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NASA

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**Editors: Two graphics are available to accompany this story at the Web site: http://www.unh.edu/news/Dec02/methanegraphics.html. A photo of Chinese farmers transplanting rice is also available at: http://www.unh.edu/news/Dec02/sk_20021219rice.html. Credit Changsheng Li. Professor Li can be reached at 603-862-1771.**

DURHAM, N.H. -- Changes to farming practices in rice paddies in China may have led to a decrease in methane emissions, and a decline in the rate that methane has entered the Earth's atmosphere over the last 20 years, a NASA-funded study finds.

Lead author Changsheng Li, professor of natural resources at the University of New Hampshire's Institute for the Study of Earth, Oceans, and Space, notes that in the early 1980s Chinese farmers began draining their paddies midway through the rice growing season -- replacing a strategy of continuous flooding -- when they learned it would increase yields and save water. Draining soil stimulates rice root development and accelerates decomposition of organic matter in the soil to produce more inorganic nitrogen, an important fertilizer.

As an unintended consequence, less methane was emitted out of the rice paddies. Methane is produced by soil microbes in paddy soils under anaerobic conditions, or in the absence of air or free oxygen. Midseason drainage aerates the soil again, and hence interrupts methane production.

Over 100 years, methane is 21 times more potent as a greenhouse gas than carbon dioxide ($CO_2$). Since 1750, methane concentrations in the atmosphere have more than doubled, though the rate of increase has slowed during the 1980-90s. Currently, about 8 percent of global methane emissions come from the world's rice paddies.

"There are three major greenhouse gases emitted from agricultural lands

-- carbon dioxide, methane and nitrous oxide," said Li. "Methane has a much greater warming potential than CO2, but at the same time, is very sensitive to management practices."

Li and his colleagues recorded reductions in methane caused by draining practices at several experimental sites in China and the U.S. At the same time, they observed that the amounts of methane reduction varied greatly in space and time due to complex interactions among several factors.

The researchers spent more than 10 years developing a biogeochemical model, called the Denitrification-Decomposition (DNDC) model, which would handle the major factors relating to methane emissions from rice paddies. These factors included weather, soil properties, crop types and rotations, tillage, fertilizer and manure use, and water management. The model was employed in the study to scale up the observed impacts of water management from the local sites to larger regional scales.

Remotely sensed data from the NASA/U.S. Geological Survey Landsat Thematic Mapper (TM) satellite were utilized to locate the geographic distributions and quantify the acreage of all the rice fields in China. A Geographic Information System database amended with this Landsat data was constructed to support the model runs at the national scale and to predict methane emissions from all rice fields in the country.

The researchers adopted 1990 as a mean representative year as they had detailed, reliable data for that year, and then ran the model with two water management scenarios to cover the changes in farming practices from 1980 to 2000. The two scenarios included continuous flooding over each season, and draining of paddy water three times over the course of each season.

When the two model runs were compared, the researchers found that methane emissions from China's paddy fields were reduced over that time period by about 40 percent, or by 5 million metric tons per year -- an amount roughly equivalent to the decrease in the rate of growth of total global methane emissions.

"The modeled decline in methane emissions in China is consistent with the slowing of the growth rate of atmospheric methane during the same period," Li said. "Still, more work will be needed to further verify the relationship demonstrated in this study with limited data points."

Demand for rice in Asia is projected to increase by 70 percent over the next 30 years, and agriculture currently accounts for about 86 percent of total water consumption in Asia, according to a recent report from the International Rice Research Institute. Changes to management practices like this will be more important and likely in the future as the world's water resources become increasingly limited, Li said.

"Just like the Chinese farmers did, if farmers around the world change management practices, we can increase yields, save water and reduce methane as a greenhouse gas," Li said. "That's a win-win situation."

The study, which appears in the print version of Geophysical Research Letters in late December, was funded by NASA through grants from the multi-agency Terrestrial Ecosystems and Global Change Program, and also NASA's Earth Science Enterprise.

For more information, please see:
http://www.gsfc.nasa.gov/topstory/2002/1204paddies.html

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