# Getting the full picture on greenhouse gases

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A new project aims to understand greenhouse gas emissions - literally from the ground up.

The average global temperature on Earth has increased during over a century, and the year 2015 was the hitherto warmest year on record, according to the World Meteorological Organization. Nitrous oxide ($N_2O$) is one of the major “greenhouse gases” causing this global warming.

The steady increase in the emissions of $N_2O$ coincide with the discovery of the Haber–Bosch process. This is the currently used process through which nitrogen-based fertilizers are produced. The process is a landmark in the striving to feed the growing global population, which has increased from 1.6 billion in 1900 to today's 7 billion.

It's actually estimated that almost 80% of the nitrogen found in humans comes from the Haber-Bosch process.

However, the constant addition of nitrogen-based fertilizers to the soil has an unexpected side effect: the release of nitrous oxide. Plants are not able to absorb all the extra nitrogen that is added to the soil. And the excess fertilizer turns out to be a fantastic food source for soil microbes that eventually transform the fertilizer into one of the worst greenhouse gases: nitrous oxide ($N_2O$).

Although being less abundant, a nitrous oxide molecule has 300 times more global warming potential than a carbon dioxide molecule ($CO_2$) and, moreover, $N_2O$ is a much more stable molecule. Once it has been released from the soil it can last in the atmosphere for more than 200 years.

#### Gathering great European minds

Naturally, scientists are concerned.

“Understanding nitrous oxide emissions require an international initiative,” asserts Dr. Andrew Gates from the University of East Anglia.

That is why NORA project, a project aiming to understand nitrous oxide, has been launched (read more about NORA in the fact box).

The NORA project has ambitious objectives and, as such, it requires a multidisciplinary approach.

This is why the partners are divided into three different groups that will analyse the problem all the wayfrom a molecular scale perspective and up to fields and ecosystems.

The PhD-student from Norwegian University of Life Sciences (NMBU), Pawel Lycus is one of the project's members:

“I will specifically try to study the characteristics of soil microorganisms that can respire nitrate when there

is no more oxygen present, a condition with particular relevance for nitrous oxide production", said Lycus, who belongs to the first group of scientists.

#### Microbes and robots

Scientists in the second group will pay special attention to the identification of microbial communities in soils and wastewaters, and their role in relation to $N_2O$ emissions. Which microorganisms produce $N_2O$ and which ones consume it? And how are they affected by different management strategies? Could they be better tools for experimentation in the laboratory? These are some of the questions the group of scientists will try to answer.

Finally, yet importantly, the third group of NORA scientist stands out for its huge display of technology. Since traditional manual techniques in the field are work intensive and yield a very limited amount of information, the project has taken a completely new approach.

NMBU has, in collaboration with the small mechatronics company ADIGO, developed a field-going robot that provides continuous nitrous oxide measurement with analytical precision.

Demonstration of a field robot specialized in measuirng gas emissions. (Photo: NORA) [5]
robotnora.jpg [6]

Fact box

**The NORA project**

The Nitrous Oxide Research Alliance (NORA) is a Marie Sklodowska Curie Initial Training Network (ITN) research project, coordinated by the Norwegian University of Life Sciences, which aims to generate specific recommendations, strategies and solutions to reduce nitrous oxide emissions.

NORA will receive a total of 3.4 million euros of European funding that will be distributed between eleven industrial and academic partners across Europe. In addition, three small/medium sized enterprises are associated NORA partners.

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August 26, 2016 - 06:00
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