Secret ingredient for the health of tropical rainforests found

December 9 2008

A team of researchers led by Princeton University scientists has found for the first time that tropical rainforests, a vital part of the Earth's ecosystem, rely on the rare trace element molybdenum to capture the nitrogen fertilizer needed to support their wildly productive growth. Most of the nitrogen that supports the rapid, lush growth of rainforests comes from tiny bacteria that can turn nitrogen in the air into fertilizer in the soil.

Until now, scientists had thought that phosphorus was the key element supporting the prodigious expansion of rainforests, according to Lars Hedin, a professor of ecology and evolutionary biology at Princeton University who led the research. But an experiment testing the effects of various elements on test plots in lowland rainforests on the Gigante Peninsula in the Barro Colorado Nature Monument in Panama showed that areas treated with molybdenum withdrew more nitrogen from the atmosphere than other elements.

"We were surprised," said Hedin, who is also a professor in the Princeton Environmental Institute. "It's not what we were expecting."

The report, detailed in the Dec. 7 online edition of *Nature Geoscience*, will be the journal's cover story in its print edition.

Molybdenum, the team found, is essential for controlling the biological conversion of nitrogen in the atmosphere into natural soil nitrogen fertilizer, which in turn spurs plant growth. "Just like trace amounts of

vitamins are essential for human health, this exceedingly rare trace metal is indispensable for the vital function of tropical rainforests in the larger Earth system," Hedin said. Molybdenum is 10,000 times less abundant than phosphorus and other major nutrients in these ecosystems.

The discovery has implications for global climate change policy, the scientists said. Previously, researchers knew little about rainforests' capacity to absorb the greenhouse gas carbon dioxide. If molybdenum is central to the biochemical processes involved in the uptake of carbon dioxide, then there may be limits to how much carbon that tropical rainforests can absorb.

The biological enzyme, nitrogenase, which converts atmospheric nitrogen into soil fertilizer, feeds on molybdenum, the researchers found. "Nitrogenase without molybdenum is like a car engine without spark plugs," said Alexander Barron, the lead author on the paper, who was a graduate student in Hedin's laboratory and earned his Ph.D. in ecology and evolutionary biology from Princeton in 2007 and who now is working on climate legislation in Congress.

Source: Princeton University