The Fourth International Nitrogen Conference: N-2007
(www.nitrogen2007.com)

Agriculture, Development, and Nitrogen

A problem of too little or too much

Introduction

The last 40 years have seen an extraordinary change in the global nitrogen cycle. As recently as the 1960s, nitrogen availability on Earth was controlled by natural processes, but the human creation of synthetic nitrogen fertilizer and the release of nitrogen from fossil-fuel combustion now match the natural rate of formation of reactive nitrogen on the planet's landscape. While the fossil-fuel source is important in many industrial regions, agriculture is the major driver of change globally. Synthetic nitrogen fertilizer has been an essential component of the Green Revolution. Most of the human population is now absolutely dependent on this fertilizer for food sustenance, and 70% of the protein in the average person on Earth is composed of nitrogen from synthetic fertilizer. Nitrogen fertilizer and the Green Revolution it has fueled have greatly reduced hunger on the planet, particularly in Asia. The rate of change is incredible, and half of the synthetic nitrogen fertilizer ever used on Earth has been used in the past 15 years.

Two major challenges now face human society. First, much of the planet has still not seen the benefits of nitrogen fertilizer and the Green Revolution. And second, nowhere on Earth is nitrogen yet used in a sustainable way, and this is the "Achilles' Heel" of the Green Revolution. The use of nitrogen is imbalanced, with industrialized countries suffering pollution problems from too much nitrogen and low-income countries having a shortage of nitrogen that constrains food production. The goal of the N2007 Symposium is to address these two challenges in an integrated manner. The meeting will bring together some of the world's best nitrogen scientists with development experts to build a vision for revising the Green Revolution and discuss new trends in the global agriculture such as organic production and genetically modified products into a more sustainable process while bringing it to the most needy populations.

Motivation

Too Little Nitrogen: Almost one billion people, or 15% of the world's population , suffer from hunger and malnutrition. Nearly 6 million children die each year as a result: 10 children every minute. The State of Food Insecurity in the World (2005) reports "many of these children die from a handful of treatable infectious diseases including diarrhea, pneumonia, malaria and measles. They would survive if their bodies and immune systems had not been weakened by hunger and malnutrition." Hunger contributes greatly not only to mortality but also poverty, illiteracy and disease in low-income countries of the world. The prevalence of widespread hunger and malnutrition is due to a number of factors. An important one (and one that can be addressed) is that the lack of nitrogen to enable food demand to be met by food production. This focus on nitrogen-limitations related to food production is in support of the first of the Millennium Development Goals: to eradicate extreme poverty and hunger by reducing by half the proportion of people living on less than a dollar a day, and the proportion of people who suffer from hunger.

Nitrogen is one of the prime factors limiting agricultural production, and so these goals cannot be met without bringing more synthetic nitrogen fertilizer into the world's less affluent countries. To date, these countries – particularly the least developed ones – have not benefited from the Green Revolution. Per-capita use of nitrogen fertilizer in the world's low-income countries averages only one-fourth of that of industrial nations. In the least developed countries, per-capita use of nitrogen is 3.5-fold less than in the average low-income nation and 12-fold less than in the industrial world.

Nitrogen is an essential component of any plan for reducing world hunger, poverty, and disease. However, the global experiment with increasing the supply of nitrogen is a recent phenomenon, and the industrialized nations and developing nations have not yet developed sustainable approaches for nitrogen use. When used in excess, nitrogen becomes an important pollutant.

This duality it one of the major challenges that humanity has to face now and in the future if we want to **ensure environmental sustainability**, another of the stated Millennium Development goals. In concert with bringing more nitrogen to the world's poorest regions, we must develop approaches for using nitrogen with less environmental harm throughout the world.

Too Much Nitrogen: In some regions of the world, particularly in industrialized countries of the Northern Hemisphere, there is an excess of nitrogen that results in a cascading series of effects on both ecosystem and human health. The First, Second and Third International Nitrogen Conferences devoted substantial attention to these issues. While the science underpinning these effects will be updated, the focus on nitrogen-excess regions will be on what policy tools / approaches have been successful in decreasing the negative impacts of anthropogenic nitrogen in the environment, what policy tools have not been effective, and how this knowledge can be used to help the development of sustainable nitrogen use in nitrogen-deficient areas. Nitrogen pollution also is major threat to human health. Tropospheric ozone production that nitrogen gases catalyze aggravates

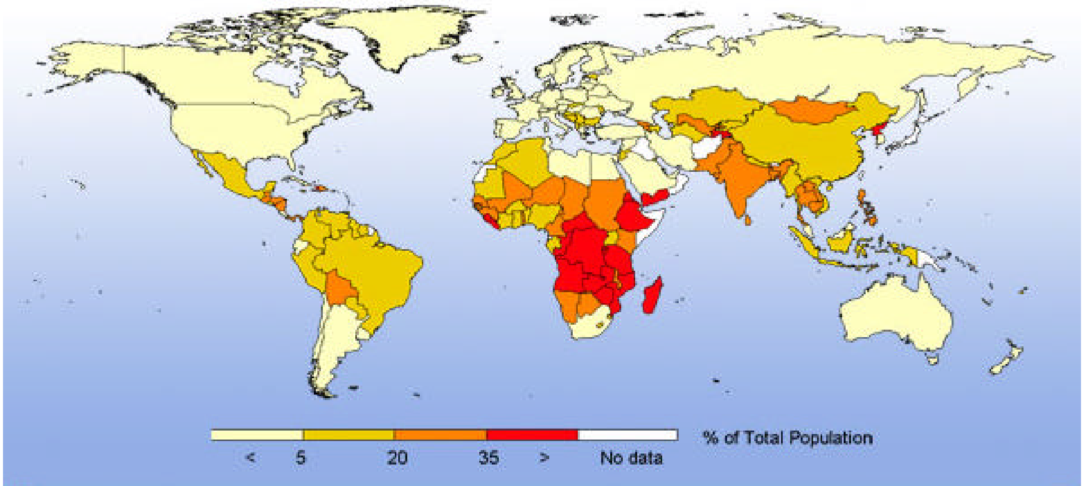

Figure 1. Percent of undernourished population (2000 - 2002) in relation to the total population. Source: FAO Statistics Division, 2005.

asthma and many other respiratory diseases; in the United States alone, this leads to an estimated 20,000 premature deaths each year. Fine nitrogen particles in air lead to both cardiovascular and respiratory diseases. Nitrate in drinking water is a carcinogen and also affects reproduction and development. In addition, nitrogen pollution may have a series of indirect health effects, by for example increasing pollen production and therefore allergies, or by increasing the populations of insects that are disease vectors.

Nitrogen in Tropical Systems: Besides the social and economic aspect, nitrogen also plays a central role in natural systems, since as an often-limiting nutrient it regulates productivity and carbon acquisition and the composition of plant and animal communities. Most of the studies regarding nitrogen dynamics in natural ecosystems were developed in temperate regions of the world. Conclusions from these temperate systems may not apply in tropical ecosystems, mainly because tropical ecosystems often are much less limited by nitrogen than temperate systems. This may make the tropical systems much leakier and less retentive of nitrogen. Understanding the differences in nitrogen cycling between temperate and tropical ecosystems is essential if we are to better manage nitrogen in the tropics. Since so many of the low-income nations of the world are in the tropics, this context is a critical background element of N2007.

Another complexity of the nitrogen issue is that while low-income countries have a shortage of nitrogen for food production, they also at the same time have a lack of proper sanitation for human wastes, so water bodies in these countries are being enriched in nitrogen, jeopardizing even more their limited water supplies.

Goals and Agenda for N-2007

The complex problems of nitrogen cannot be tackled individually, but rather the solutions must engage a large community that encompasses a broad spectrum of professionals. For N2007, we will invite not only participants that are concerned with particular aspects of nitrogen cycling but participants from the policy, development, and engineering communities that can share their expertise to help build a sustainable future. The N2007 meeting is the perfect venue to discuss these issues and to find common ground to begin to find answers and solutions to alleviate world hunger with minimal environmental harm. N-2007 will build an agenda for how to better manage nitrogen across our planet. We will develop some specific goals to reach by 2025, set in the context of the goals of the United Nations Millennium Development Program. To achieve these goals, we will use a mixture of plenary lectures, short workshops, and poster sessions. The plenary lectures will be used to inspire and challenge the meeting participants. Detailed scientific presentations will be given in a series of concurrent workshops . Posters will be equally important in the N2007 conference and will be grouped by topic area and with plenty of time for interaction among the presenters. The workshops will be the prime focus of the meeting, with participants interacting across disciplinary lines to consider approaches for closing the loop on agriculture, development, biogeochemistry and nitrogen. Some examples of potential workshop topics include:

- *Understanding differences between N biogeochemistry in tropical and temperate systems*
- *Nitrogen biological fixation in natural and agricultural systems*
- *Nitrogen and carbon sequestration*
- *Nitrogen in aquatic systems and eutrophication*
- *Getting nitrogen into agriculture in low-income countries*
- *Reducing nitrogen losses from agricultural systems*
- *Developing appropriate sewage technologies for low-income countries*
- *Applying technologies for reducing nitrogen pollution from animal wastes*
- *Nitrogen and biofuel production*
- *Nitrogen and human health*
- *Global food trade and nitrogen*

Conference Products

We will publish workshops results, general conclusions, and statements in the web site of the International Nitrogen Initiative, which guarantees free global access, with much less delay than has traditionally been possible. Selected presentations well be invited to submit their material to a peer-review journal . Indefinite future access to these materials will be provided by posting them to D-space publication space at Cornell University.

Intended Audience

Overtime, the attendance at the International Nitrogen Conferences has grown increasingly diverse in terms of professional discipline. N-2007 will be no different. We expect a strong representation from both the energy and food production industries, as well as from NGOs, and United Nation agencies (FAO, UNEP, WHO). This broad-based attendance will help insure that post-conference distribution of conference products will also be extensive.

Venue

The conference will be held October 1-5, 2007 in the Costa do Saupe complex, which is located 110 km north from the city of Salvador, capital of the State of Bahia. Brazil was chosen because it is an important country in terms of both food/feed production (soybean, beef) and because of the large extent of intact natural ecosystems. The State of Bahia, which the capital is the city of Salvador was chosen because this is one of the most beautiful coast of Brazil, but it is also a typical poor region of Brazil with low-nitrogen input.

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