Nitrogen pollution boosts plant growth in tropics by 20 percent

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A study by UC Irvine ecologists finds that excess nitrogen in tropical forests boosts plant growth by an average of 20 percent, countering the belief that such forests would not respond to nitrogen pollution.

Faster plant growth means the tropics will take in more carbon dioxide than previously thought, though long-term climate effects are unclear. Over the next century, nitrogen pollution is expected to steadily rise, with the most dramatic increases in rapidly developing tropical regions such as India, South America, Africa and Southeast Asia.

Nitrogen fertilizer, applied to farmland to improve crop yield, also affects ecosystems downwind by seeping into runoff water and evaporating into the atmosphere. Industrial burning and forest clearing also pumps nitrogen into the air.

“We hope our results will improve global change forecasts,” said David LeBauer, graduate student researcher of Earth system science at UCI and lead author of the study.

The research results appear in the February issue of the journal *Ecology*.

Using data from more than 100 previously published studies, LeBauer and Kathleen Treseder, associate professor of ecology and evolutionary biology at UCI, analyzed global trends in nitrogen’s effect on growth rates in ecosystems ranging from tropical forests and grasslands to wetlands and tundra. Nitrogen, they found, increased plant growth in all

ecosystems except for deserts.

Surprisingly, tropical forests that were seasonally dry, located in mountainous regions or had regrown from slash-and-burn agriculture also responded to added nitrogen. Although these are not the tropical forests that typically come to mind, they collectively account for more than half of the world's tropical forests.

Scientists believed added nitrogen would have little effect in the tropics because plants there typically have ample nitrogen and are constrained by low levels of phosphorus. If one necessary plant nutrient is in short supply – in this case phosphorus – plant growth will be poor, even if other nutrients such as nitrogen are abundant. Experiments in the study added nitrogen at the high end of ambient nitrogen pollution to test the maximum potential response.

It is difficult to predict the long-term effects of nitrogen on global climate change. One factor will be the degree to which humans change natural ecosystems, for example by cutting down or burning the tropical forests. Further, climate change may determine whether these areas grow back as forests or if they are replaced by grasslands or deserts. It also is unknown how nitrogen will affect the fate of carbon once plants die and begin to decompose.

"What is clear is that we need to consider how nitrogen pollution interacts with carbon dioxide pollution," LeBauer said. "Our study is a step toward understanding the far-reaching effects of nitrogen pollution and how it may change our climate."

Source: University of California - Irvine