NitroEurope and other activities as a contribution to COST 729

Report to the Lisbon MC Meeting of COST 729
25 April 2008

Mark Sutton

COST 729 and
European Nitrogen Networks

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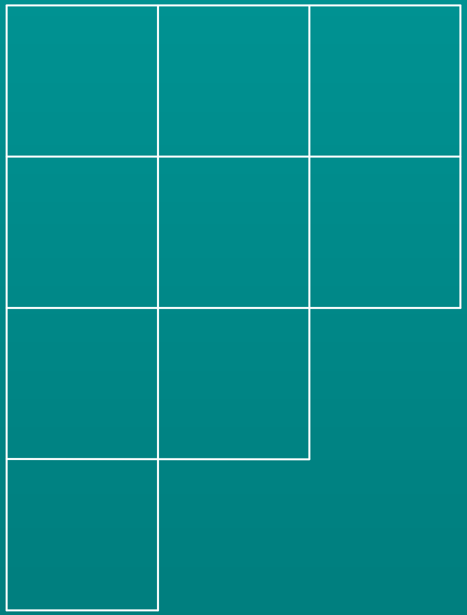
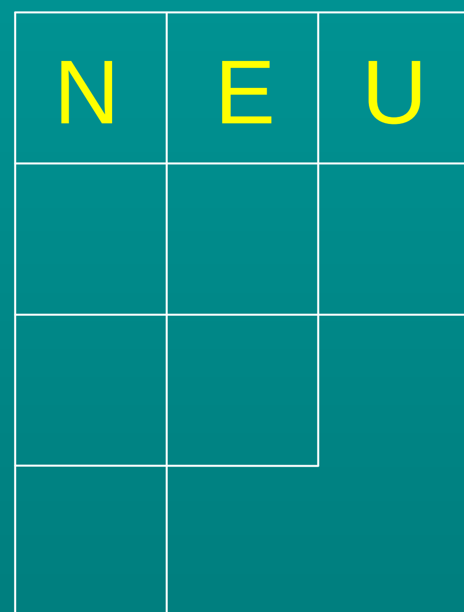
European Nitrogen Networks



COST 729 and
European Nitrogen Networks



NitroEurope IP (FP7)

COST 729 and
European Nitrogen Networks

Nitrogen in Europe
(ESF)

N		
I		
N		
E		

COST 729 and European Nitrogen Networks

	E	
I	N	I
	A	

International Nitrogen Initiative (IGBB/SCOPE)

European Nitrogen Assessment to NinE, INI, TFRN

COST 729 and European Nitrogen Networks

N	E	U
I	N	I
N	A	
E		

COST 729 and
European Nitrogen Networks

N	E	U
I	N	I
N	A	2
E	7	9

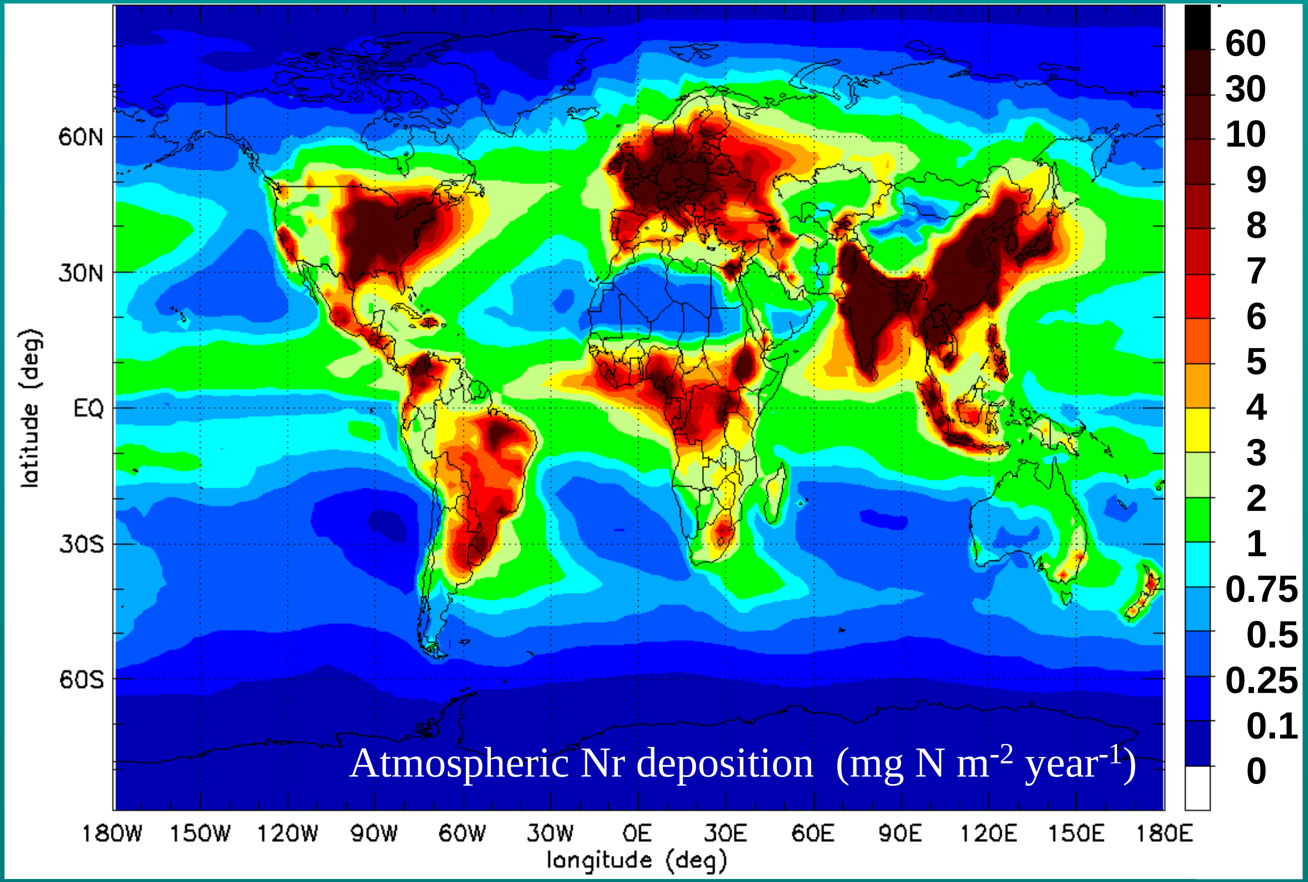
COST 729
Assessing & managing nitrogen fluxes in the atmosphere biosphere system in Europe

Global N production and dispersion

Human Nr Production:
(Tg yr^{-1})
1860: 15
1995: 156
2005: 191

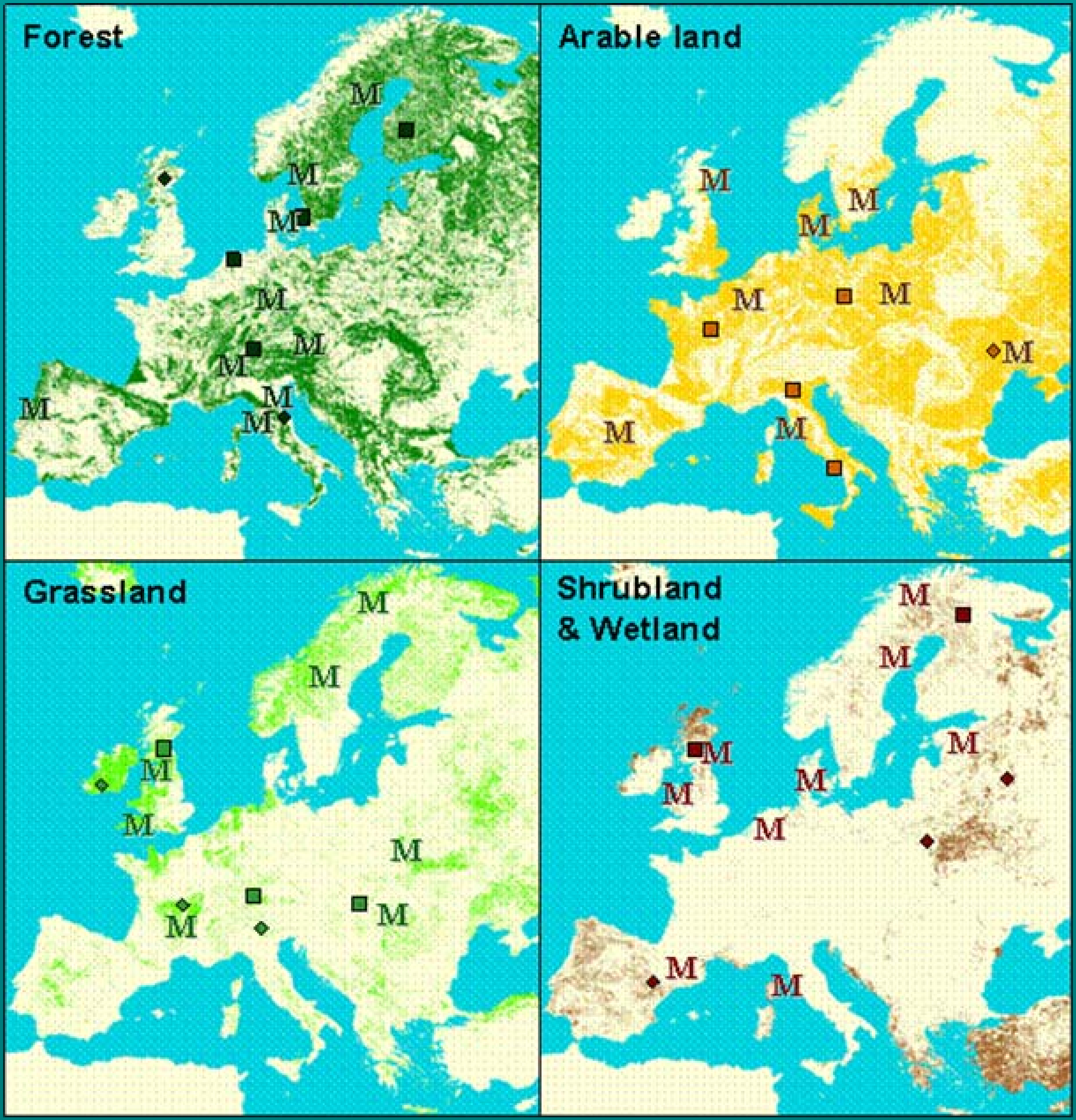
2005 sources:
Haber Bosch: 121
Biol N fixn: 45
NOx emission: 25

1/2 – 2/3 all Nr is of human origin



Galloway Erisman, Sutton et al. *Science* (2008. in press)
COST 729 contribution

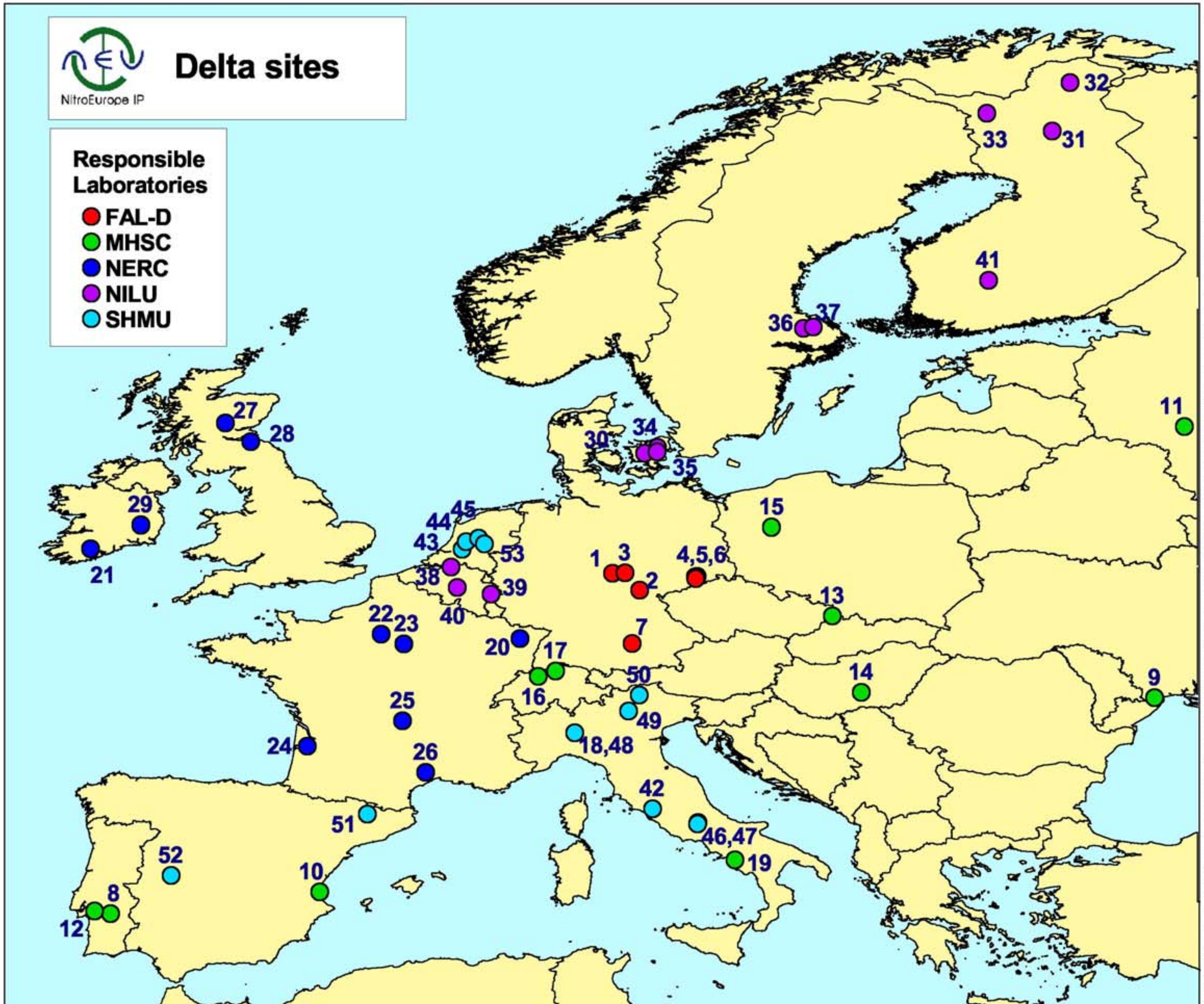
NitroEurope: Flux network (C1) & Manipulation network (C2)



13 Super Sites
9 Regional Sites
50 Inferential Sites

22 Core Manipulation Sites
14 Assoc. Manipulation Sites

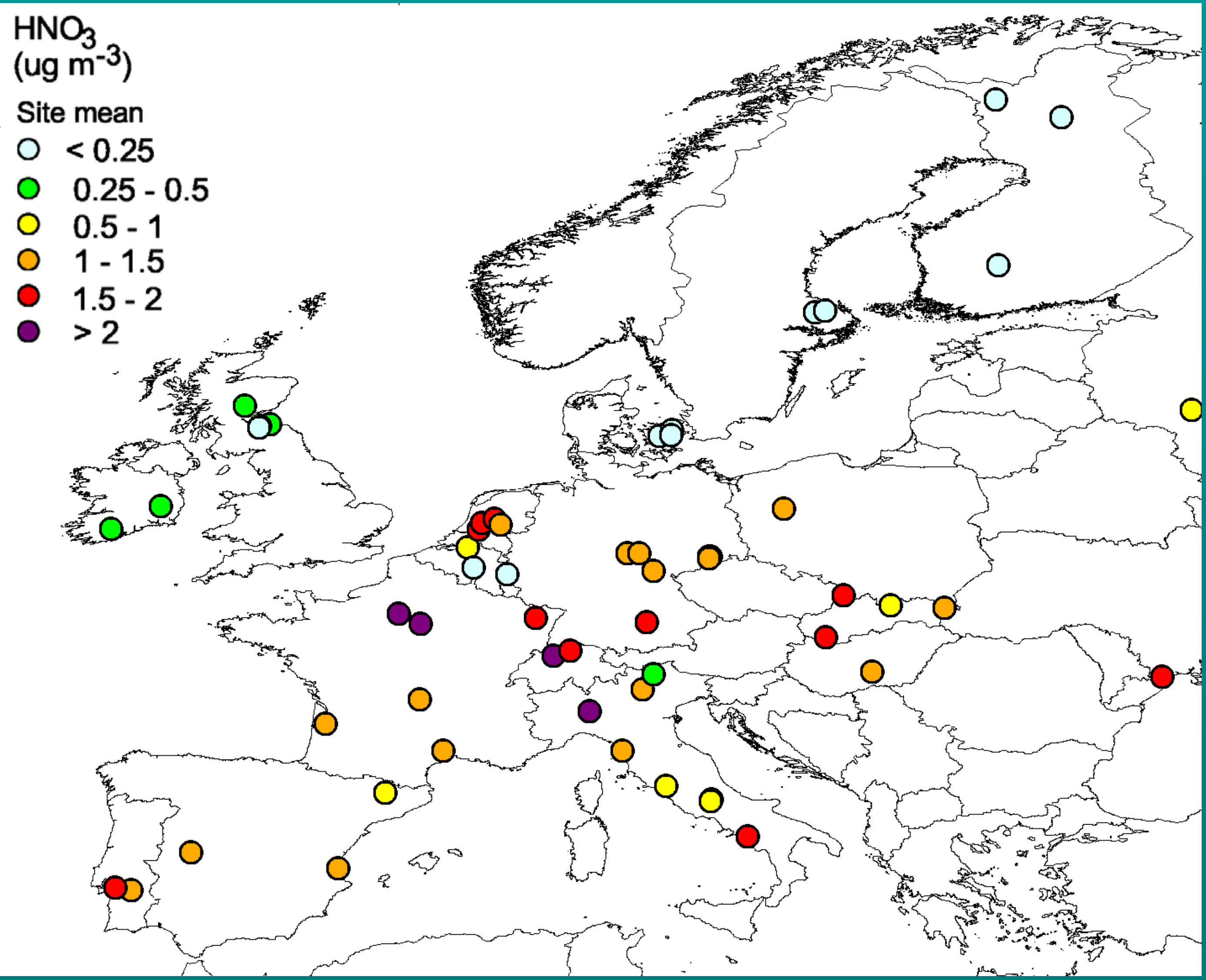
The NEU L1 DELTA Network



Site names

1 Hainich
2 Wetzstein
3 Gebesee
4 Tharandt
5 Grillenburg
6 Klingenberg
7 Hoglwald
8 Mitra II
9 Petrodolinskoye
10 El Saler
11 Fyodorovskoe bog
12 Espirra
13 BKFORES
14 Bugac
15 POLWET
16 Oensingen
17 Laegern
18 Po Valley Pavia
19 Piana del Sele
20 Hesse
21 Dripsey
22 Grignon
23 Fontainbleu
24 Le Bray
25 Laqueuille
26 Puechabon
27 Griffin
28 East Saltoun
29 Carlow
30 Soroe
31 Sodankylä
32 Kaamanen
33 Lompolojänkkä
34 Rimi
35 Risbyholm
36 Norunda
37 Skyttorp
38 Braschaat
39 Vielsalm
40 Lonzee
41 Hyytiälä
42 Roccarespampani
43 Cabauw
44 Horstermeer
45 Speulder
46 Amplero
47 Collelongo
48 Parco Ticino
49 Monte Bondone
50 Renon
51 Vall de Aliñá
52 Las Majadas del Tietar
53 Loobos

NitroEurope A1.5: First HNO_3 field



Also for
NO_3^-, NH_3, NH_4^+, HNO_2, NO_2^- for N deposition to Level 1 sites

(Plus SO_2, SO_4^{2-}, HCl, Cl & Base Cations)

Tang, Sutton and NEU A1.5 team et al.

Level 3 sites 6 months GHG budget

NitroEurope IP

Greenhouse gas fluxes as CO_2 equivalent (kg/ha/y)

	1.1. to 30.6.2007			
Level 3 sites	CO2	CH4	N2O	total
Sor_DK forest	-16408.0	-120.5	104.3	-16424.3
Hyt_FIN forest	-13317.8	-244.3	115.7	-13446.4
Gri_FR arable	-61135.0	0.0	244.8	-60890.2
Cas_I arable	-11153.8	233.2	1677.8	-9242.8
Oen_CH grass	-44958.2	7.8	184.3	-44766.1
Bug_HU grass	-3676.9	0.3	51.6	-3624.9
EBu_UK grass	-9850.1	10.6	7327.9	-2511.5
Lom_FIN wetland	524.4	22057.6	59.7	22641.6
Amo_UK wetland	-1724.6	27.4	-70.6	-1767.9

Preliminary calculations only!

Skiba & the NEU A1.3 team

Does N drive forest C sequestration?

NATURE|Vol 000|00 Month 2008 **BRIEF COMMUNICATIONS**

Ecologically implausible carbon response?

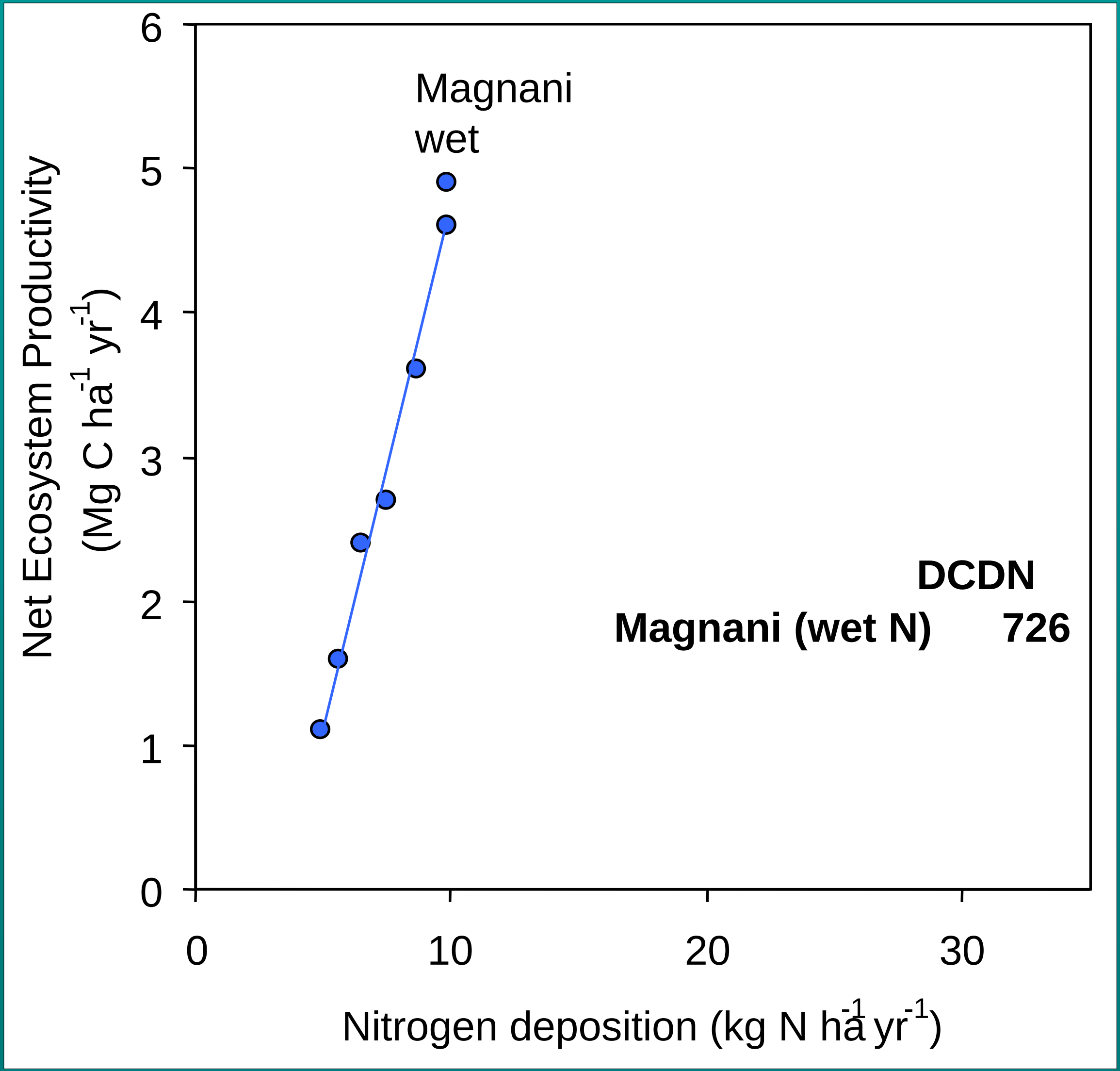
Arising from: F. Magnani *et al.* *Nature* 447, 848–850 (2007)

Magnani *et al.*[1] present a very strong correlation between mean lifetime net ecosystem production (NEP, defined as the net rate of carbon (C) accumulation in ecosystems[2]) and wet nitrogen (N) deposition. For their data in the range 4.9–9.8 kg N $ha^{-1} yr^{-1}$, on which the correlation largely depends, the response is approximately 725 kg C per kg N in wet deposition. According to the authors, the maximum N wet deposition level of 9.8 kg N $ha^{-1} yr^{-1}$ is equivalent to a total deposition of 15 kg N $ha^{-1} yr^{-1}$, implying a net sequestration near 470 kg C per kg N of total deposition. We question the ecological plausibility of the relationship and show, from a multi-factor analysis of European forest measurements, how interactions with site productivity and environment imply a much smaller NEP response to N deposition.

However, even this lower response is unlikely. ^{15}N-lab experiments in temperate forests indicate that N retent occurs in stem wood but mainly in the soil[7]. Consideri of N and the ranges in C:N ratios in forest ecosystem com this implies a carbon response near 50 kg C per kg N in fo tems[7,8]. Even though the above-ground C sequestratio underestimated by Nadelhoffer *et al.*[7], owing to neglectin of direct foliar uptake[9,10], this effect is likely to be small ground foliar N uptake is generally less than 5 kg N (ref. 11), whereas below-ground uptake is generally 50 kg N $ha^{-1} yr^{-1}$. Furthermore, similar results are foun term (15-30 yr) nitrogen-fertilizer trials at rates of nitrog below 50 kg N $ha^{-1} yr^{-1}$ (refs 12, 13) and in process-ba

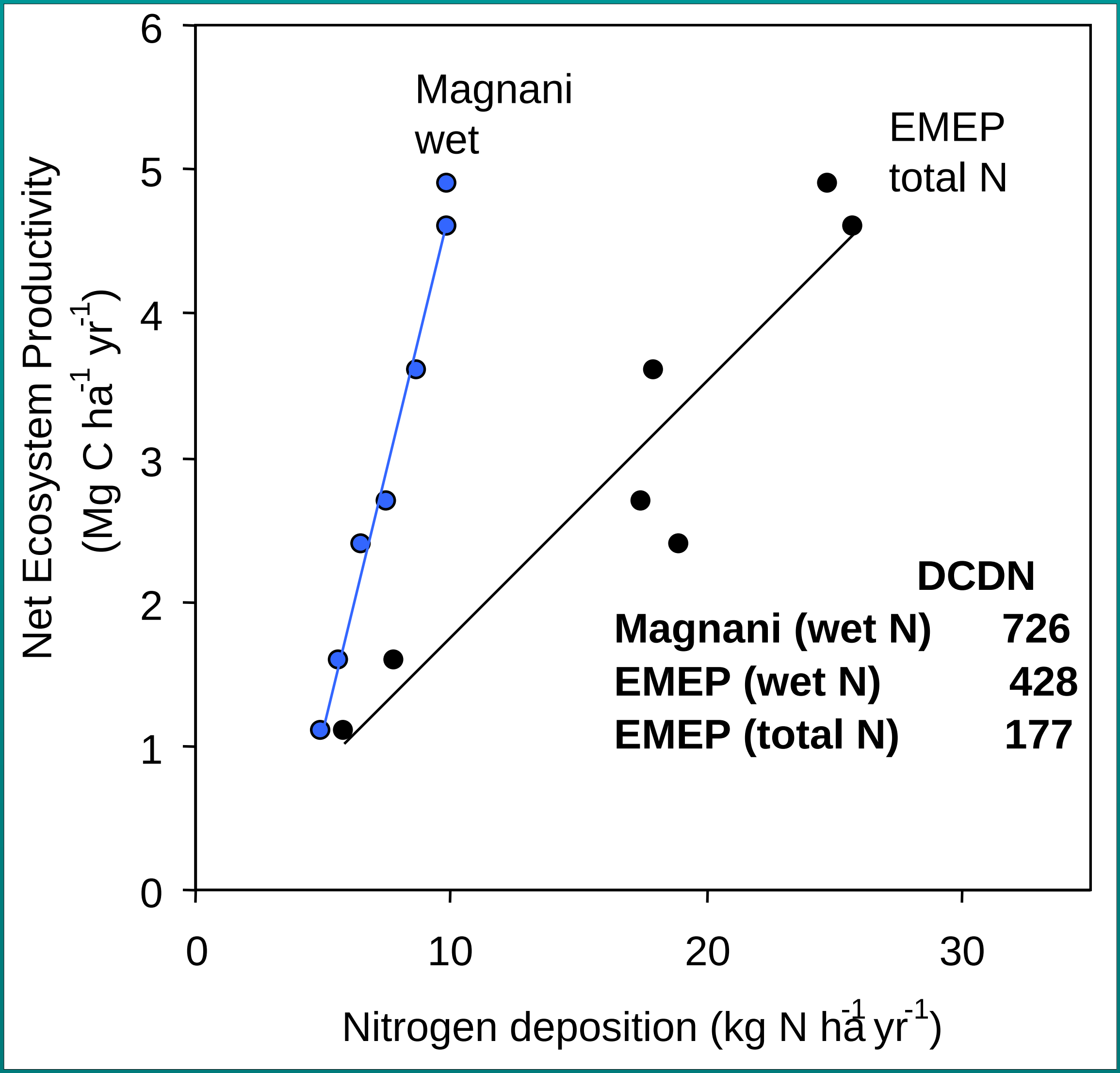
de Vries, Sutton et al.
Nature 15 Feb 2008

Re-interpreting the nitrogen interaction



Sutton et al. *Global Change Biology* (in press)

Re-interpreting the nitrogen interaction



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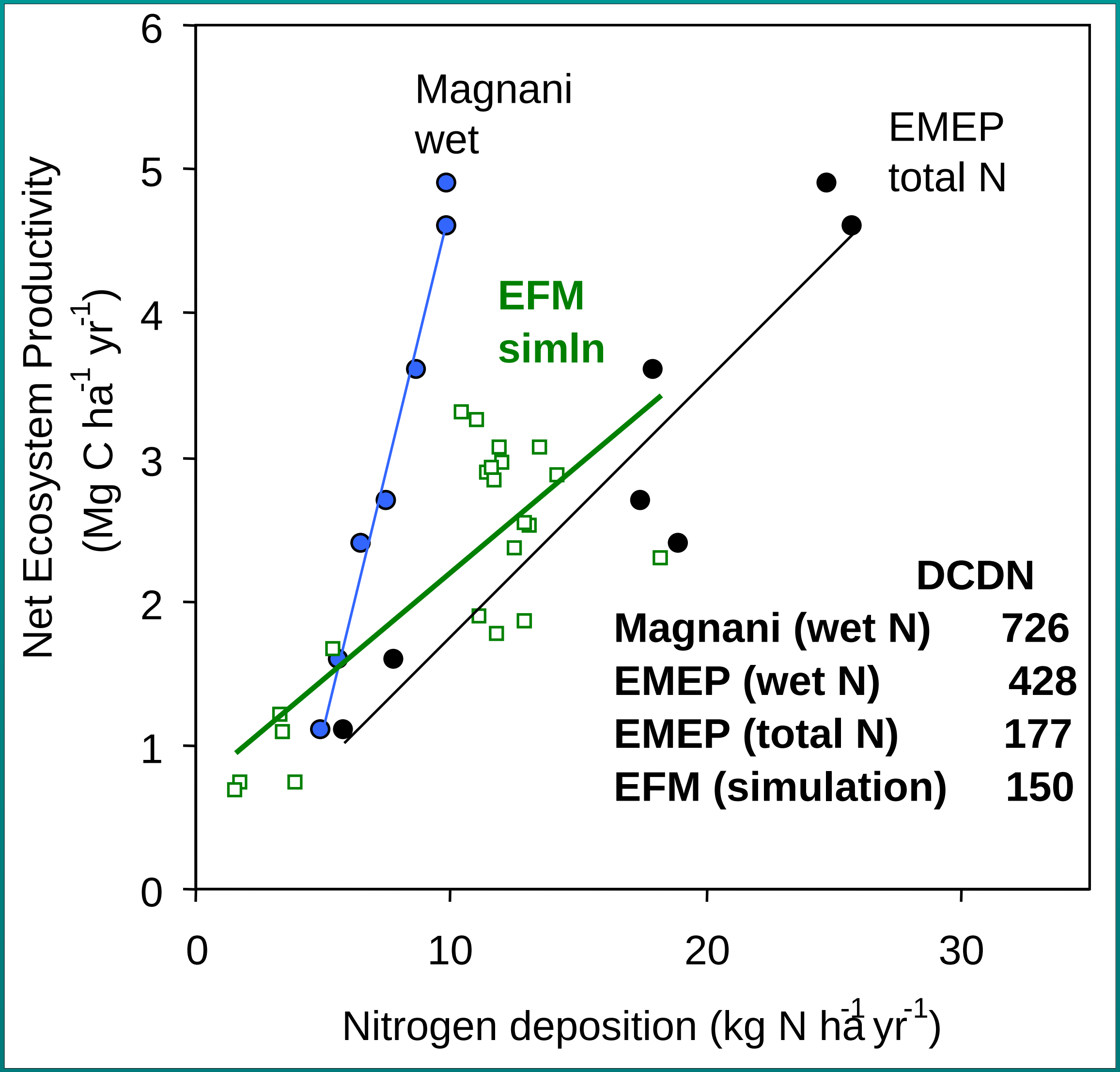

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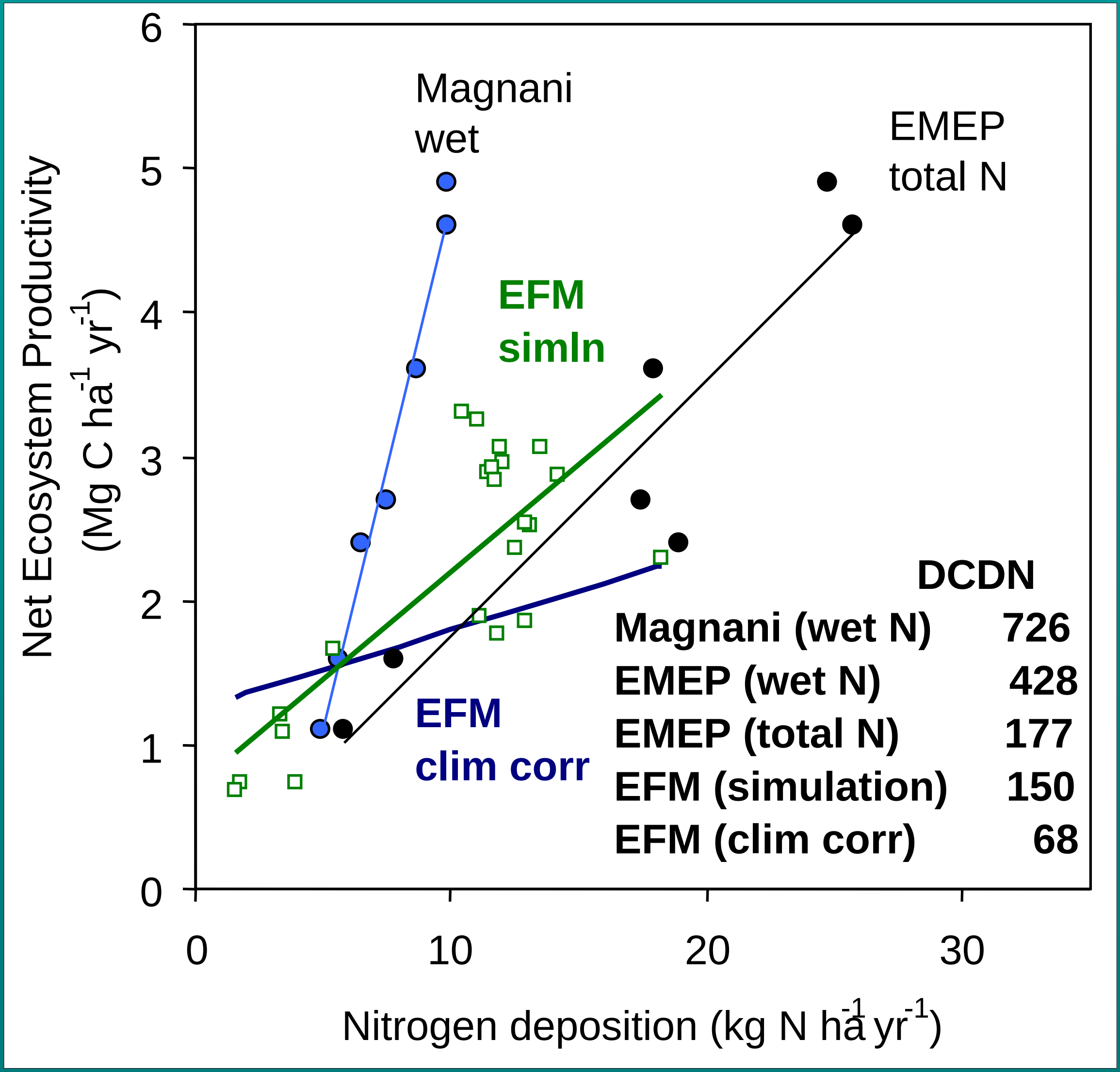
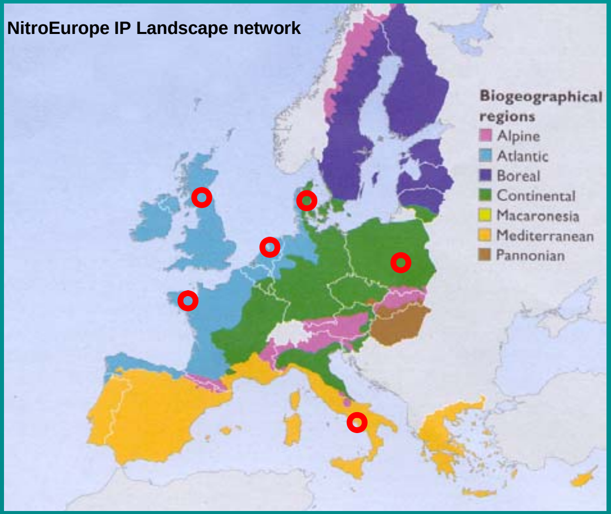
Re-interpreting the nitrogen interaction



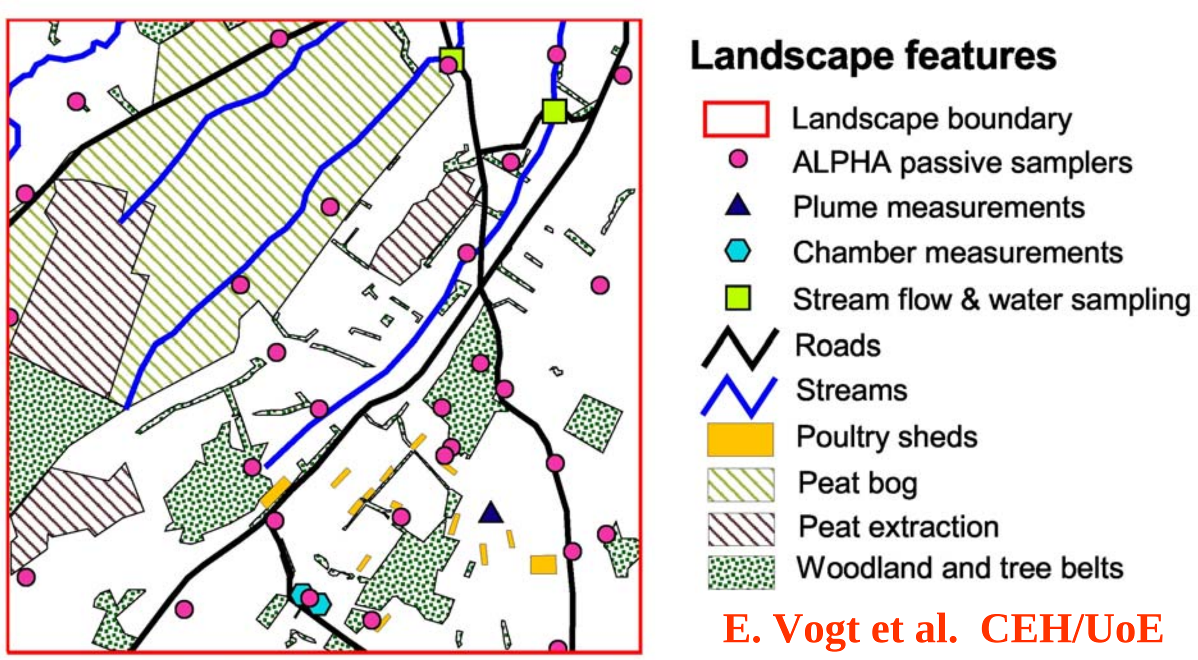
Sutton et al. *Global Change Biology* (in press)

NitroEurope Landscape Analysis (C4)

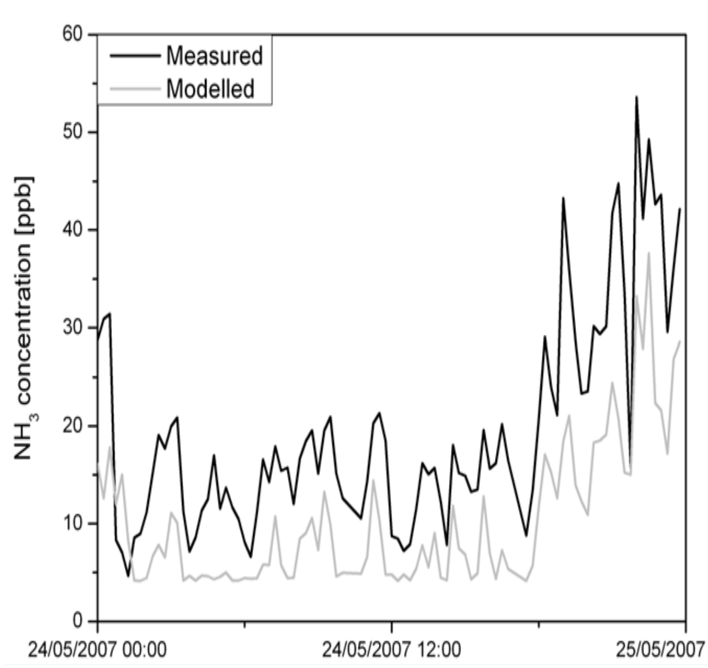
NitroEurope IP



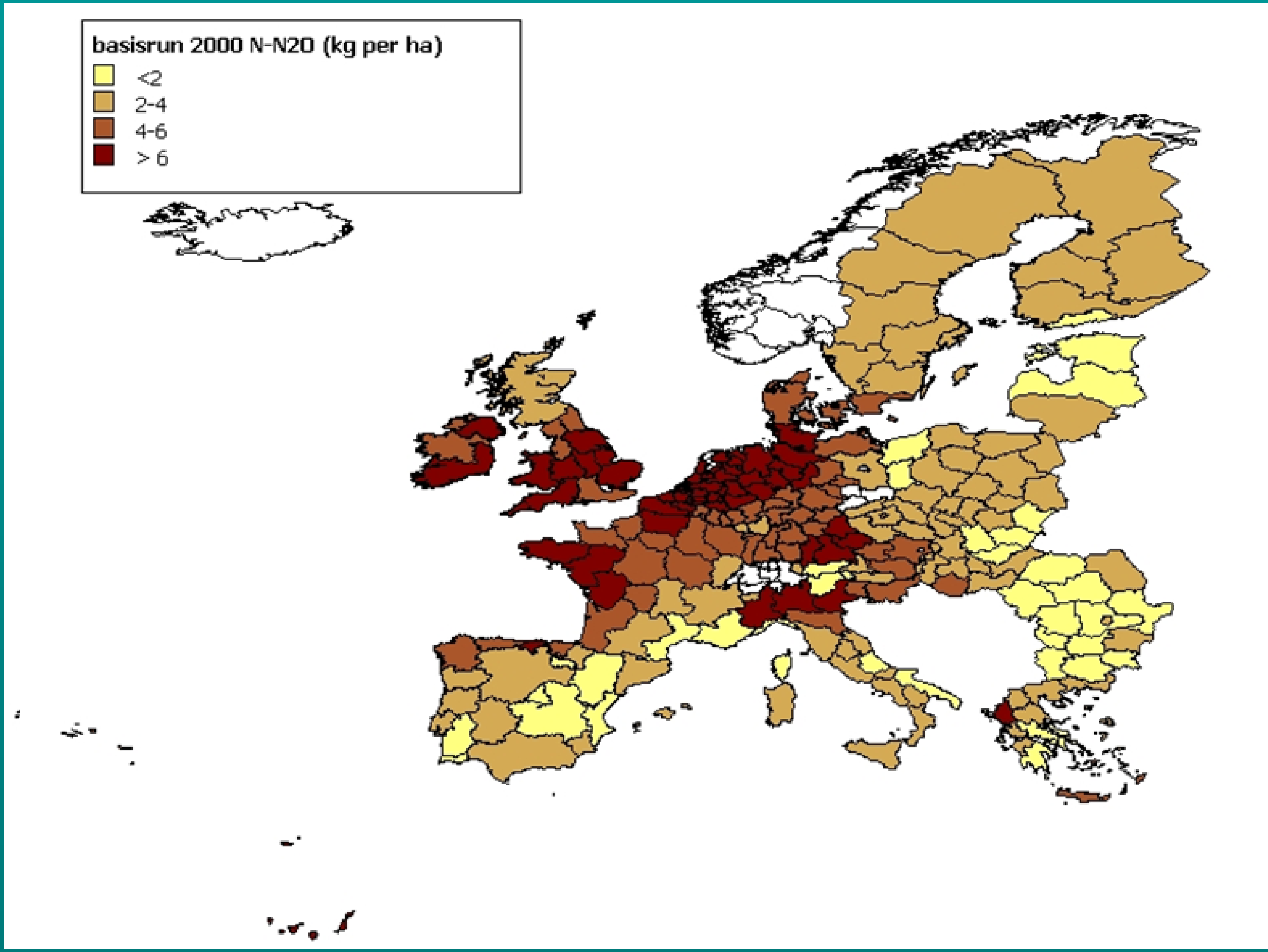
- Inventory methods developed
- Landscape modelling framework agreed
- First verification measurements



E. Vogt et al. CEH/UoE



N_2O emissions from agriculture (2000)



Velthof et al. Alterra (Miterra-Europe) (DG Env Service Contract)

COST 729 Dissemination

Task Force on Reactive Nitrogen

- United Nations Economic Commission for Europe (UNECE)
  - Convention on Long Range Transboundary Air Pollution
  - Gothenburg Protocol: multi-pollutant, multi-effect
  - Develop integrated approach to managing excess Nr.
- Task Force on Reactive Nitrogen (TFRN)
  - established by Executive Body Dec 2007.
  - Co-chairs: Sutton and Oenema
  - UNECE Secretariat: Johansson
  - www.unece.org/env/tfrn
  - TFRN-1, Wageningen 20-23 May.
  - Activity review, current policies, national priorities

European Nitrogen Assessment (ENA)

- Major Sponsor: ESF Nitrogen in Europe (NinE)
- Information Sources: NEU & Euro research inc. COST 729
- Contribution to: International Nitrogen Initiative (INI)
- Reported to: International Conventions on climate, air, water, biodiversity through the TFRN.

- Timing: Workshops & chapters 2008-09. Delivery 2010.
- ENA-1: 20-21 May 08, Wageningen before TFRN-1
- Contributions: Express interest via www.nine-esf.org
  ena@nine-esf.org

Overall structure of the ENA - 1

A. Nitrogen in Europe: the present position.
   - Wageningen (20-23 March, joint with TFRN)

B. Nitrogen processing in the biosphere
   - Crieff, Scotland (18-20 June)

C. Dispersion, budgets & impacts of nitrogen on different scales
   - Paris (4-6 November)

D. Managing nitrogen in relation to key societal threats
   - Sweden (Spring 2009)

E. European N policies and future challenges
   - Netherlands (mid 2009)

Overall structure of the ENA - 1

1. Introduction, Scope & Objectives

A. Nitrogen in Europe: the present position.

2. European N problem in global perspective (Erisman)
3. N in current European policies (Oenema)
4. Challenge to integrated N science & policies

B. Nitrogen processing in the biosphere

5. N processes & effects in terrestrial ecosystems (Gunderson & Butterbach Bahl)
6. N processes & effects in aquatic ecosystems (Durand & Breuer)
7. N processes & effects in coastal/marine ecosystems (Voss)
8. N processes & effects in the atmosphere (*Ole Hertel*)

Overall structure of the ENA - 2

C. Dispersion, budgets & impacts of nitrogen on different scales

9. Rural landscapes (Cellier)
10. Urban landscapes (*Anastasia Svirejeva-Hopkins*)
11. Regional watersheds (inc. coastal & marine) (Billen)
12. Atmos transport & deposition over Europe (Simpson)
13. Integrating N fluxes at European scale (de Vries & Leip)

Overall structure of the ENA - 3

D. Managing nitrogen in relation to key societal threats

Need to develop consensus on the 5 priorities!

- Water quality
- Air quality (esp. particulate and ozone)
- Greenhouse gas balance
- Ecosystem biodiversity
- Soil fertility/soil quality

Overall structure of the ENA - 3

D. Managing nitrogen in relation to key societal threats

Need to develop consensus on the 5 priorities!

- **W**ater quality
- **A**ir quality (esp. particulate and ozone)
- **G**reenhouse gas balance
- **E**cosystem biodiversity
- **S**oil fertility/soil quality

The WAGES of excess nitrogen

Overall structure of the ENA - 4

E. European N policies and future challenges

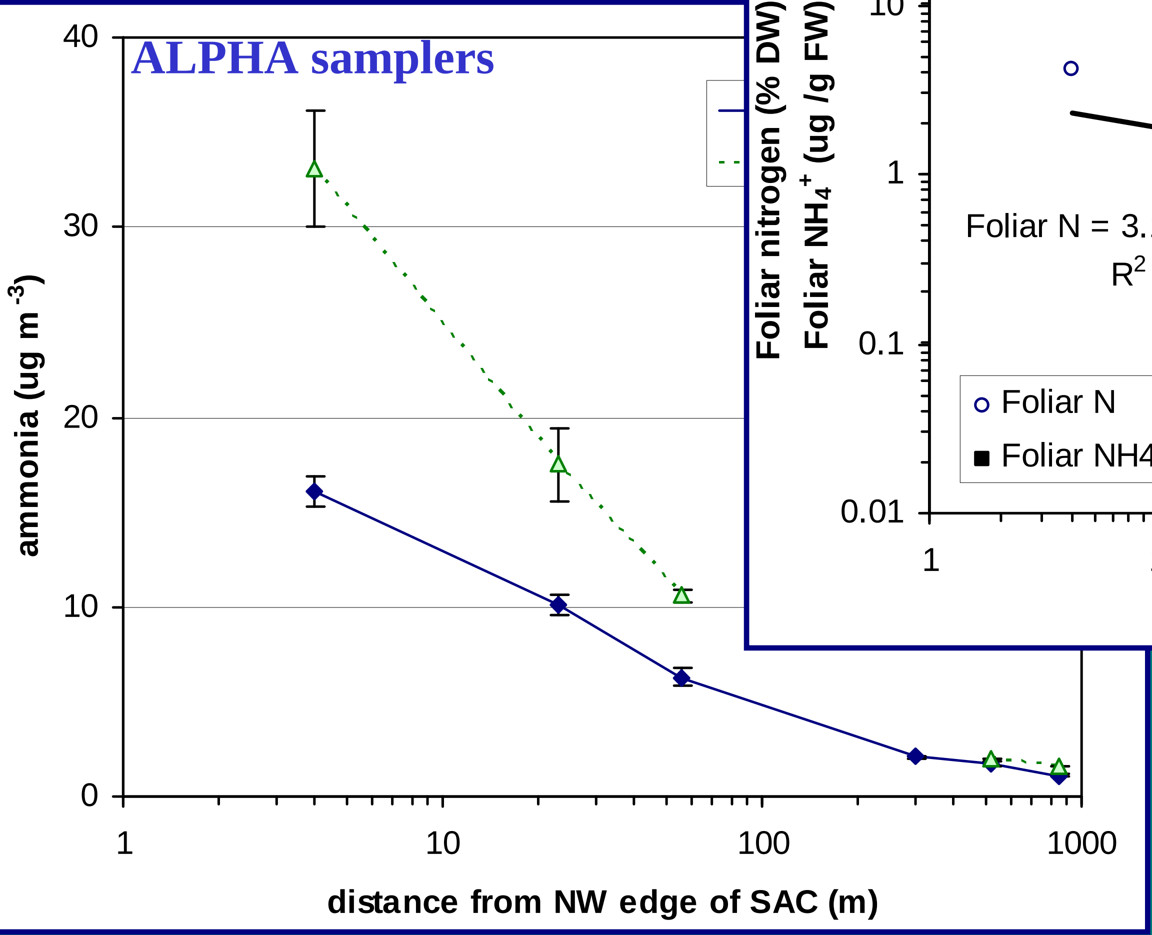
19. Future scenarios
20. Costing nitrogen in the environment
21. Integrated approaches to better N management
22. Streamlining European nitrogen management between international conventions
23. Societal choice and the European N challenge
24. Communication and dissemination

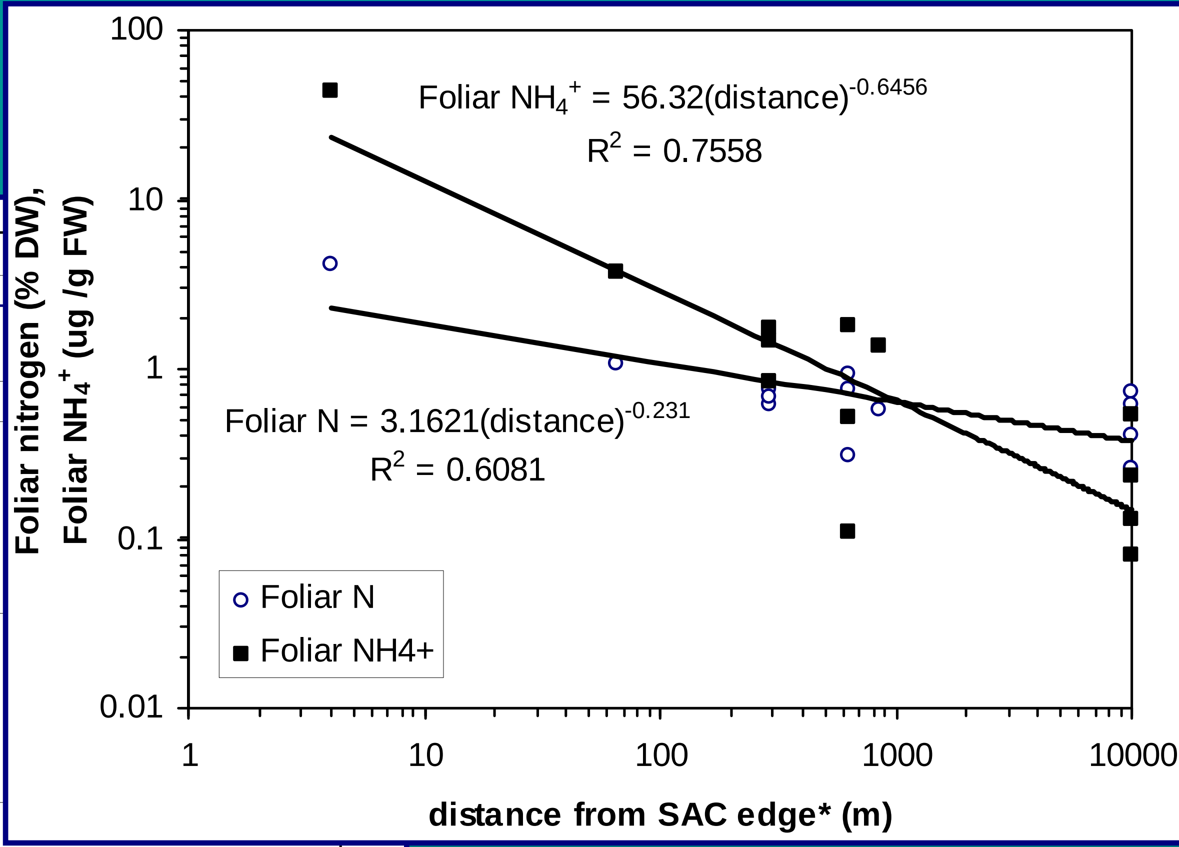
www.nine-esf.org ena@nine-esf.org

N deposition & Biodiversity:

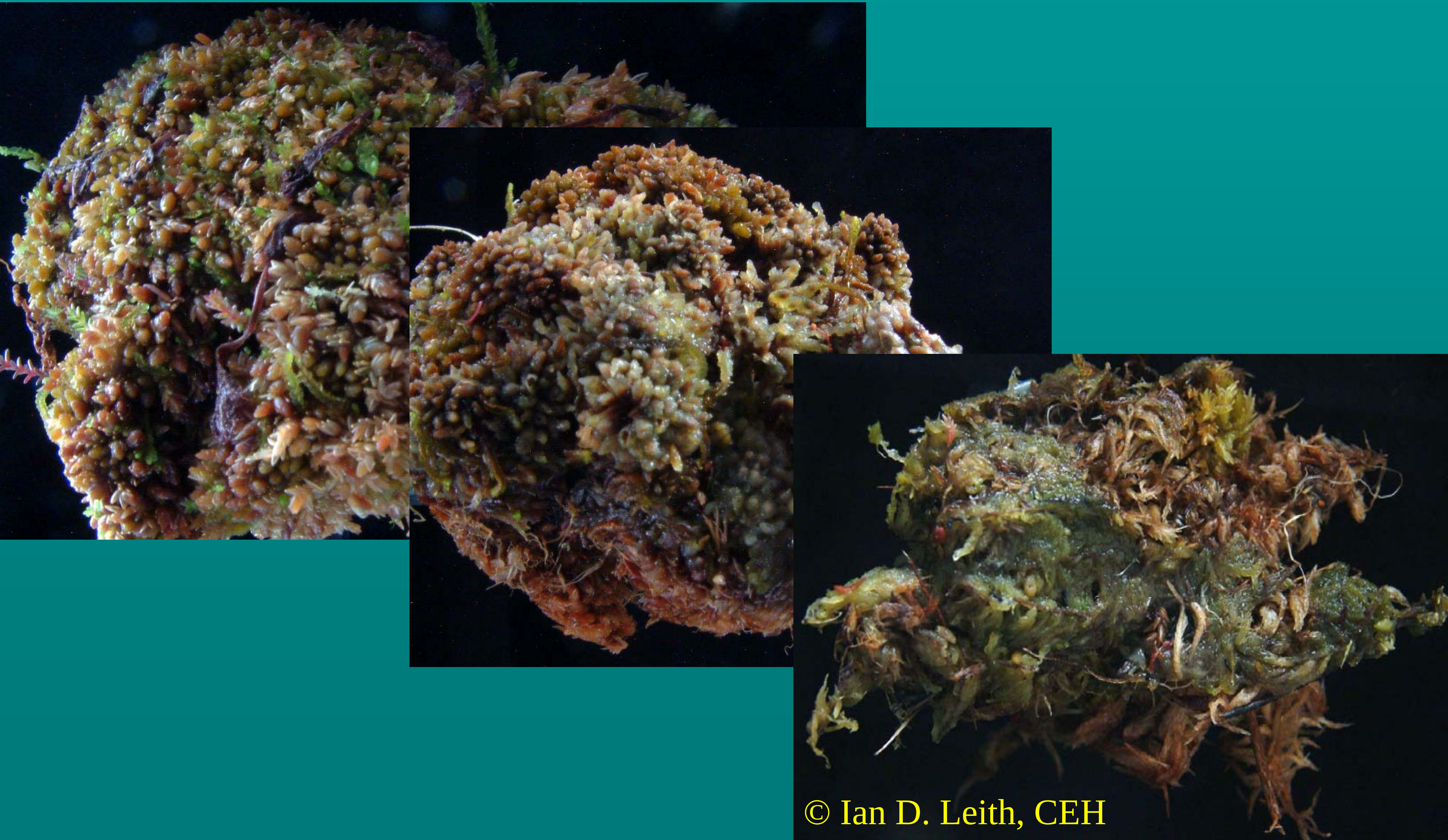
Case Study of Moninea Bog

Test measurements Moninea Bog





Ammnia damage to *Sphagnum imbricatum*



Ammonia damage to *Cladonia uncialis*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COST 729 Mid-term Workshop 2009

Nitrogen Deposition and Natura 2000

Science and practice in determining environmental impacts

Goal

- To develop harmonized approaches for assessing the impacts of atmospheric nitrogen deposition on sites Natura 2000.

Key Issues

- Pairing national scientists and conservation practitioners
- Considering site-based case studies
- Comparing approaches between countries
- Developing clear messages to improve assessments
- Exploiting cross-compliance between directives
- Communicating the scale of the problem

- Coordinates: Belgium April 200 Information: info@cost729.org