen inputs, "this research shows that human impacts on the nitrogen cycle are even bigger than we thought. Preserving human and ecosystem health requires immediate steps to solve this growing problem," Cleveland said.

Sullivan worked with UM doctoral student Megan Nasto and researcher Bill Smith. Smith provided the spatial data analysis that put Sullivan's field and lab-tested results into a global context. Co-authors also include UM alumna Sasha Reed at the U.S. Geological Survey, and researchers at the University of Colorado-Boulder and the University of Connecticut.

The research paper, titled "Spatially Robust Estimates of Biological Nitrogen (N) Fixation Imply Substantial Human Alteration of the Tropical N Cycle," was published in the journal *Proceedings of the National Academy of Sciences*.

More information: Paper: www.pnas.org/cgi/doi/10.1073/pnas.1320646111

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