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Title:	Returning to a Planetary Boundary for Nitrogen: Science, Economics and Policy
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Abstract:	My dissertation studies several of the major scientific, economic and policy issues central to managing global nitrogen (N) pollution. Chapter 2 uses the terrestrial component of an Earth System model to evaluate how global improvements in N use efficiency (NUE) could affect agricultural nitrous oxide (N <sub>2</sub> O) emissions - an important component of global N pollution. Emissions are projected to increase significantly in a business-as-usual scenario - driven by growth in global fertilizer and manure consumption - though less markedly than previous estimates, due to increased crop N uptake. Nevertheless, global NUE scenarios could reduce global N <sub>2</sub> O emissions below 1990-2000 levels, delivering important climate and stratospheric ozone benefits. Chapter 3 is the first evaluation of improved N management measures to consider the economic interests of the fertilizer industry in tandem with farmers and the environment. It demonstrates that the regulatory "sweet spot" - where improved N management benefits the environment, reduces farmers' costs, and increases fertilizer industry profitability - is more likely to occur in China than the U.S. due to the currently extensive over-application of fertilizer, which creates a greater potential for economic gains from improved N management. The fact that the environmental benefits of improving N management consistently dwarf its economic impacts on farmers and the fertilizer industry suggests that policy-makers should consider investing in side-payments to increase stakeholder support. Chapter 4 addresses the major scientific, legal, technical and policy questions that would have to be considered by the Parties to the international ozone regime if they decided to control N <sub>2</sub> O. It identifies several legal avenues for controlling N <sub>2</sub> O, provides a sector-by-sector overview of the major N <sub>2</sub> O mitigation strategies, and outlines how existing policies managing N <sub>2</sub> O and other N compounds could be harnessed to implement controls. Finally, it describes three of the major challenges and potential co-benefits of controlling N <sub>2</sub> O (and N pollution more broadly): food security, equity, and the N cascade. Chapter 5 concludes with a research proposal to study how calls for an international response to N pollution can be reconciled with the reality that solutions are often locally specific.
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