Nitrogen emissions in Latin America should be monitored, experts insist

September 6 2016

BRICS (Brazil, Russia, India, China and South Africa) nations and Latin American countries are generally the main sources of reactive nitrogen emissions in the form of ammonia and nitrous oxide, among others, due to fossil fuel burning, the use of nitrogen fertilizer, and untreated sewage. The impact of these emissions on the environment, climate and health has not been monitored, however.

A warning came from experts during the "School of Advanced Science on Nitrogen Cycling, Environmental Sustainability & Climate Change" conference, organized by the University of São Paulo's Center for Nuclear Energy in Agriculture (CENA-USP) and the Inter-American Institute for Global Change Research (IAI).

One hundred graduate students, 50 from Brazil and 50 from other countries, were selected to take part in the ten-day course of lectures and discussions on the unequal distribution of nitrogen in the world and its impact on environmental sustainability in the context of climate change.

"There should be a continuous monitoring network that collects data across 20-year time series, for example, in order to measure the impact of rising urbanization and large-scale use of nitrogen fertilizer on ecosystems in Latin America and BRICS," said Tibisay Pérez, a professor at the Venezuelan Scientific Research Institute's Center for Atmospheric & Biogeochemical Sciences (CCAB-IVIC).

"Proper monitoring would provide a sound basis for public policy

targeted to the needs of these countries," Pérez told.

In the member countries of the Organization for Cooperation & Economic Development (OECD), which has such a monitoring system, the use of nitrogen fertilizer has already reached the maximum permissible limit, according to Pérez.

Thanks to a combination of technology and public policy, including the abolition of fertilizer subsidies in the 1990s, the European Union succeeded in reducing nitrous oxide emissions by 49% between 1990 and 2009. Agriculture still accounts for some 60% of reactive nitrogen emissions in the EU, however. These statistics were presented during the event by Jan Willem Erisman, a professor at the Free University of Amsterdam (VU) in the Netherlands.

European discussions of strategies to reduce reactive nitrogen emissions include concepts such as the "nitrogen footprint", a measure of the amount of nitrogen released into the environment as a result of human activities, especially food consumption and production, utilities, and fossil fuels burned in transportation.

BRICS nations and Latin America, currently the largest users of nitrogen fertilizer, are experiencing an uncontrolled urbanization process that contributes to rising reactive nitrogen emissions due to fossil fuel combustion and effluent in urban areas.

In Latin America, only 20% of domestic sewage is treated and 17% of the population lack access to basic sanitation, noted Jean Pierre Ometto, Head of the Earth System Science Center (CCST) at Brazil's National Space Research Institute (INPE), in his presentation during the event.

Because Latin American countries are located in tropical and subtropical regions with biodiversity hotspots, their ecosystems may be severely

threatened by the impact of nitrogen deposition, according to the researchers who participated in the event.

"Latin America has undergone rapid urbanization and replacement of traditional farming by mechanized agriculture that makes intense use of nitrogen fertilizer. This has happened without taking into account the problem of reactive nitrogen emissions," said Mercedes Bustamante, a professor at the University of Brasília (UnB).

The increase in reactive nitrogen deposition in the atmosphere is acknowledged to be one of the main reasons for the reduction in plant diversity in natural and semi-natural ecosystems today, Bustamante added, because it acidifies and poisons the soil, among other impacts.

According to Bustamante, however, almost all the available data on the impact of nitrogen deposition in plant diversity comes from studies performed in northern Europe and North America.

"It's very important to obtain data from regions where this problem has recently begun to intensify or is set to do so in the near future, such as Latin America and BRICS," she said.

For example, China uses 400 kg of nitrogen fertilizer per hectare in some areas of horticulture. The average for corn crops in Brazil and South Africa is 120 kg per hectare.

In sub-Saharan Africa, at the opposite extreme, the average is 8 kg per hectare.

"Fertilizer use is excessive in some parts of the world, while in other parts there is a deficit," Bustamante said. "There are pronounced regional differences. The countries that need to increase levels of nitrogen fertilizer should avoid following in the footsteps of polluter

nations and find more sustainable ways to increase soil fertility."

This recommendation is valid for carbon as well, according to Bustamante. Experts have suggested that less developed or developing countries opt for the low-carbon road to development and avoid following the traditional route.

International alliance

Based on the view that reactive nitrogen emissions are a global problem despite the regional disparities, Bustamante and a group of scientists from several countries began organizing a global network of scientists to draw attention to the problem in the early 2000s.

Formally established in February 2003, the International Nitrogen Initiative (INI) is sponsored by the Scientific Committee on Problems of the Environment (SCOPE), an intergovernmental agency associated with the United Nations Educational, Scientific & Cultural Organization (UNESCO), and by the International Geosphere-Biosphere Program (IGBP).

The INI aims to interact with decision makers and practitioners to identify management options that optimize the use of nitrogen fertilizer while minimizing the negative effects of reactive nitrogen emissions. The network has regional centers in Europe, North America, Latin America, Africa, and South and East Asia, according to Bustamante.

"The idea is not just to alert decision makers to the impact of growing reactive nitrogen emissions into the atmosphere on the environment, climate and health but also to call attention to the need to create a monitoring network and encourage more research in certain parts of the world, such as Latin America," she said.

The effects of reactive nitrogen deposition on ecosystems are cumulative and detectable only after a long time lag, possibly taking decades to be felt. Moreover, critical levels vary in different biomes, according to Bustamante.

"The critical level for the Atlantic Rainforest, for example, isn't the same as for the Amazon, or for the Cerrado or Caatinga biomes. That's why levels should be monitored," she said.

Provided by Fundação de Amparo à Pesquisa do Estado de São Paulo