

## Nitrogen management policies urgently needed

Nitrogen cycling in Latin America: Drivers, impacts and vulnerabilities

Budget: US\$ 996,100

Lead Agency: Instituto Nacional de Pesquisas Espaciais, INPE

PI: Jean Pierre Ometto

Countries: Brazil, Argentina, Bolivia, Chile, Mexico, USA, Venezuela



### Summary

*Balanced use of nitrogen for sustainable agriculture requires appropriate management and public policies that ensure that the amount of nitrogen in the environment is maintained at adequate levels, not only for food production but also for the health of ecosystems, soils and living organisms, including human beings. The Inter-American Institute for Global Change Research (IAI) supports collaborative work that provides scientific evidence to achieve it.*

Scientists of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) claim that by 2050, soil degradation and climate change will reduce crop yields by 10 percent globally. As a result, the drop in food production is anticipated to force migration of some 50 to 700 million people, mainly in Central America, South America, Sub-Saharan Africa, and Asia.

Soils are essential to agriculture and therefore to food security. Soils undergo degradation as a result of deforestation, erosion, and food production on lands that are not managed under sustainable agriculture or service crops.

Global calls to action include Sustainable Development Goal 15 which appeals to 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and **halt and reverse land degradation** and halt biodiversity loss', while Aichi Biodiversity target 8 states that 'by 2020, **pollution, including from excess nutrients**, has been brought to levels that are not detrimental to ecosystem function and biodiversity'.

Nitrogen is one of the most widely used nutrients to accelerate plant growth; however, when applied in excess, disregarding agronomic and environmental knowledge, nitrogen fertilizers lead to soil degradation and water pollution.

The research project *Nitrogen cycling in Latin America: Drivers, impacts and vulnerabilities* of the Inter-American Institute for Global Change Research (IAI) led by Brazilian agronomist Jean Pierre Ometto, indicates that specific and immediate policies in Latin

America are urgently needed to ensure “the health of soils and an adequate nutrient balance”, so to achieve uniform food production and reduce negative impacts.

Ometto highlights the importance of nitrogen in food production, but alerts “bad agricultural practices may lead to the release of this nutrient to the environment and cause pollution and affect human health.”

In response to its mission to bring together scientists from countries in the Americas to work jointly in seeking solutions to common problems, the IAI is supporting the network on nitrogen cycling (Nnet) which involves researchers from Argentina, Bolivia, Brazil, Chile, Mexico, United States, and Venezuela. The goal of Nnet is to monitor the release of this nutrient into the atmosphere, its incidence on soil erosion and the consequences on food security.

With this project, the IAI, which is composed of 19 countries in the Americas, aims at enhancing the understanding of the nitrogen cycling and promote management options for this nutrient, as for instance establishing threshold levels –dose and frequency– to prevent them from becoming potentially toxic to nature.

Another major aspect of environmental pollution in Latin America is the poor treatment of wastewater, particularly domestic sewage. When not treated, wastewater affects not only water resources, but also biodiversity, and compromises environmental health and the ecosystem services those environments provide, such as fishing and recreation.

Ometto and his colleagues from the Brazilian National Institute for Space Research (INPE), suggest that an immediate measure could be increasing the number of wastewater treatment plants –in South America only 20 per cent is treated– and improving existing plants in order to reduce the impact of the nitrogen load on watersheds and coastal areas. Otherwise, coastal amounts of nitrogen will triple by 2050.

The current lack of information about the real impacts of human activity on the nitrogen cycle, as well as the variety of natural ecosystems and socio-economic situations in the region have led to fall behind implementation of guidelines.

In view of the above, this IAI project has created a set of useful tools to improve the understanding and management of the nitrogen cycle, impact models and quantification of nitrogen fluxes as well as regional maps of nitrogen emissions, among others.

For instance, the project made direct measurements of biological nitrogen fixation in different ecosystems in Mexico, Chile, Bolivia, Brazil, and Argentina and modeled the different cases. Such fixation occurs when bacteria transform nitrogen into ammonium for uptake by plant roots.

The results reveal the effects of nitrogen excess and deficits in the different ecosystems under study, as well as the likely impacts on the people and the natural resources in the region.

The findings of this project set the basis for the support of policy frameworks aimed at managing the nitrogen cycle, promoting best agricultural practices with reduced use of fertilizers, and developing long-term strategies for an efficient use of nitrogen in Latin America.