Human nitrogen fixation and greenhouse gas emissions: a global assessment

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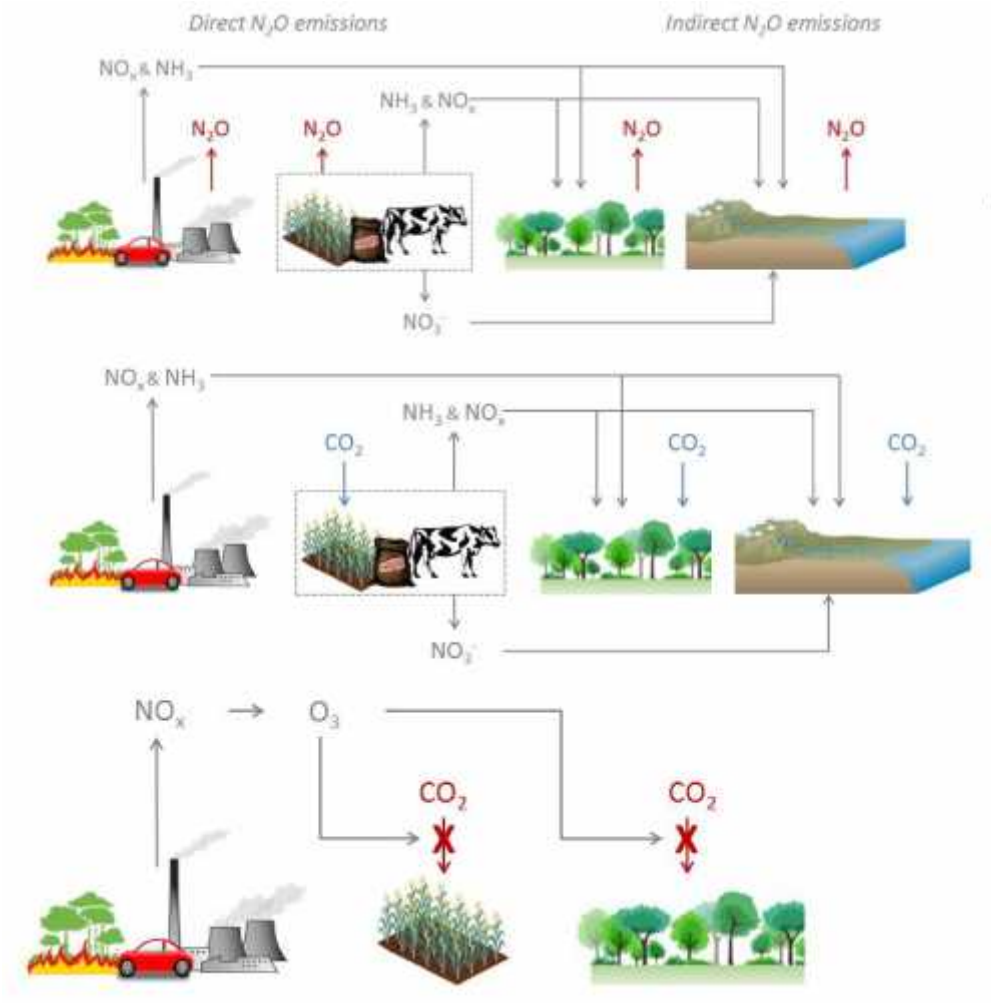
Linkages between human N fixation and greenhouse gas emissions



1. Direct and Indirect N_2O emissions

2. N-induced C sequestration

3 NO_x-induced O_3 formation reducing C sequestration

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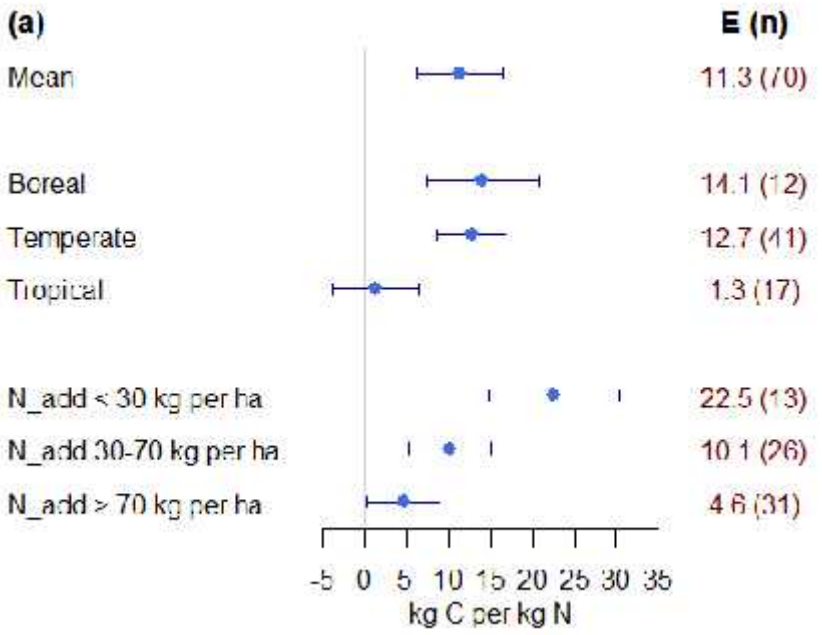
Calculation of GHG response to N fixation

- $N_2O\text{-}N_{exchange} = N_{input,ecosystem} \times N_2O\text{-}N_{response,ecosystem}$
- $CO_2\text{-}C_{exchange} = N_{input,ecosystem} \times C\text{–}N_{response,ecosystem}$
- $CO_2\text{-}C_{exchange} = O_{3exposure,ecosystem} \times C\text{–}O_{3response,ecosystem}$

O_3 exposure = fr x NO_x emission

Ecosystem = agriculture, non-agriculture (forests/semi-natural vegetation) and marine systems

Example of C-N response of forests based on a meta-analysis



Forest type	C–N response [kg C kg N^{-1}]
Tropical	1.3 (-1.3–3.9)
Temperate	12.7 (10.6–14.9)
Boreal	14.1 (10.6–17.5)
All	11.3 (8.7–13.9)

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Schulte-Uebbing and De Vries (2016)

Estimated Impacts of human N fixation on net greenhouse gas emissions at global scale

N_2O and NO_x-O_3 induced warming (Pg CO_2-C eq. yr^{-1})

- N_2O agriculture direct: **0.51**
- N_2O agriculture indirect: **0.29**
- N_2O industry & other sources: **0.22**
- NO_x-O_3: **0.14**

N-CO_2-induced cooling (Pg CO_2-C eq. yr^{-1})

- CO_2 agriculture: **0.13**
- CO_2 forest: **0.44**
- CO_2 marine: **0.18**

The effect of human N fixation on global N_2O emissions and CO_2 sequestration is an increase in emissions of 0.41 Pg CO_2-C eq. yr^{-1}.

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De Vries et al. (2016; in press)

Questions?


INMS
Towards the Establishment of an
International Nitrogen Management System
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