

Nitrous oxide: the forgotten greenhouse gas

Organised and edited by AJ Thomson, E Baggs and DJ Richardson

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Nitrous oxide (N_2O) is a powerful atmospheric greenhouse gas and cause of ozone-layer depletion. Global emissions continue to rise; more than two thirds of these emissions arise from bacterial and fungal denitrification and nitrification processes in soils, largely as a result of the application of nitrogenous fertilisers.

This issue derives from an interdisciplinary meeting held at the Kavli Royal Society International Centre in May 2011, and comprises 11 articles, plus an introduction and summary.

The introduction provides a background to the nature of the problem, and discusses the biological sources and sinks of N_2O in oceans, soils and wastewaters, as well as the fate of the gas in the atmosphere. More widely, genetic regulation and molecular details of the enzymes involved are described and techniques for determining global and local N_2O budgets are presented.

The conclusions are drawn together in a discussion of strategies for mitigating N_2O emissions, under three headings: managing soil chemistry and microbiology; engineering crop plants to fix nitrogen; and sustainable agricultural intensification.



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Introduction: Biological sources and sinks of nitrous oxide and strategies to mitigate emissions

AJ Thomson, G Giannopoulos, J Pretty, EM Baggs and DJ Richardson

The role of N₂O derived from crop-based biofuels, and from agriculture in general, in Earth's climate

KA Smith, AR Mosier, PJ Crutzen and W Winiwarter

UK emissions of the greenhouse gas nitrous oxide

U Skiba, SK Jones, U Dragosits, J Drewer, D Fowler, RM Rees, VA Pappa, L Cardenas, D Chadwick, S Yamulki and AJ Manning

Fungal denitrification and nitric oxide reductase cytochrome P₄₅₀nor

H Shoun, S Fushinobu, L Jiang, S-W Kim and T Wakagi

Structural basis for nitrous oxide generation by bacterial nitric oxide reductases

Y Shiro, H Sugimoto, T Tosha, S Nagano and T Hino

Biochemical characterization of the purple form of *Marinobacter hydrocarbonoclasticus* nitrous oxide reductase

S Dell'Acqua, SR Pauleta, JIG Moura and I Moura

Nitrous oxide production and consumption: regulation of gene expression by gas-sensitive transcription factors

S Spiro

EXiS Open Choice Regulation of denitrification at the cellular level: a clue to the understanding of N₂O emissions from soils

LR Bakken, L Bergaust, B Liu and Å Frostegård

Impacts of nitrogen application rates on the activity and diversity of denitrifying bacteria in the Broadbalk Wheat Experiment

IM Clark, N Buchkina, D Jhurrea, KWT Goulding and PR Hirsch

Global oceanic production of nitrous oxide

A Freing, DWR Wallace and HW Bange

Stratospheric ozone depletion due to nitrous oxide: influences of other gases

RW Portmann, JS Daniel and AR Ravishankara

Nitrous oxide emissions from wastewater treatment processes

Y Law, L Ye, Y Pan and Z Yuan

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