Waterways contribute to growth of potent greenhouse gas

December 20 2010

Nitrous oxide, a potent greenhouse gas, has increased by more than 20 percent over the last century, and nitrogen in waterways is fueling part of that growth, according to a Michigan State University study.

Based on this new study, the role of rivers and streams as a source of nitrous oxide to the atmosphere now appears to be twice as high as estimated by the Intergovernmental Panel on Climate Change, according to Stephen Hamilton, a professor at MSU's Kellogg Biological Station. The study appears in the current issue of the *Proceedings of the Academy of Sciences*.

The increased production of nitrous oxide in streams can be traced to the growth of nitrogen fertilizers and the cultivation of crops that return nitrogen to the soil naturally, both of which have the unintended consequence of increasing nitrogen in streams. Some of the nitrogen entering streams is converted to nitrous oxide.

While many studies have focused on how agricultural soils contribute to the production of this greenhouse gas, little attention has been given to nitrous oxide originating from streams and rivers, according to the study.

Nitrous oxide exists at low levels in the atmosphere, yet is thought to be responsible for 6 percent of climate warming and also contributes to stratospheric ozone destruction. It packs a much bigger punch – on a molecular level – than carbon dioxide, Hamilton said.

"Nitrous oxide is the leading human-caused threat to the atmospheric ozone layer, which protects the earth from the sun's harmful ultraviolet radiation," said Hamilton, who works with MSU's Long-Term Ecological Research program. "And on a per molecule basis, its global warming potential is 300-fold greater than carbon dioxide."

Hamilton was part of a team of researchers led by Jake Beaulieu of the Environmental Protection Agency and formerly with the University of Notre Dame. The team conducted experiments on 72 U.S. rivers and streams and ran their findings through a global river network model. They studied the production of nitrous oxide from the process of denitrification, in which bacteria convert nitrates to nitrogen gases.

"Even with more than 99 percent of denitrified nitrogen in streams and rivers being converted to the inert gas, dinitrogen, river networks still contribute to at least 10 percent of global anthropogenic nitrous oxide emissions," Hamilton said.

Reducing use of agricultural fertilizer and other sources of nitrogen are examples of how to decrease humanity's contribution to the growth of nitrous oxide produced in waterways, the study concluded.

Provided by Michigan State University