

Considering the stratospheric ozone regime as a tool to manage nitrous oxide and a potential means to increase the profitability of the fertilizer industry

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A post-Kyoto partner: Considering the stratospheric ozone regime as a tool to manage nitrous oxide

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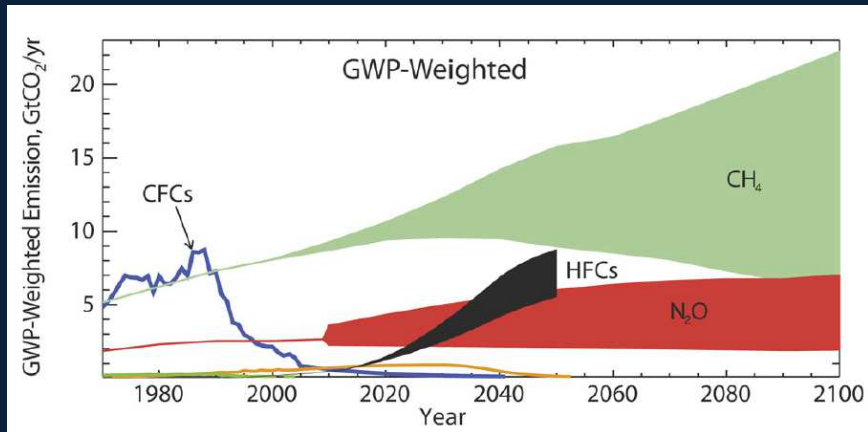
Nitrous oxide (N₂O) is the largest known remaining anthropogenic threat to the stratospheric ozone layer. However, it is currently only regulated under the 1997 Kyoto Protocol because of its simultaneous ability to warm the climate. The threat N₂O poses to the stratospheric ozone layer, coupled with the uncertain future of the international climate regime, motivates our exploration of issues that could be relevant to the Parties to the ozone regime (the 1985 Vienna Convention and its 1987 Montreal Protocol) should they decide to take measures to manage N₂O in the future. There are clear legal avenues to regulate N₂O under the ozone regime as well as several ways to share authority with the existing and future international climate treaties. N₂O mitigation strategies exist to address the most significant anthropogenic sources, including agriculture, where behavioral practices and new technologies could contribute significantly to reducing emissions. Existing policies managing N₂O and other forms of reactive nitrogen could be harnessed and built on by the ozone regime to implement N₂O controls. There are several challenges and potential cobenefits to N₂O control which we discuss here: food security, equity, and implications of the nitrogen cascade. The possible inclusion of N₂O in the ozone regime need not be viewed as a sign of failure of the United Nations Framework Convention on Climate Change to adequately deal with climate change. Rather, it could represent an additional valuable tool in sustainable development diplomacy.

climate gases | nitrogen cycle | stratospheric ozone depletion |
global environmental governance

The ozone regime (the 1985 Vienna Convention and its 1987 Montreal Protocol) is widely regarded as the most effective international environmental institution ever established. The Montreal Protocol has reduced the production and consumption of the ozone-depleting substances (ODSs) it controls by 98% since its inception, while simultaneously delaying the growth of overall anthropogenic radiative forcing by an amount equivalent to 7–12 y of increased CO₂ emissions in the early 21st century (3). Its institutional architecture has elements that various Parties regard as essential to their participation. Every country in the world has ratified the Protocol, and all Parties have legally binding commitments (with developing countries given longer to comply with their commitments, which are often identical to developed country commitments). There is a strong financial mechanism, the Multilateral Fund, funded by developed countries that finances projects in developing countries to cover their incremental costs of complying with their Montreal Protocol commitments. There is also an enforcement mechanism restricting trade in ODS. Well-respected assessment panels, made up of experts from industry, government, international organizations, private consultancies, and academia, provide valuable information and advice to the Parties on the science and environmental effects of ozone depletion as well as the technical and economic feasibility of chemical and process alternatives. The Parties may wish to use this existing institutional architecture if they decide to adopt future N₂O controls. For example, the Parties could request a scoping report from the Technology and Economics Assessment Panel on the technical and economic

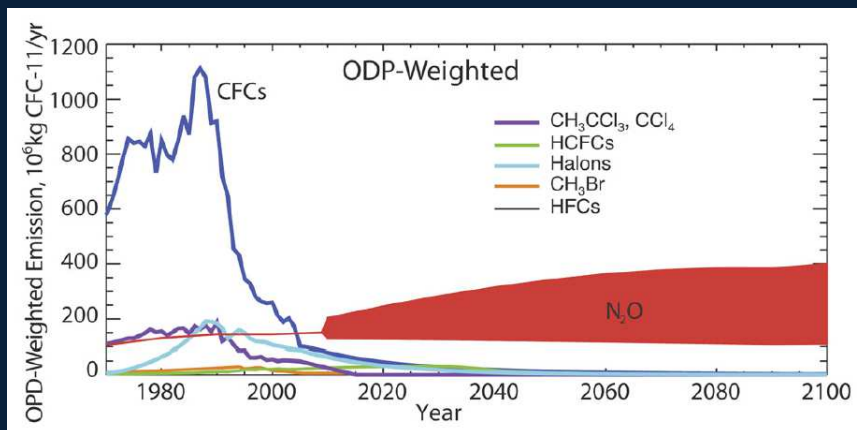
REVIEW

N₂O – Greenhouse gas



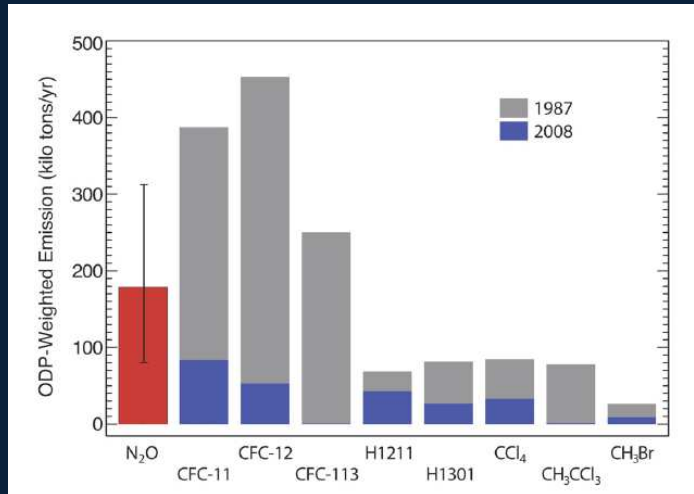
Ravishankara et al. 2009

N₂O – Ozone depleting substance



Ravishankara et al. 2009

N₂O largest remaining ozone threat



Ravishankara et al. 2009

The international ozone regime

- 1985 Vienna Convention and its 1987 Montreal Protocol
- Consumption of controlled ozone depleting substances (ODS) has decreased by 98%
- Signed and ratified by every country
- Universal participation
- Successful financial mechanism and well-respected assessment panels
- “Start and strengthen”
- Better climate treaty than Kyoto Protocol

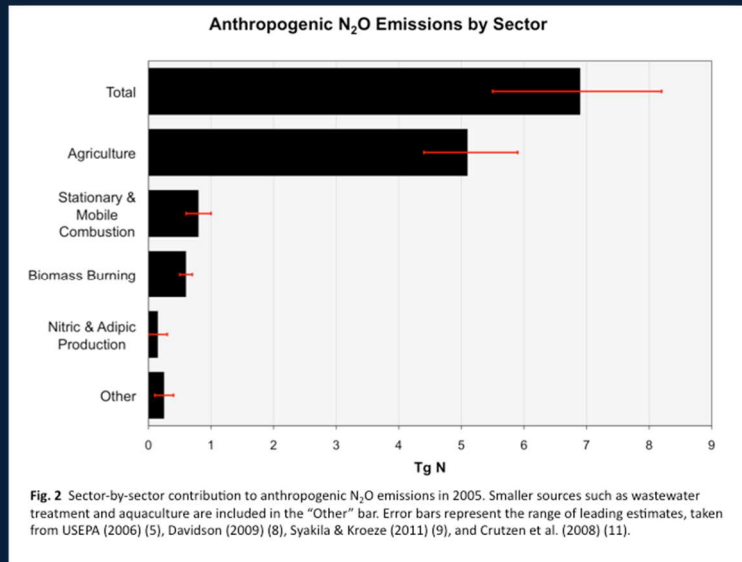
Successful industry involvement

- Leading CFC manufacturers (e.g. Dupont, Honeywell) supportive of ozone regime
- Captured significant portion of new market for CFC alternatives
- Substantial influence on ozone regime through assessment panels and national delegations
- Important ozone and climate benefits achieved while simultaneously protecting and enhancing industry interests

The legal case

- Ozone regime has clear legal authority to control N₂O
- Could be added via an amendment to Montreal Protocol or new protocol under the Vienna Convention
- Partnership opportunities with current and post-2012 international climate regime

Emissions & mitigation opportunities



Agriculture

- **Technology**
 - Controlled-release fertilizers, nitrification/urease inhibitors...
- **Farmer behavior**
 - 4Rs: Right product, right rate, right time, right place
- **Consumer behavior**
 - Food wastage, meat consumption...

Challenges & opportunities to managing agricultural N₂O

- **Food security**
 - How to preserve and increase crop yields while reducing N₂O?
- **Equity**
 - How to allow regions that vastly under-fertilize to increase fertilizer use while globally reducing N₂O?
- **Nitrogen cascade**
 - Tight coupling of N cycle means that one atom of nitrogen can cascade through a variety of chemical forms, each with a different impact on environment

Ozone regime applied to N₂O

- **Production and consumption, not emissions**
 - Focus on fertilizer consumption (and use efficiency) rather than N₂O emissions
- **Experience with agricultural sector**
 - Methyl bromide phase out: Montreal Protocol financial mechanism helped retrain farmers in developing countries to use ozone friendly practices and technologies

Opportunities for fertilizer industry

- Similarities between CFC and fertilizer industry
- Ozone regime taking on N₂O could spark increased demand for enhanced efficiency fertilizers and fertilizer services
- Any decreases in projected revenue due to increased fertilizer use efficiency could be offset by an increase in fertilizer services and enhanced efficiency products with higher profit margins

Conclusions

- N₂O largest remaining known anthropogenic threat to stratospheric ozone layer
- Ozone regime's legal authority and possibility of cooperation with climate regime clear
- History of positive cooperation with industry
- Challenges & opportunities for agricultural N₂O
- Opportunity for fertilizer industry to expand market share of enhanced efficiency fertilizers
- Upcoming UNEP report on N₂O to be presented at international ozone and climate talks