

GLOBAL NITROGEN ENRICHMENT

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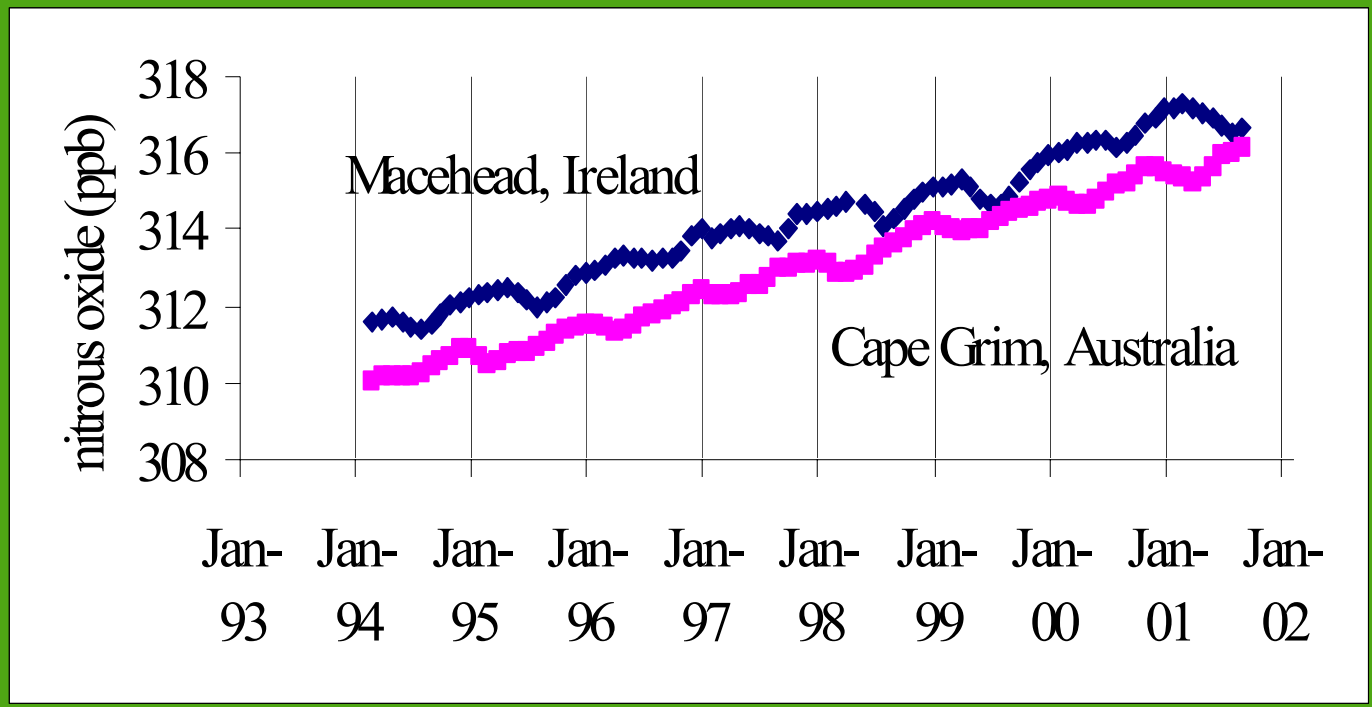
Nitrous oxide (N_2O)

- Average atmospheric lifetime: 120 years
- Global warming potential 280 times larger than CO_2
- Annual growth rate 0.25%
  - 1860: 285 ppb
  - 2000: 315 ppb



Global budget of N_2O

Natural Sources	kt N_2O-N y^{-1}
Oceans	3
NH_3 oxidation	0.6
Tropical soils	4
Temperate soils	2
Anthropogenic Sources	
Agricultural soils	4.2
Biomass burning	0.5
Industries	1.3
Cattle & feedlot	2.1
Sources	**17.7**
Sinks (stratospheric)	**12.3**
Imbalance	3.9

Intergovernmental Panel on Climate Change (IPPC)

Emission factor approach

- 1.25 % of the mineral N fertiliser applied
- 1 % of the atmospheric N deposited
- 1.5 % of NO_3 leached to ground and drainage waters
- 1.4 % of dissolved inorganic nitrogen in estuaries is emitted as N_2O

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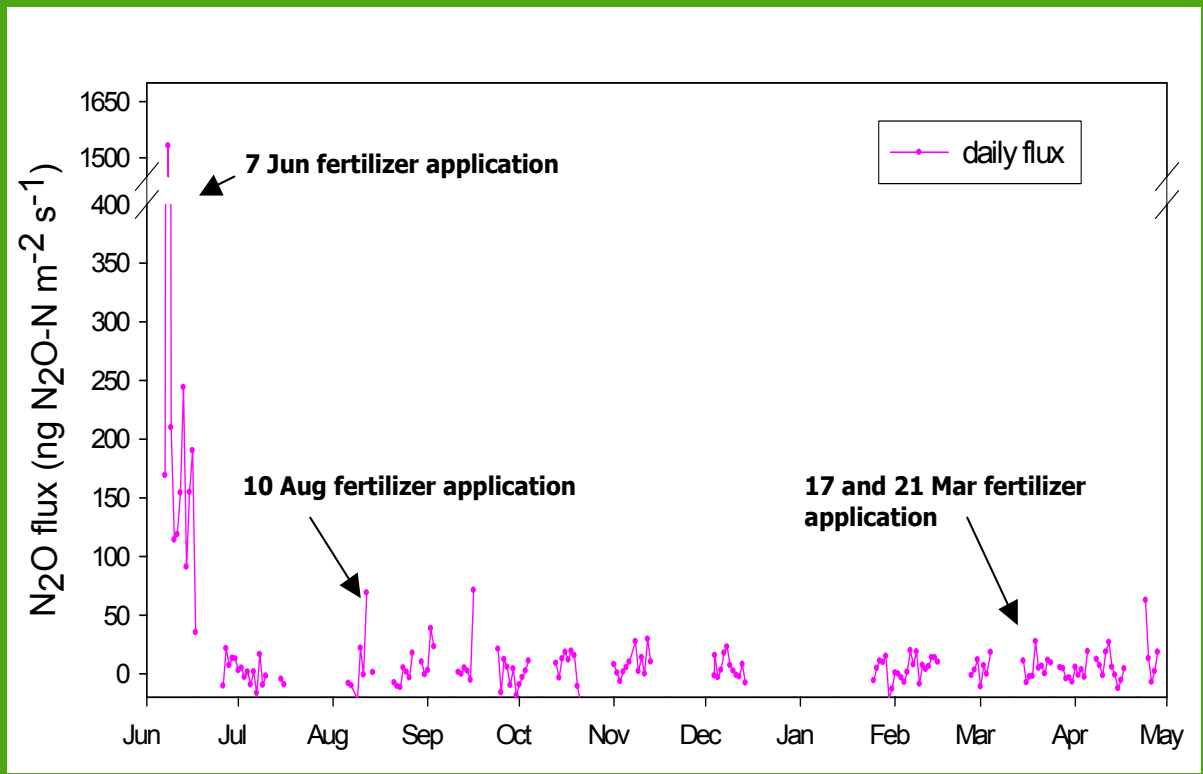
Agricultural soils

Improved measurements of N_2O at the field scale



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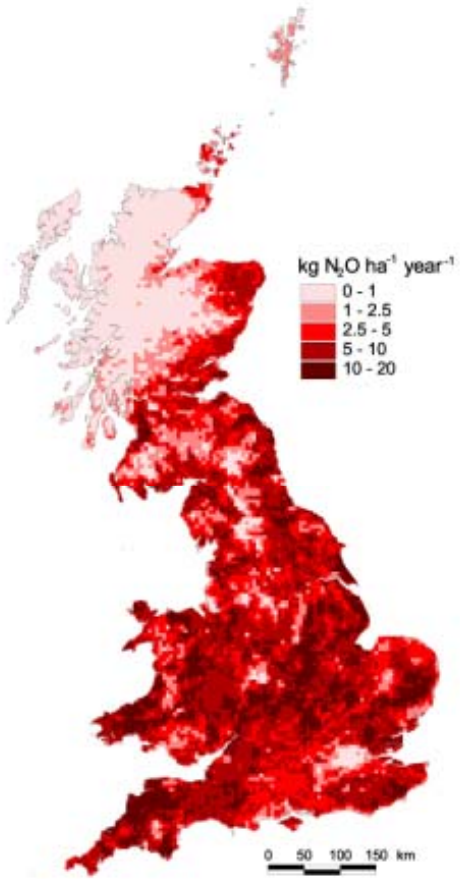
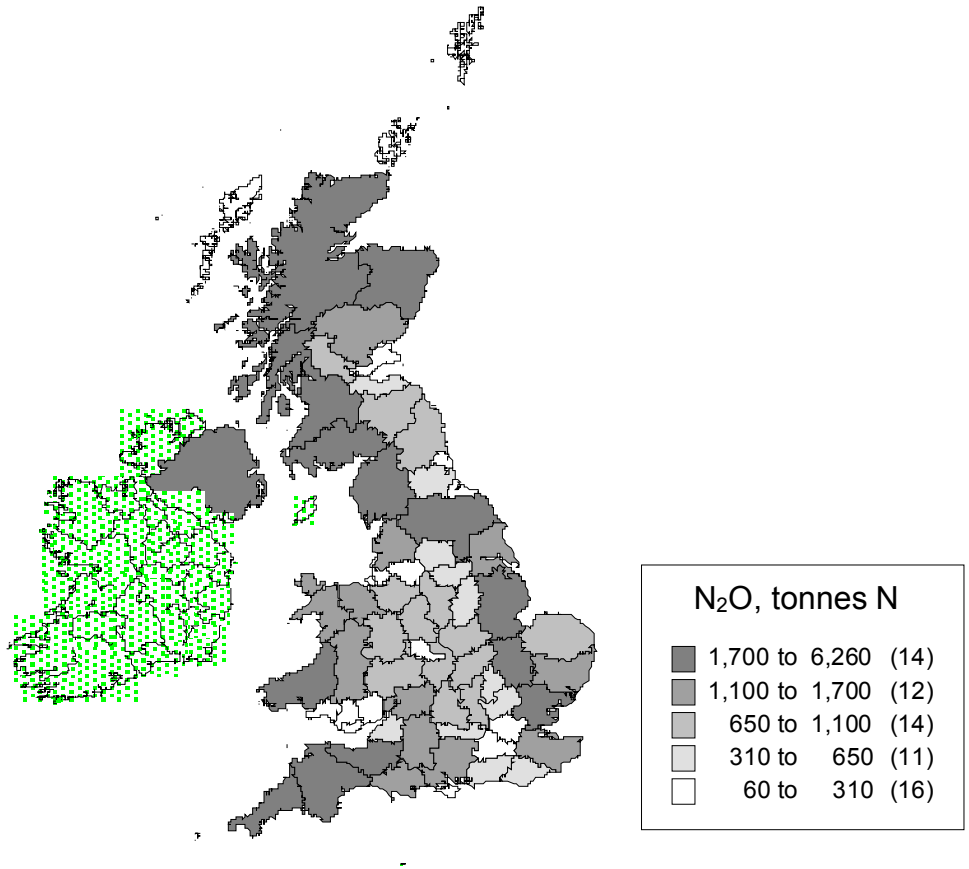
Nitrous oxide emissions from soils
119 kt N_2O y^{-1}





Regression model

DNDC (mechanistic model)

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Is the subsoil a source of N_2O?

Yes

Microbes at the clay interface transform fertiliser and animal excreta nitrogen rapidly into ammonium and nitrous oxide

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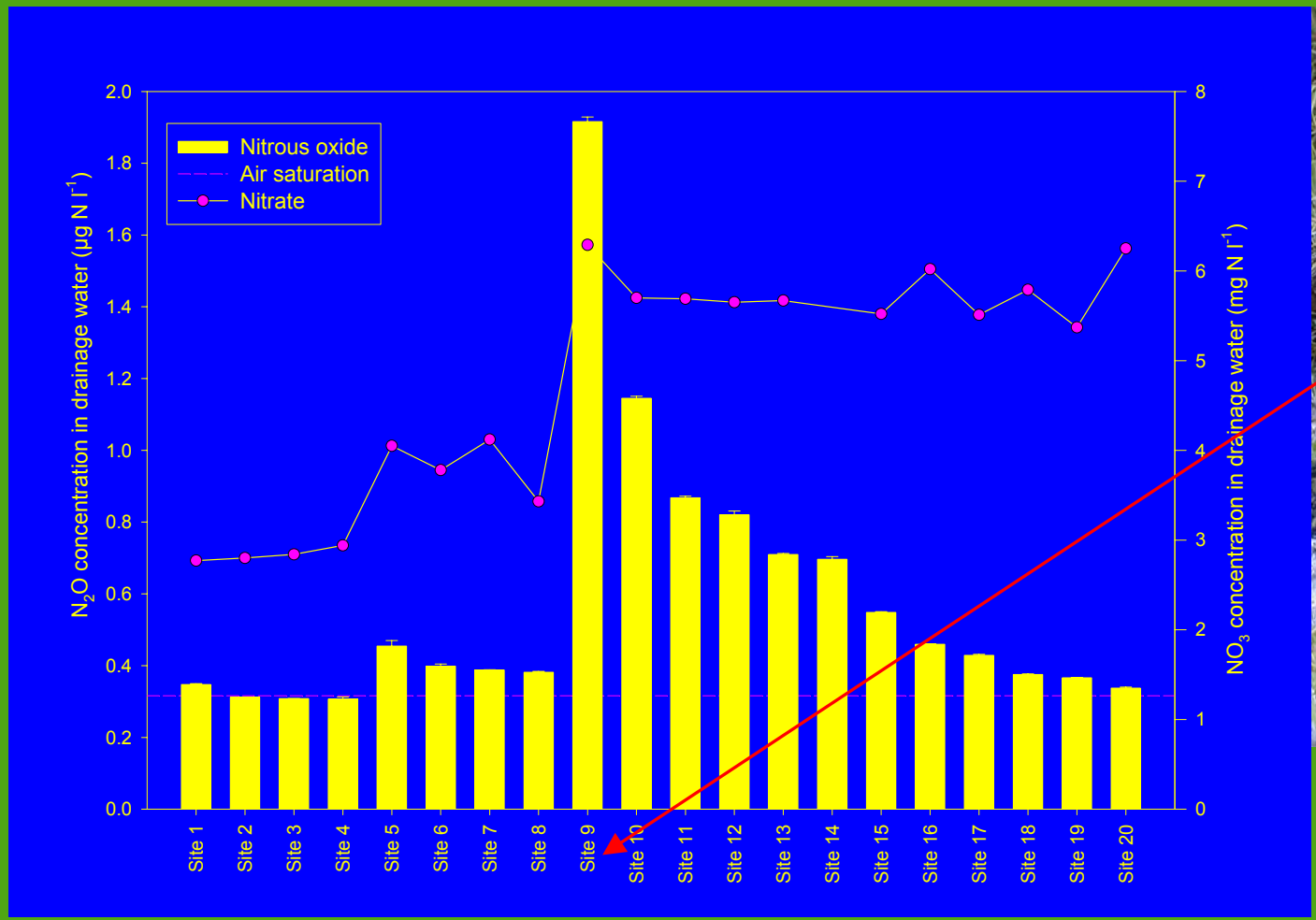
Impact of agricultural drainage waters on N_2O emissions from streams



N_2O concentrations in aquifers are related to nitrate concentrations

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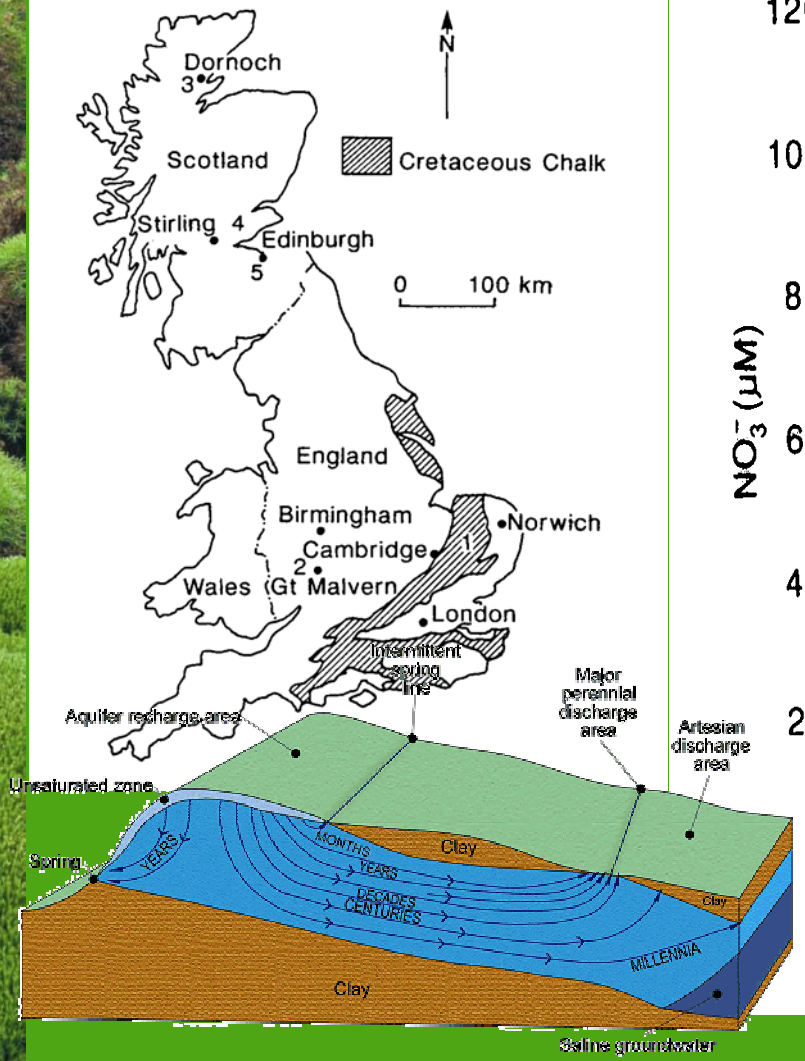

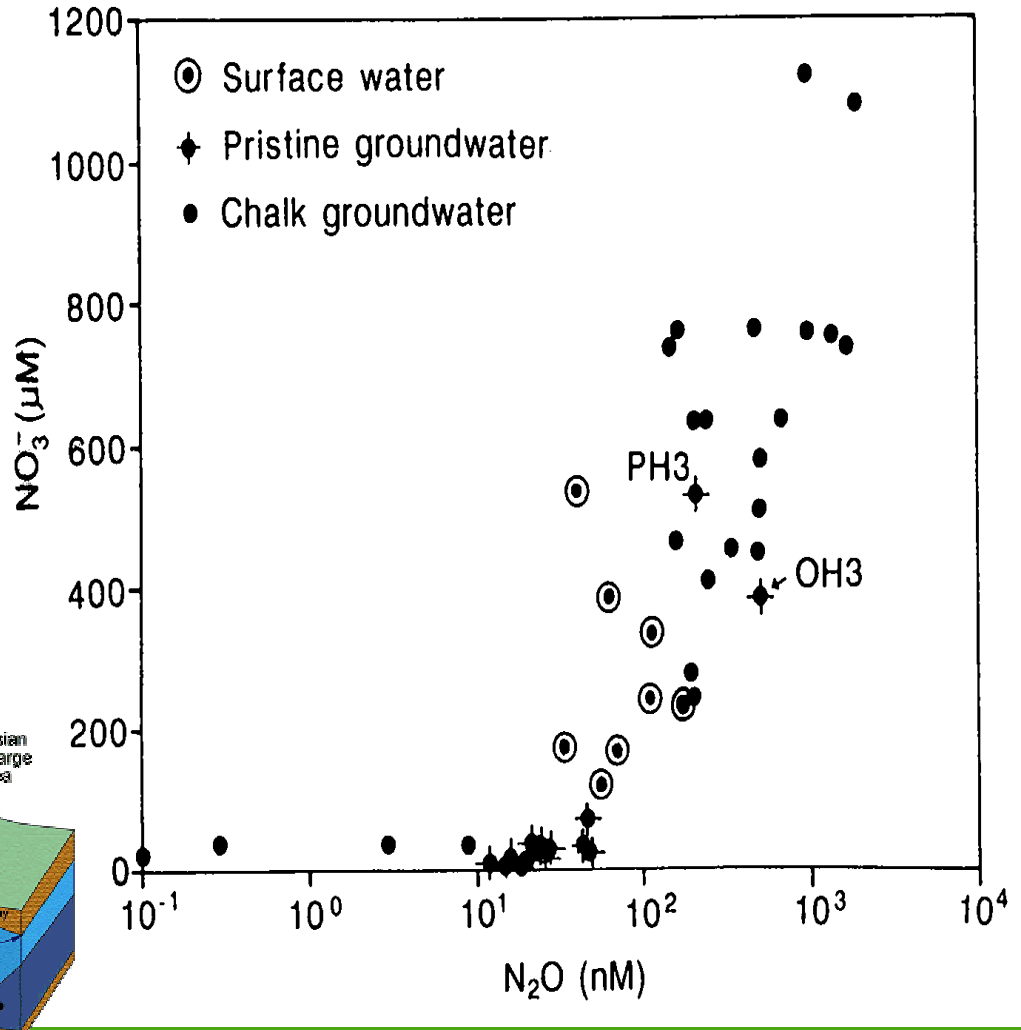

Nitrous oxide emissions from field drains and aquifers are smaller than previously estimated

- Only 0.2% of the nitrate in water is emitted as N_2O and not 1.5%
- IPCC emission factor for ground and drainage waters overestimates N_2O emissions!

Nitrous oxide emission from UK rivers and estuaries

	Percentage (%)	
	Rivers	Estuaries
Colne	0.5	99.5
Stour	6.9	93.1
Orwell	1.1	98.9
Deben	1.8	98.2
Trent *	4.3	
Ouse *	2.1	
Humber *		93.6
Conwy	31.3	68.7

*Trent+Ouse+Humber

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N_2O emissions from the intertidal zones

Estuaries are a source of N_2O

- Related to mineral N concentration
  - Only nutrient rich estuaries are sources of N_2O
  - Salt marshes emit more N_2O compared to mudflats
- Produced in sediments by denitrification

N_2O flux from estuaries

Estuary	N_2O flux t N_2O y^{-1}
Humber	500
Forth	18
Tamar	1.5
Tyne	0.56
Tees	4.8
Tweed	0.19
Tay	4.6
Total	530

UK estuaries emit 0.7 – 1.6 kt N_2O y^{-1}

In agreement with existing estimates

= 33% of all UK estuarine area

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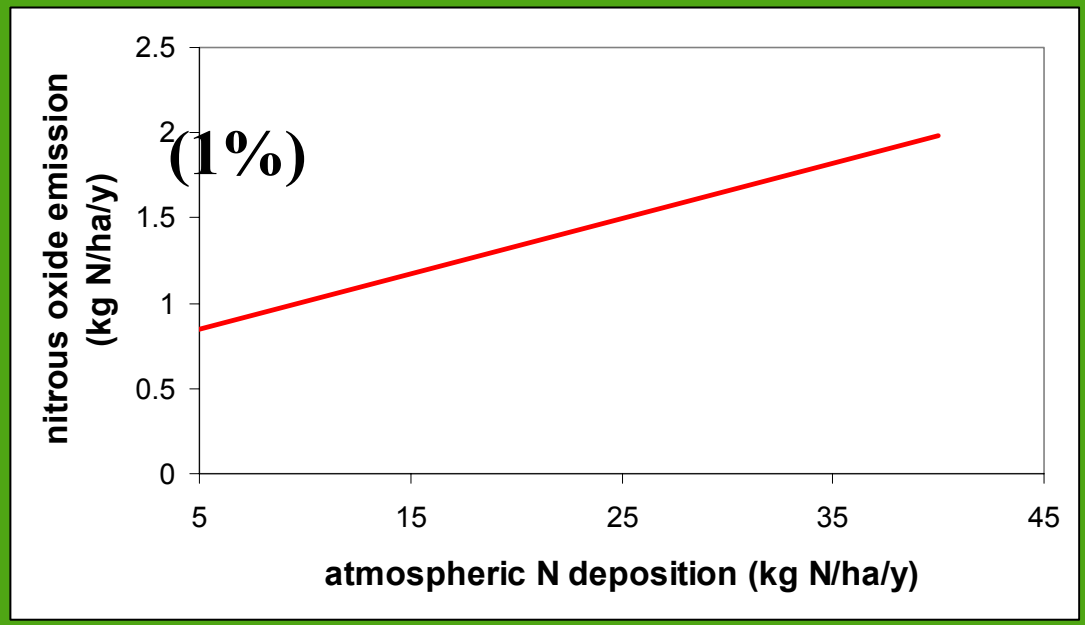
The relationship between atmospheric N deposition and N_2O emissions



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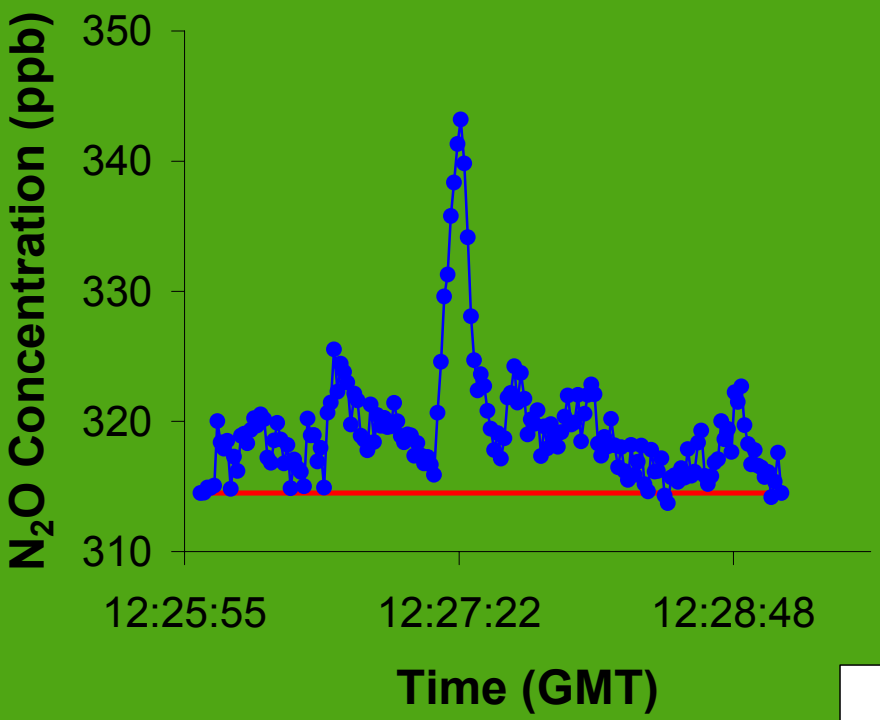
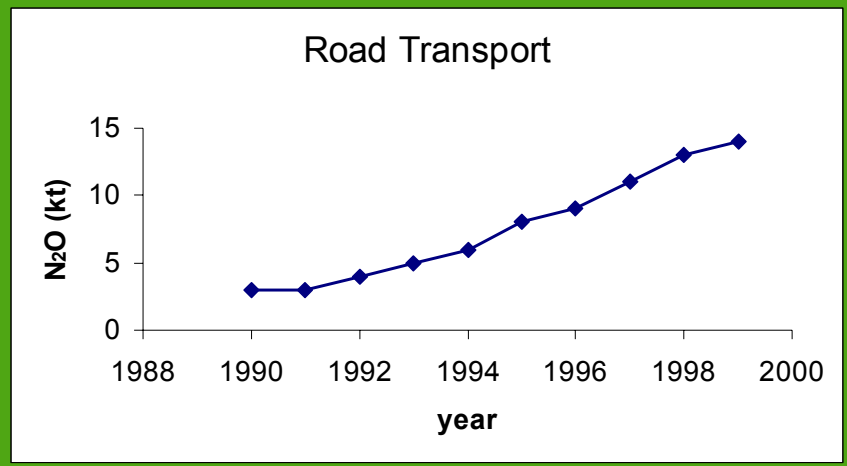
Nitrous oxide emissions from traffic





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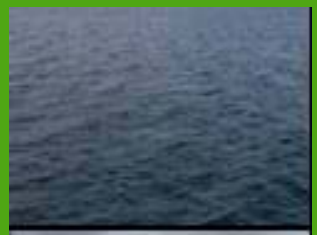
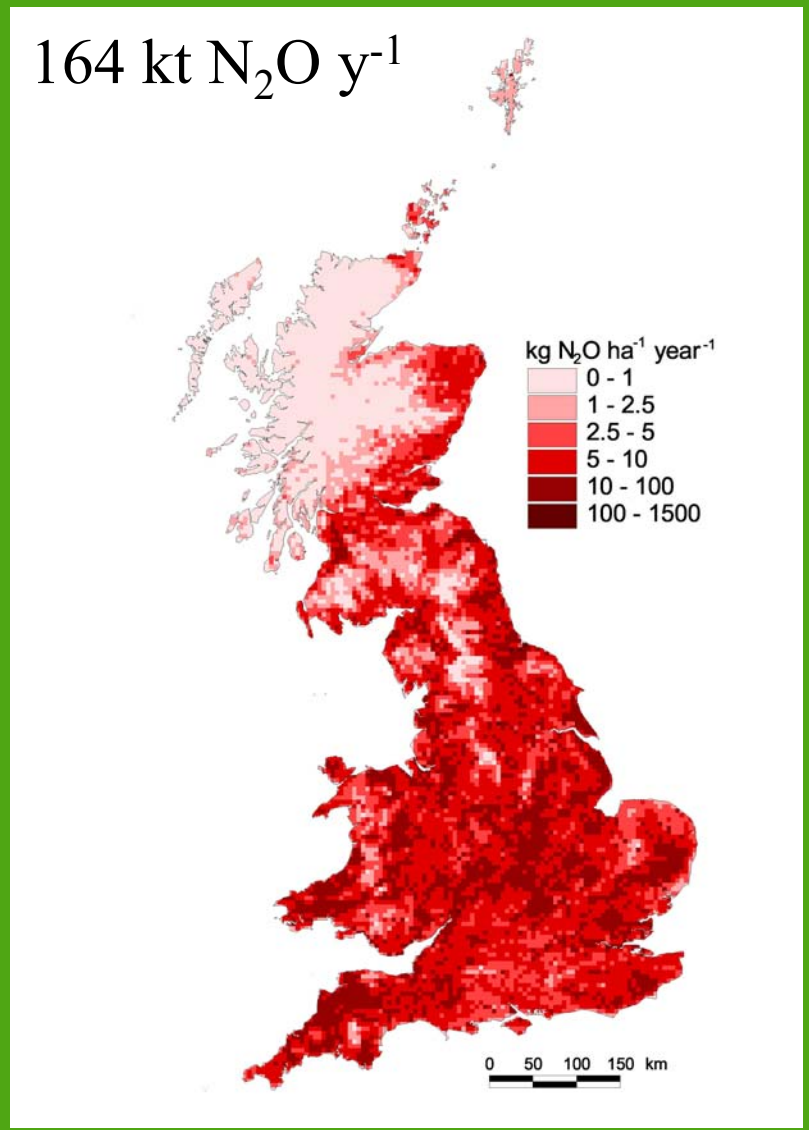
A spatial inventory of GB N_2O emissions



Sources of N_2O

Rivers	1%
Estuaries	1%
N deposition	4%
Mineral N fertiliser	52%
Livestock managem.	21%
Industry	13%
Road transport	8%



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Biomass burning and fires

- A new method was developed to estimate fuel combustion and total nitrogen loss from savanna (and other) wildfires.

- N_2O emissions from fires are correctly estimated by IPCC

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Conclusions

- Improved estimates of N_2O emissions from field drains, aquifers, rivers, estuaries and nitrogen polluted forests and moorlands

  BUT, their contribution to the total emission is small (< 6%)

- Efg is much smaller than previously thought.

- Agriculture contributes >80%.

  Gane provided better methods and models to estimate N_2O emissions from agricultural soils.

- Total annual N_2O emission in GB is 164 kt y^{-1}.