N flux measurements and the NEU flux network

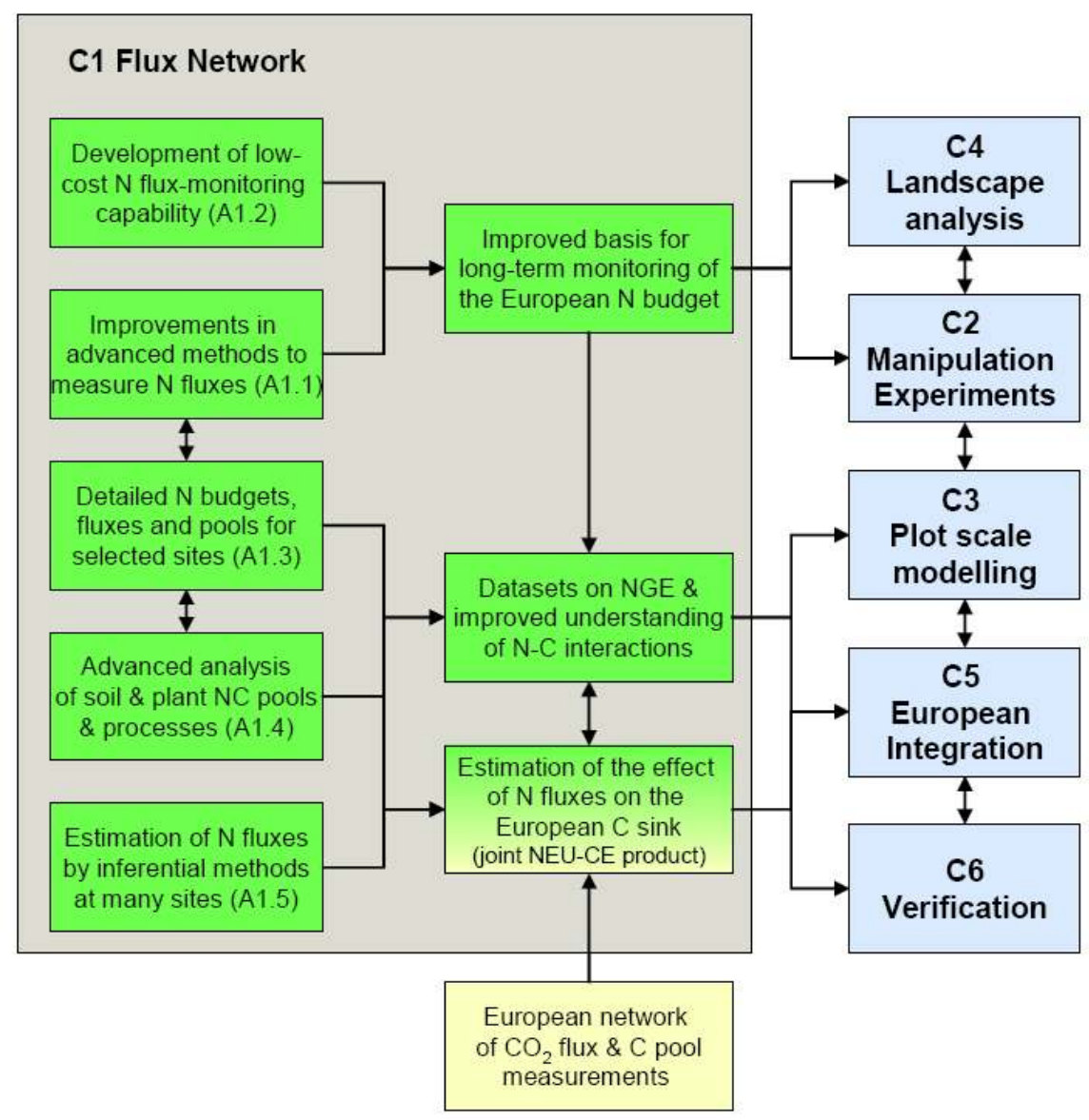
Level 1-2-3

Activity 1.3: Fluxes, pools and budgets (NERC)

Activity 1.4: Plant & soil pools and processes (SUN)

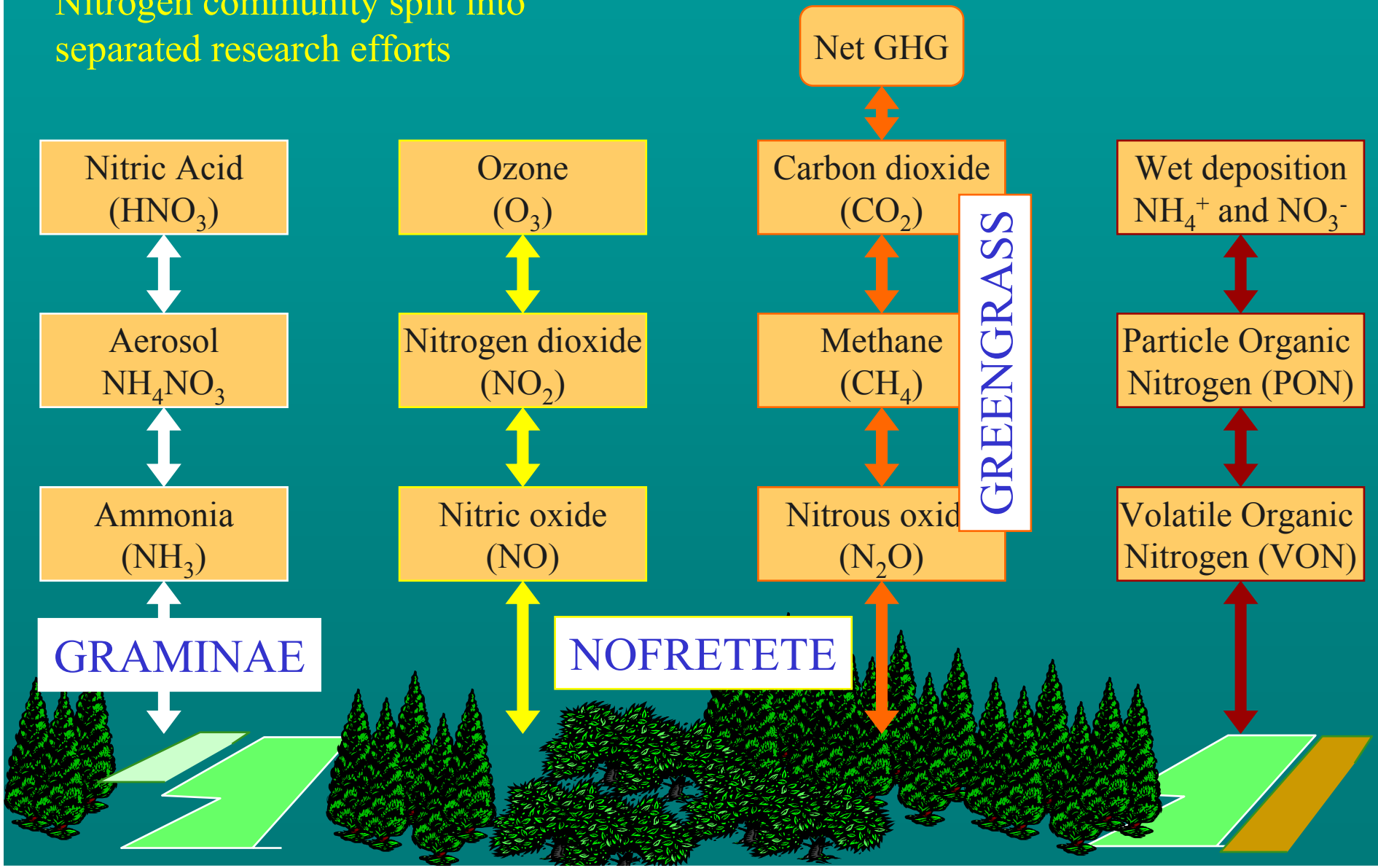
Activity 1.5: Inferential N fluxes and C interactions (NERC)

C1 NEU flux network



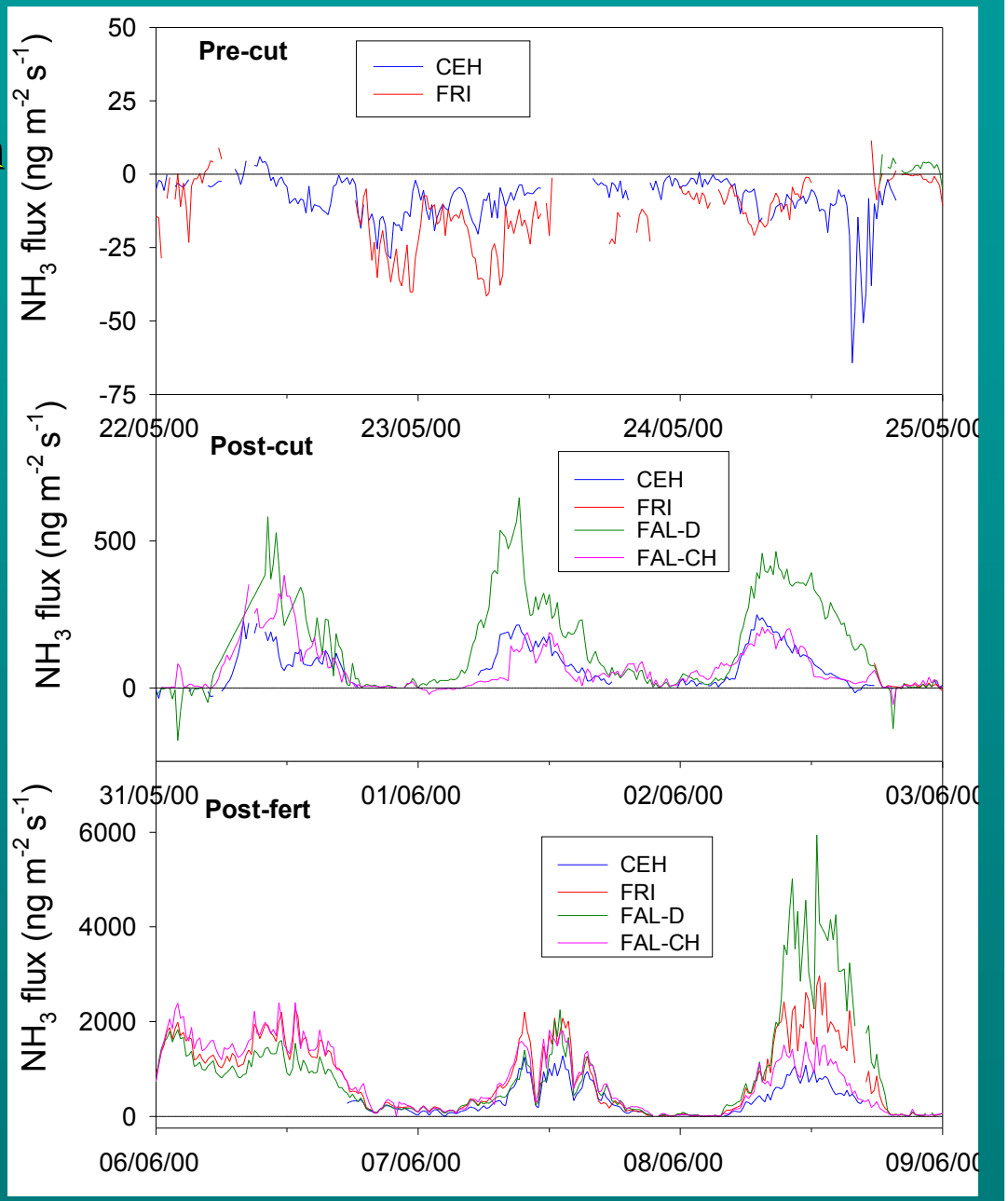
Land-atmosphere exchange of nitrogen

Nitrogen community split into separated research efforts

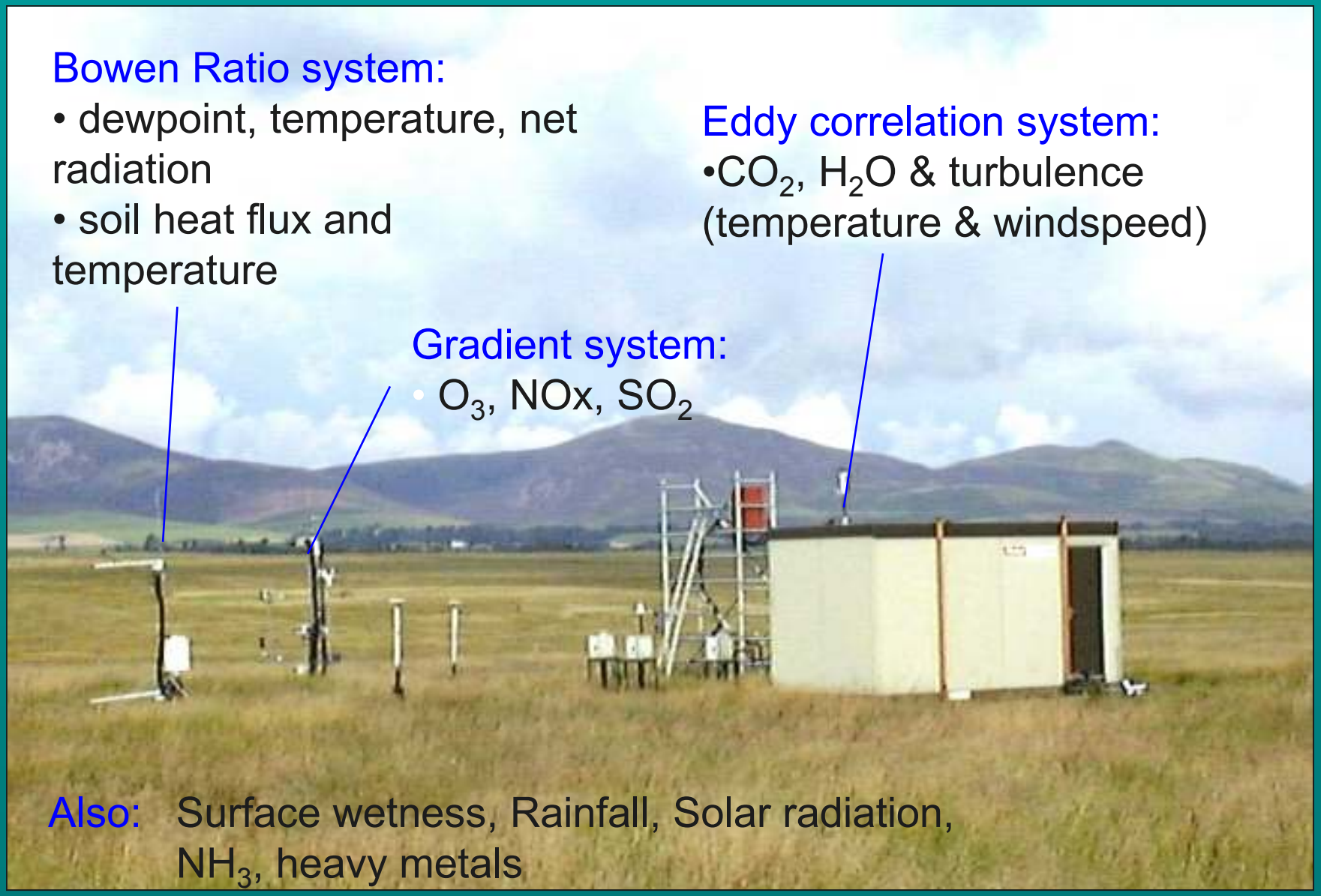


Biosphere-atmosphere interactions of ammonia with European Grasslands

Example of NH_3 fluxes from the 4 different systems, pre-cutting, post-cutting and post-fertilising.



Life programme: Auchencorth Moss



Annual atmospheric N deposition to the 3 *LIFE* flux monitoring stations

Table 8.3. Annual atmospheric N deposition to the 3 *LIFE* flux monitoring stations.

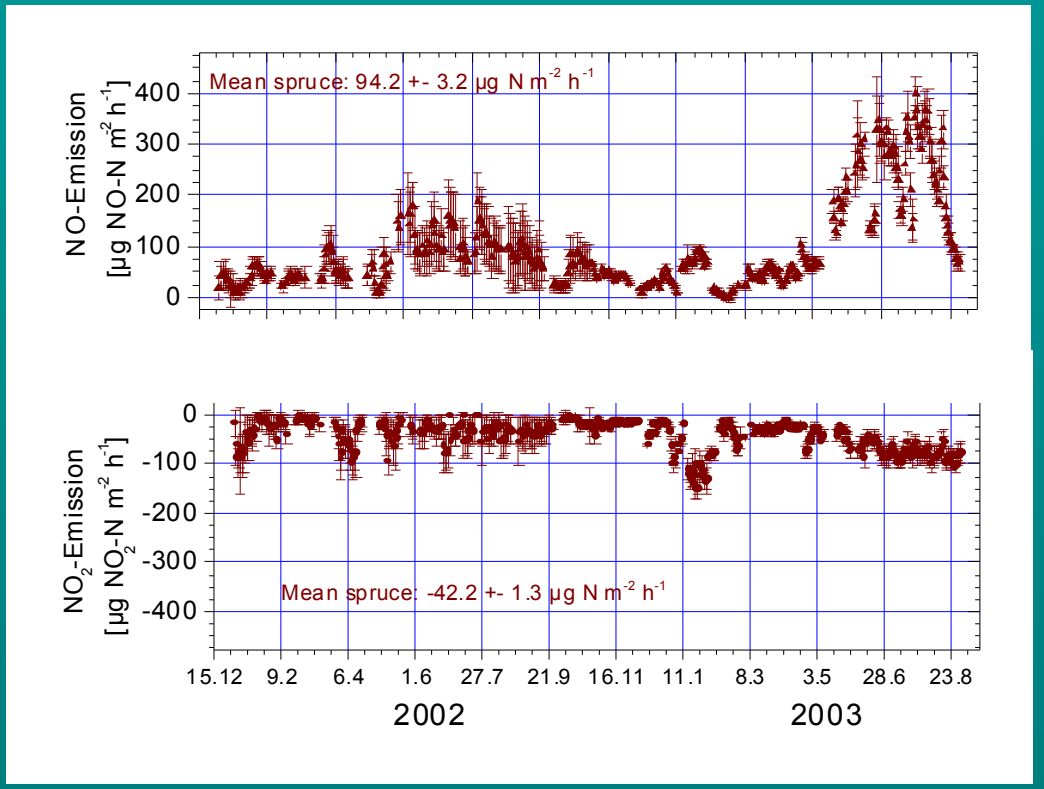
		Auchencorth Moss		Melpitz [b]		Speulder Forest [b]	
		kg N ha^{-1} a^{-1}	% of N_t [a]	kg N ha^{-1} a^{-1}	% of N_t [a]	kg N ha^{-1} a^{-1}	% of N_t [a]
NH_3		**2.5**	30%	**7.2**	41%	**17.9**	37%
NH_4^+	Dry	0.3		0.7		4.7	
	Wet	2.4		4.7		11.3	
NH_x [c]		**5.2**	64%	**12.6**	72%	**33.9**	71%
NO_3^-	Dry [d]	0.4		1.0		5.1	
	Wet [e]	1.9		3.3		5.2	
HNO_2		0.1		0.3		1.0	
NO_x [f]		0.6		0.2		2.8	
NO_y [g]		**3.0**	36%	**4.8**	28%	**14.1**	29%
Dry		**3.9**	48%	**9.4**	54%	**31.6**	66%
Wet		**4.3**	52%	**8.0**	46%	**16.4**	34%
N_t [a]		**8.2**		**17.4**		**48.0**	

[a]: total atmospheric N input (= NH_x + NO_y); [b]: Source Erisman *et al.* (1996); [c]: total reduced N (= NH_3 + NH_4^+); [d]: gaseous HNO_3 + particulate NO_3^-; [e]: in rain only; [f]: NO_2 + NO; [g]: total oxidized nitrogen.

From C. Flechard, PhD thesis

Nofretete

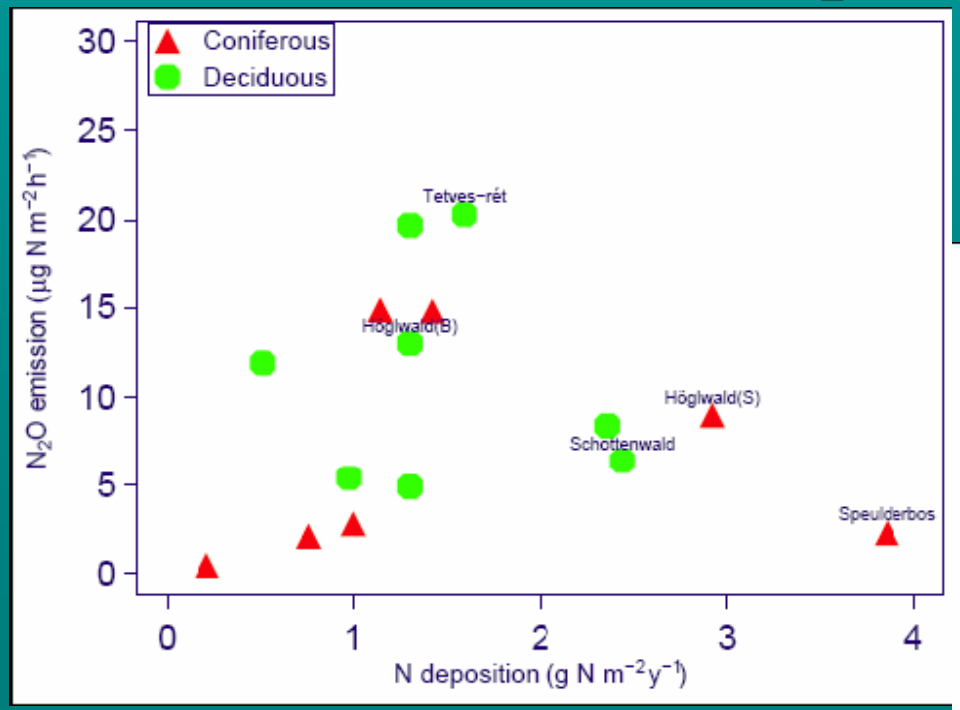
Nitrogen Oxides Emissions from European Forest Ecosystems

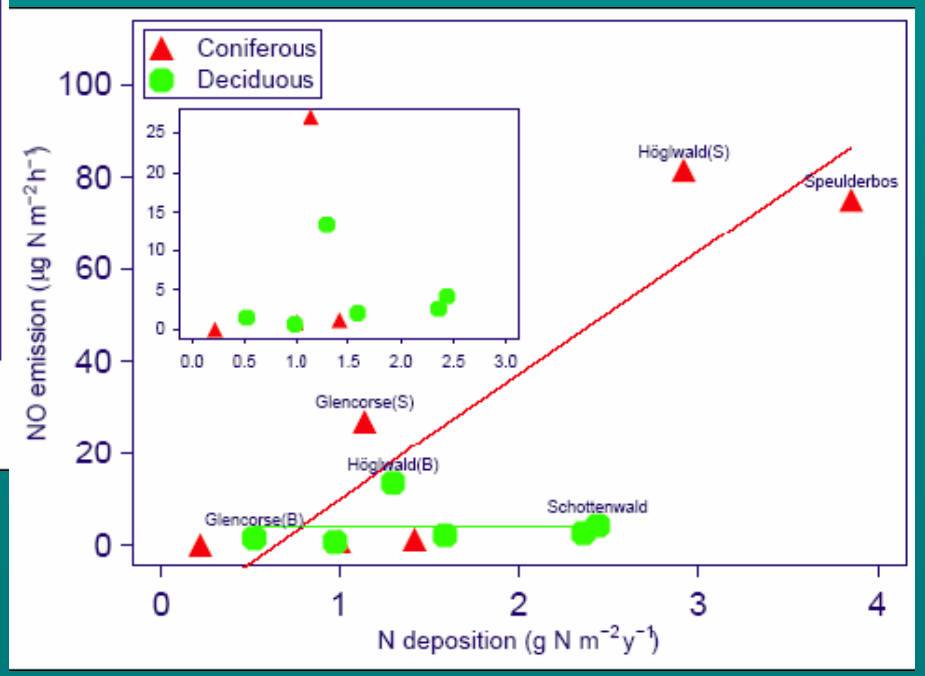


Höglwald

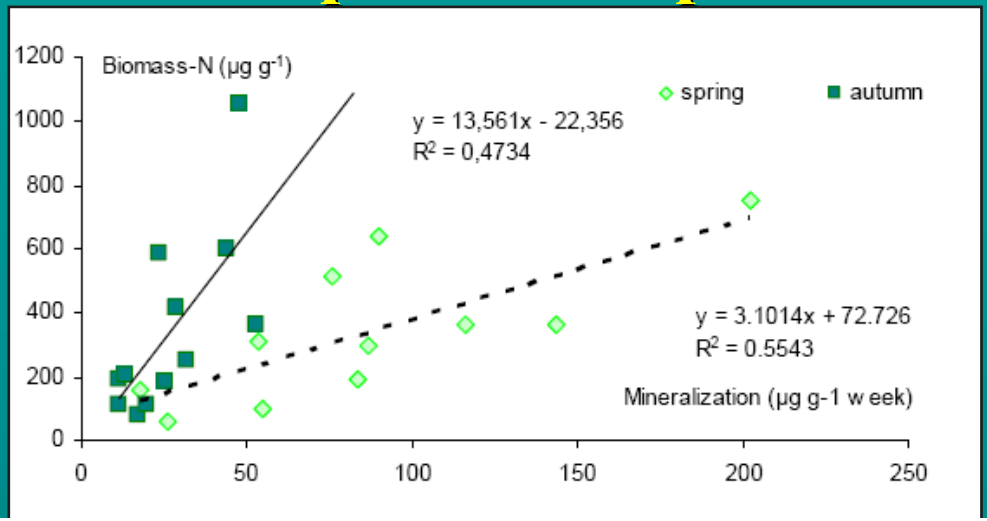
NOFRETETE

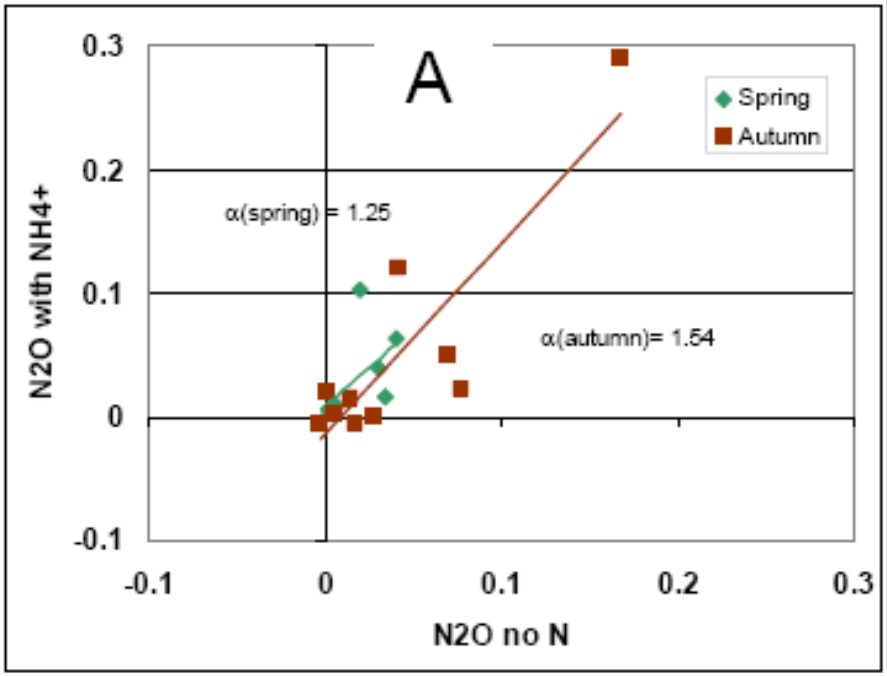
The relationship between N deposition and NO & N_2O emissions

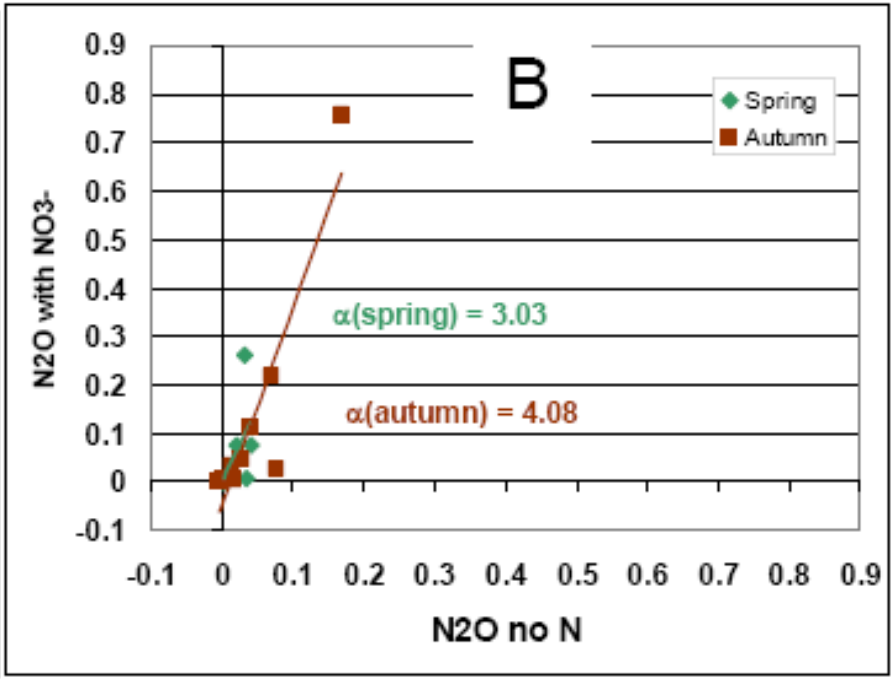




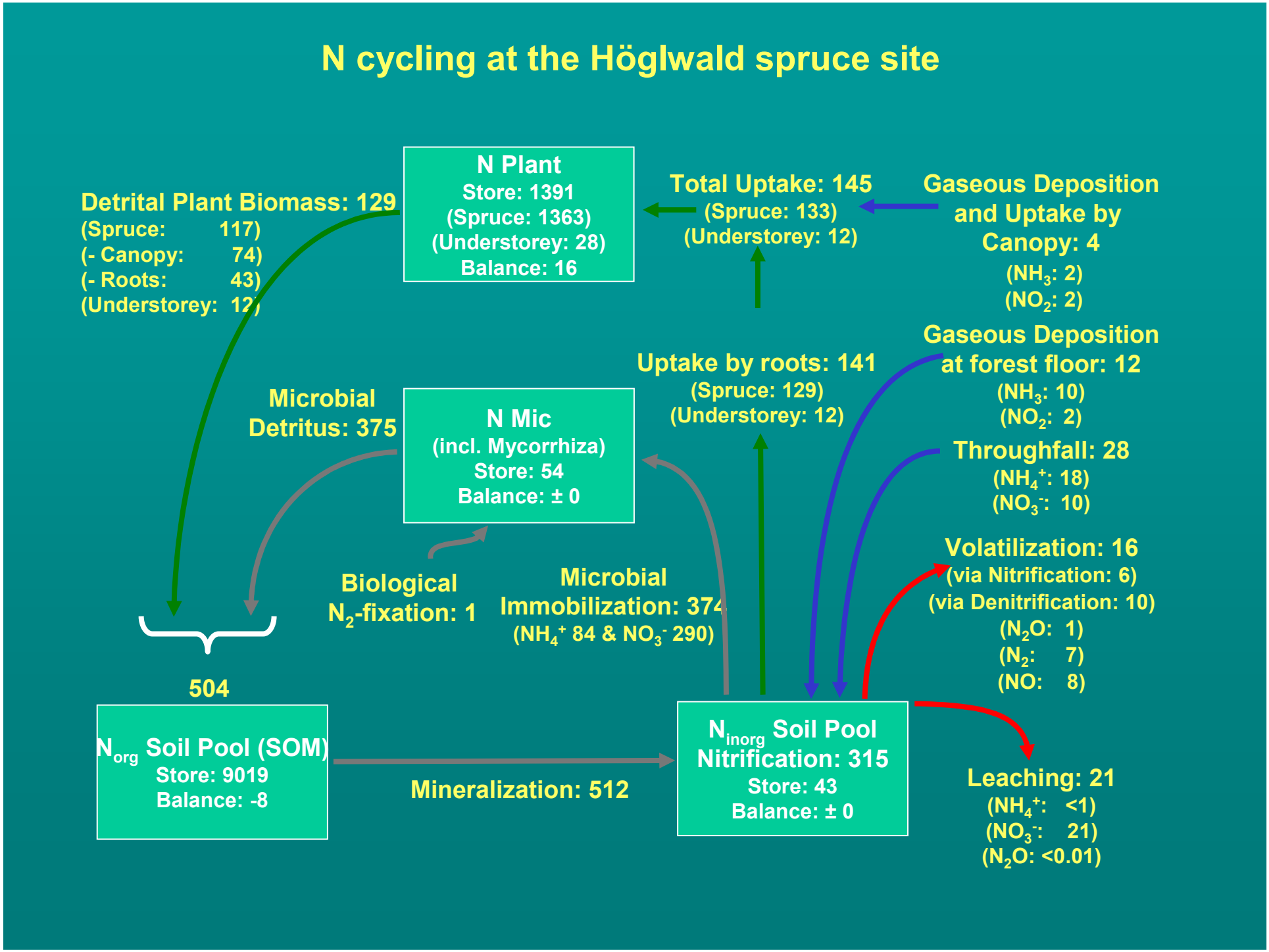
NOFRETETE
Soil manipulation experiments



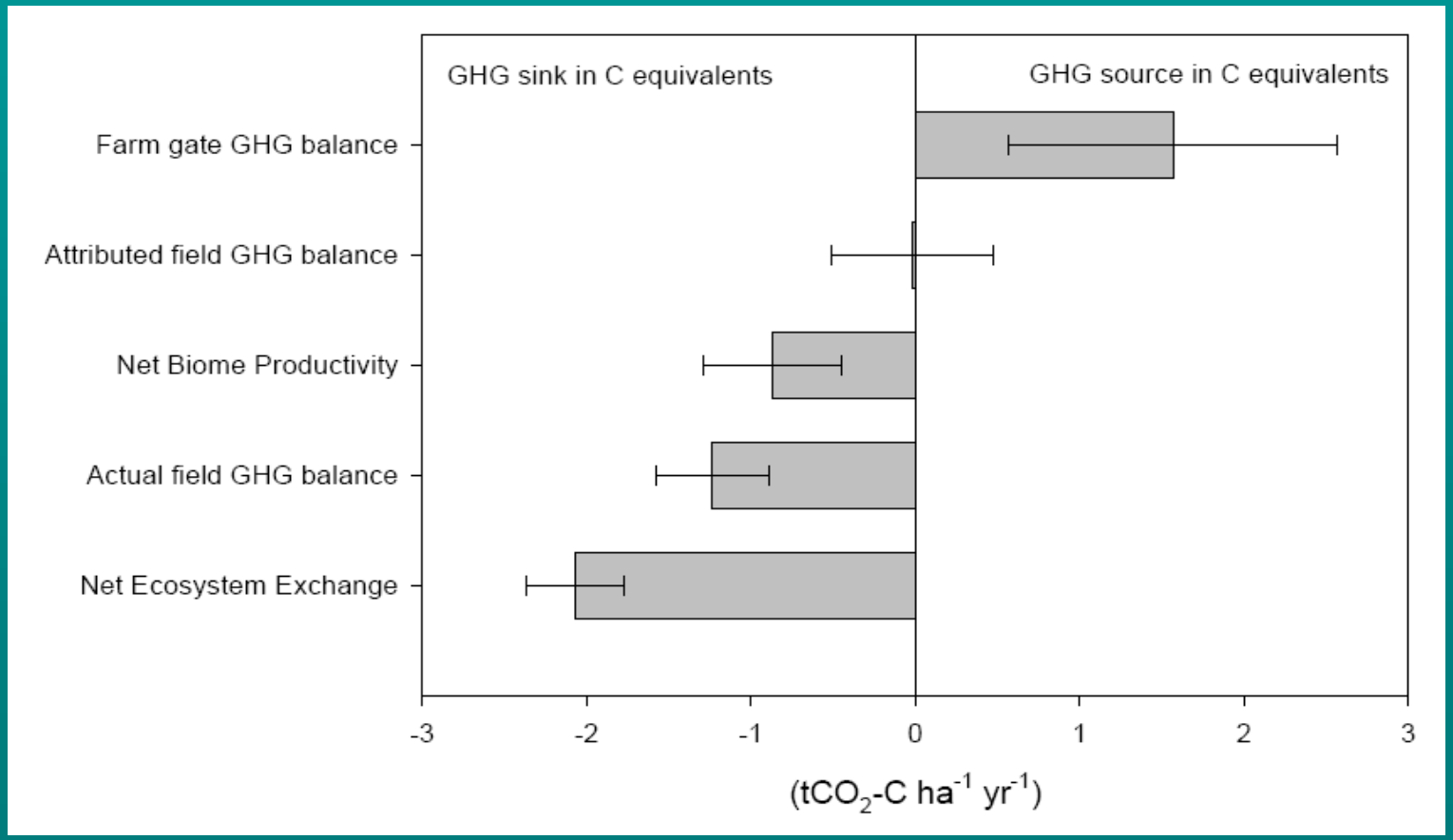




N cycling at the Höglwald spruce site

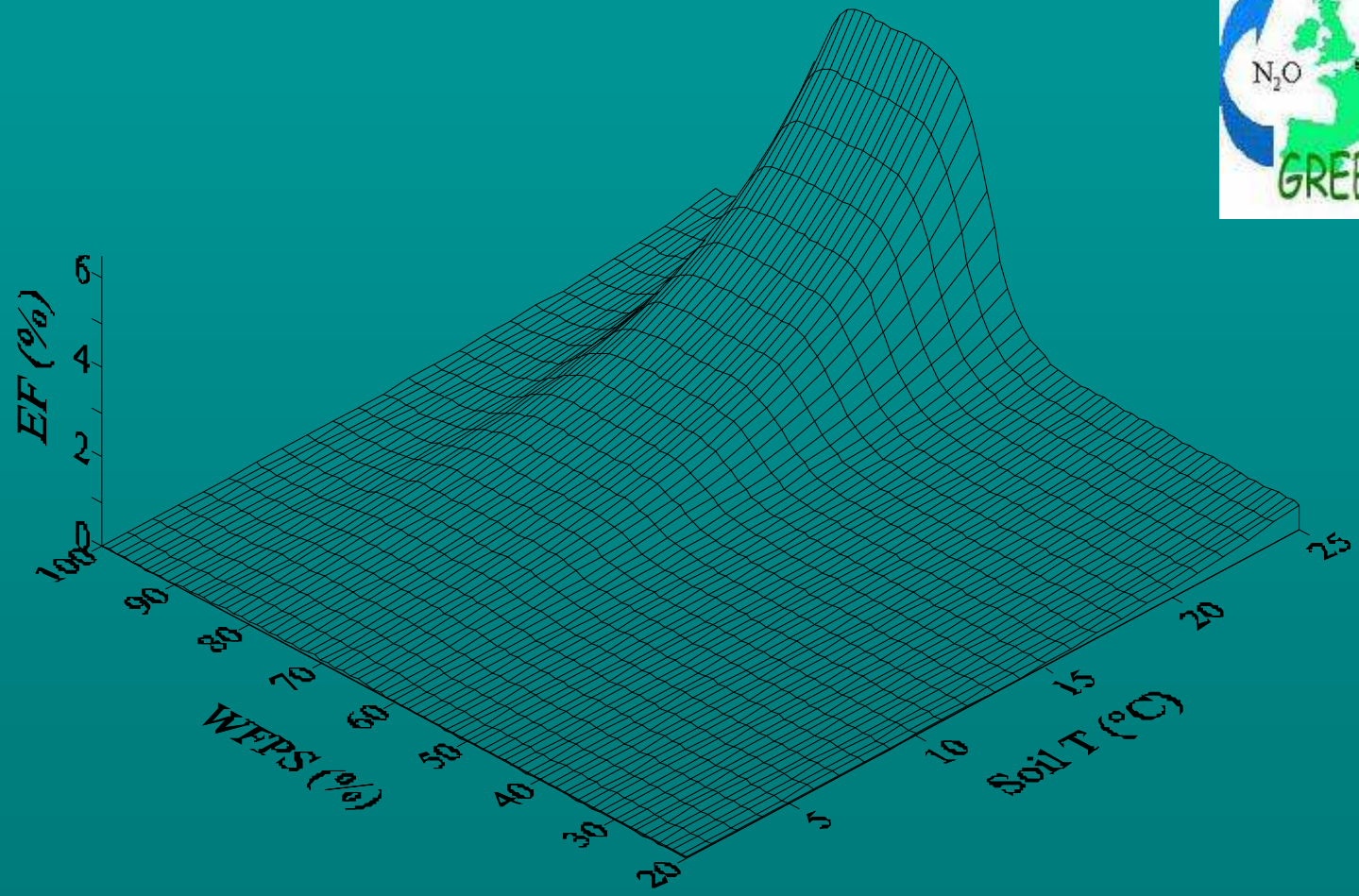


Average GHG exchange of 9 European grasslands



The message regarding net GHG of grassland depends on scale

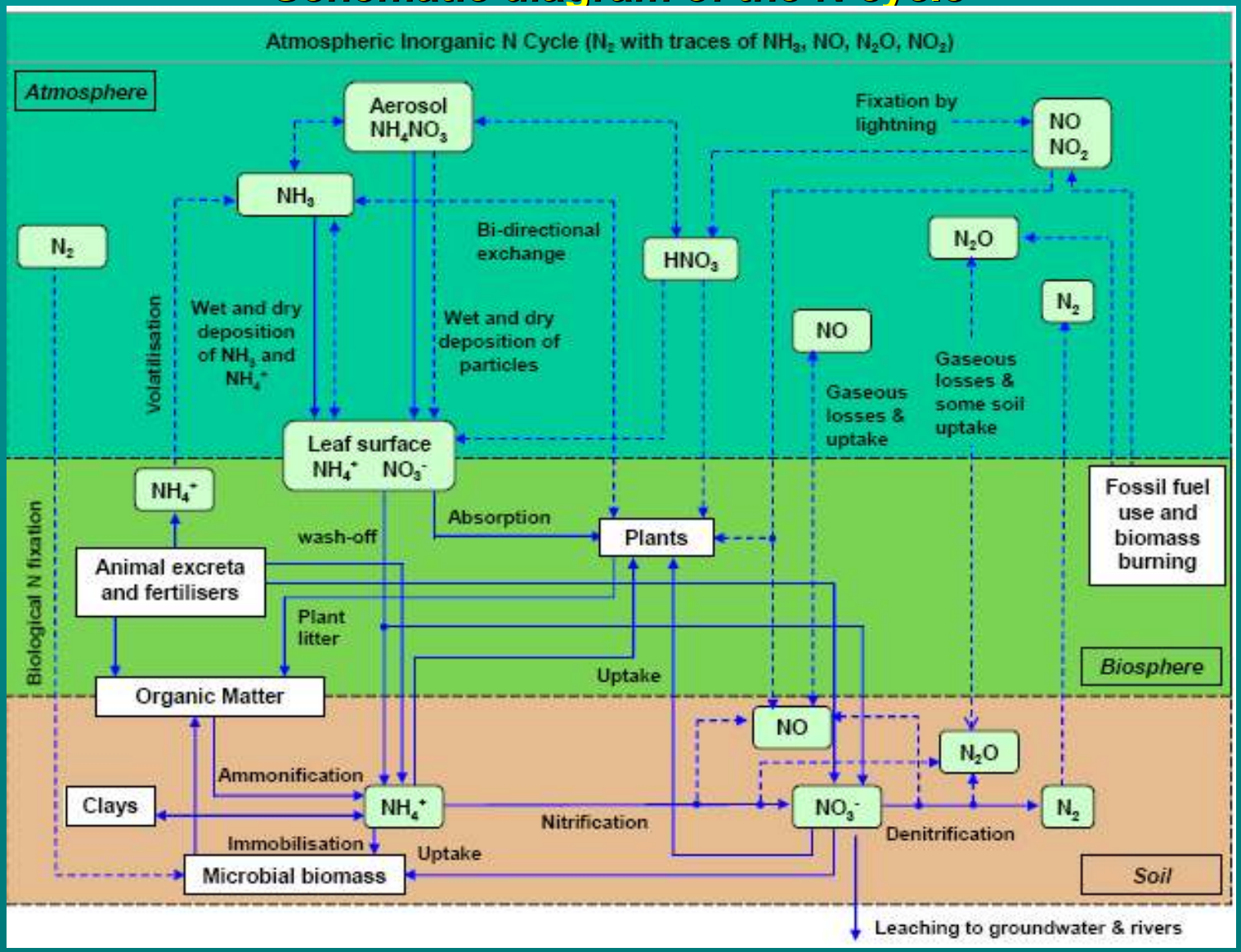
The control of N_2O fluxes from Europe's grasslands



Flechard et al, AEEG, submitted

Nitroeurope C1

Schematic diagram of the N cycle



NitroEurope IP

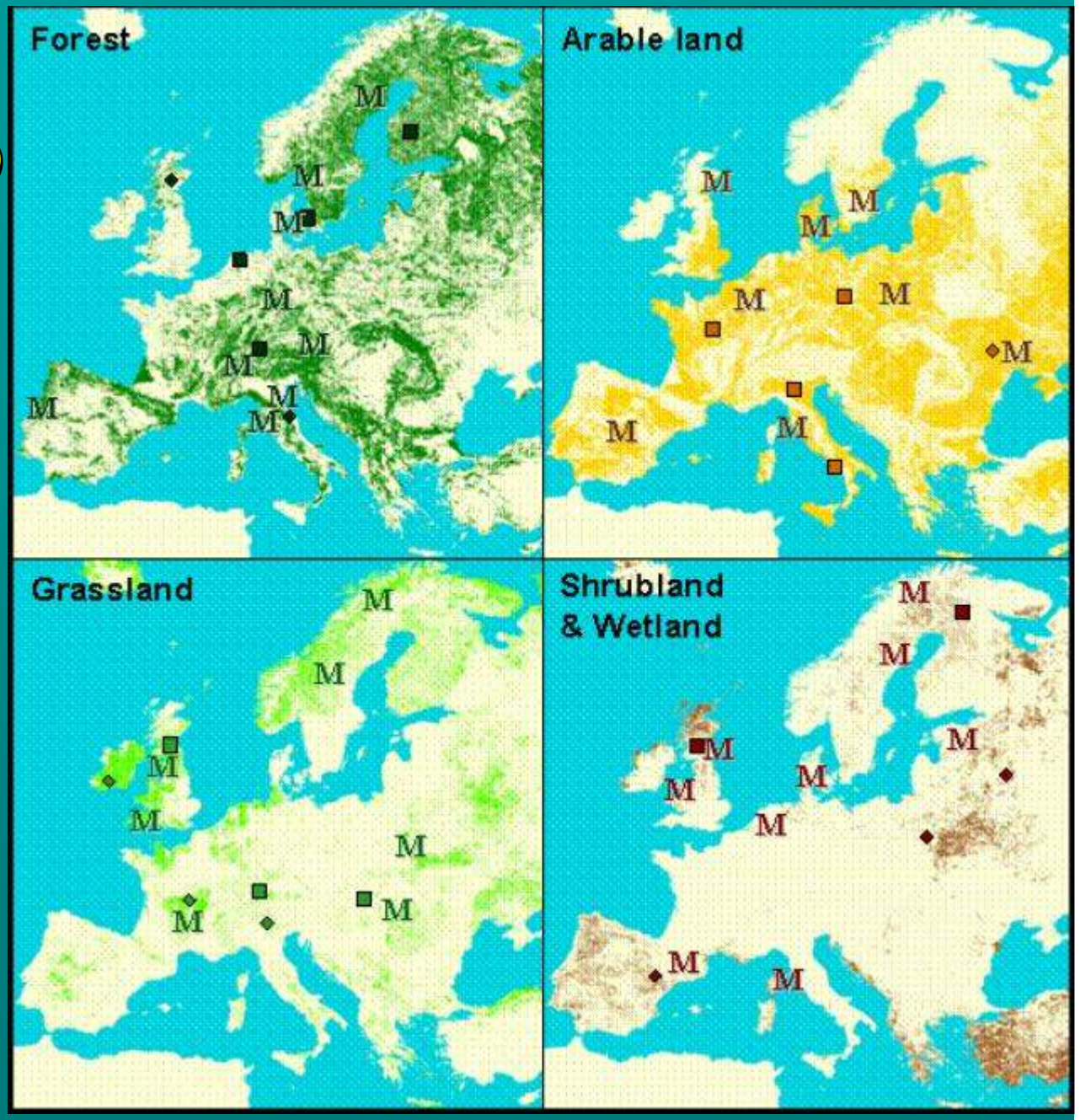
Component 1
Flux network

- Level 3 (“13 Super Sites”): N and GHG fluxes: Core Measurements + Special Topics. Includes high cost micromet methods and process analysis.
- Level 2 (“ 9 Regional Sites”): Basic N and GHG flux monitoring, e.g. COTAG, simple cuvettes
- Level 1 (“50 Inferential Sites”): Basic N air concentration measurements at 50 CO_2 flux sites. e.g. DELTA low cost denuders.

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

13 Level 3 Super Sites
9 Level 2 Regional Sites
50 Level 1 Inferential Sites

22 Core Manipulation Sites
14 Assoc. Manipulation Sites



Forest network

1	Hyytiälä	FI (UHEL)
2	Soro	DK (RISOE)
3	Speulder Bos	NL (ECN)
4	Högelwald	DE (IMK-IFU)
5	Griffin	UK (UEDIN)
6	Roccarespampani	IT (UNITUS)

Hyytiälä

Soro

Grassland network

7	Easter Bush	UK (NERC)	Lolium perenne
8	Oensingen	CH (FAL-CH)	Grass & clover
9	Carlow	IE (TCD)	Lolium perenne, Trifolium repens
10	Bugac	HU (FRI)	Festuca spp.
11	Laqueuille	FR (INRA)	A. capilaris.; Dactylis ; Trisetum
12	Monte Bondone	IT (CEA)	Spp. rich, Nardus stricta

Arable network

13	Gebesee	DE (MPI-Je)	Wheat/barley/ Potato/rapeseed
14	Grignon	FR (INRA)	Mustard/maize/ wheat/barley
15	Po Valley, Pavia	IT (JRC)	Maize/rice
16	Piana del Sele	IT (ISAFoM)	Maize/alfalfa/ winter veg./Lolium
17	Petrodolinskoye	UA (ONU)	Grain/indust./veg.

Grignon

Wetland network

18	Lompolojänkkä (Pallas)	FI (FMI)	Sedge Fen
19	Auchencorth Moss	UK (NERC)	Calluna/grass, Eriophorum vag. Sphagnum spp.
20	El Saler	ES (CEAM)	High maquia
21	Rzecin	PL (AUP)	Carex spp., Phragmites spp., Sphagnum spp.
22	Fyodorovskoe bog	RU (IPEE-RAS)	Sphagnum spp., Eriophorum, Vaccinnium vag.


Lompolojänkkä (Pallas)


Auchencorth Moss


Fyodorovskoe bog

Acitvity 1.3 Detailed N budgets and pools for level 3 sites

- Eddy covariance CO_2
- Soil N_2O & CH_4 by autochambers
- NOx/O_3 by autochamber/micromet.
- Meteorology & soil climate

} **Continuous**

- Air conc. of NH_3, HNO_3, NH_4, NO_3
- Bulk wet NH_4 & NO_3 dep., DON? ,throughfall & stemflow

} **Monthly/ weekly**

- Soil description **Once**
- extractable mineral N **Weekly/ monthly?**
- Estimate of N leaching, denitrification
- Plant biomass, LAI, Foliar N… (**Carboeurope protocol**)
- Detailed description of site management

Acitvity 1.3 Detailed N budgets and pools for level 3 & 2 sites

Appendix B:

Protocols of Mandatory Measurements

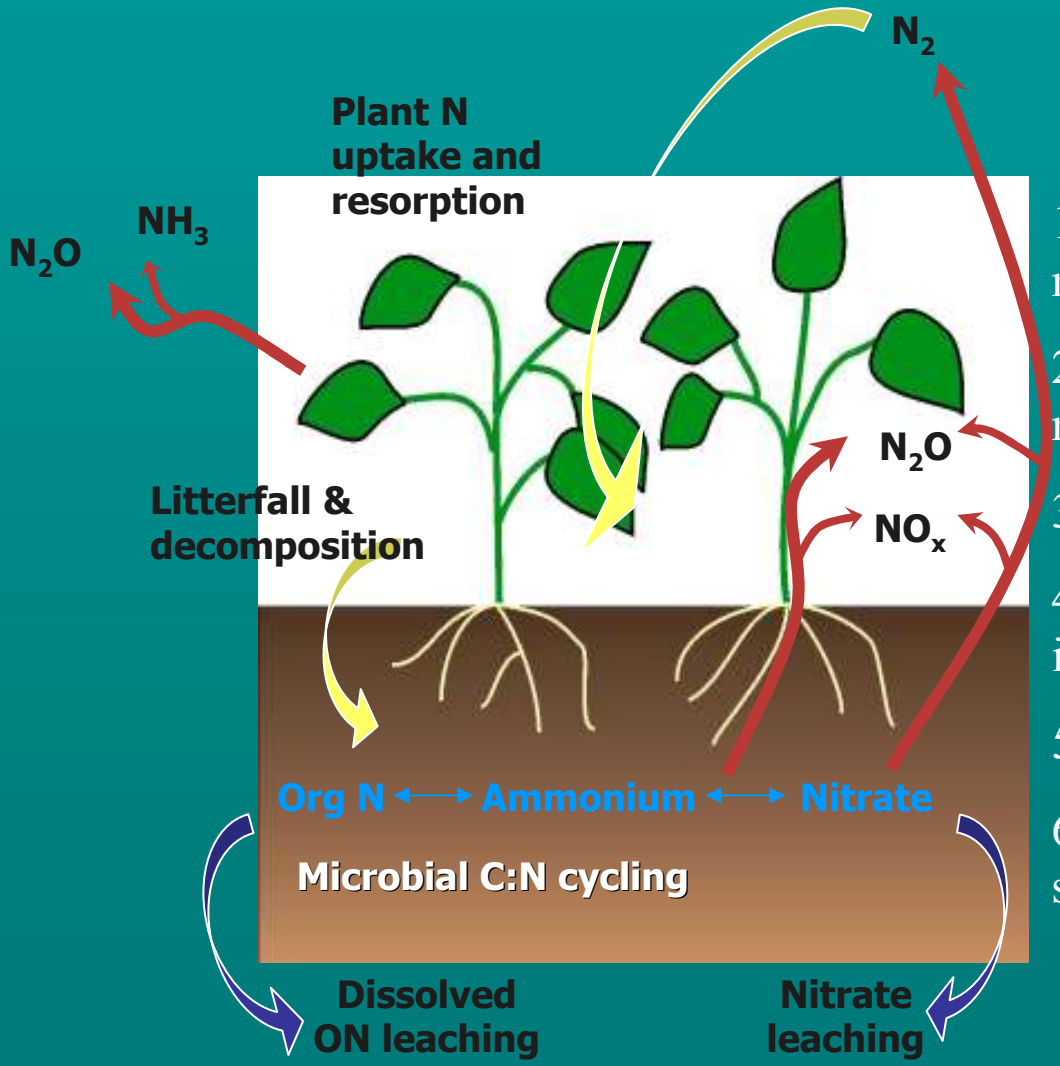
Tuesday 14th March Parallel Group Session 2:
16:00 – 18:00

Room B : Fluxes, concentrations, meteorology / autochambers

Room C: Soil, vegetation / chambers

CROSSCUTTING ACTIVITY 1.4

PLANT – SOIL – ATMOSPHERE N EXCHANGE PROCESSES



1) Plant N pool: biomass, LA, C/N, Plant mediated NH_3/N_2O transfer

2) Soil N pool: SOC – SON, mineralisation / immobilisation

3) Litter production / decomposition

4) Plant soil N & C dynamics using isotopic tracers

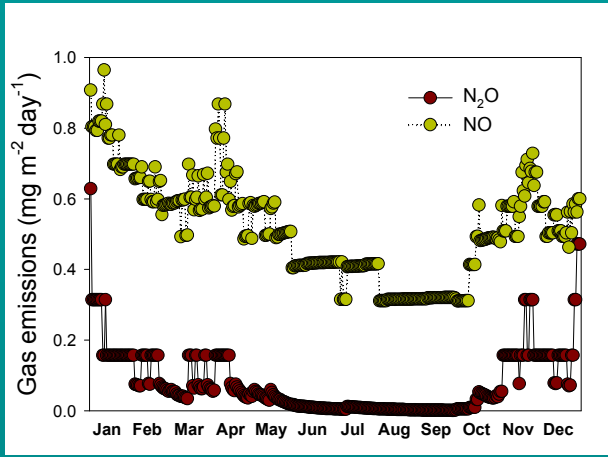
5) Sources of N_2O

6) Soil N fluxes in the Mediterranean sites

TWO MEDITERRANEAN SHRUBLANDS (SUN)

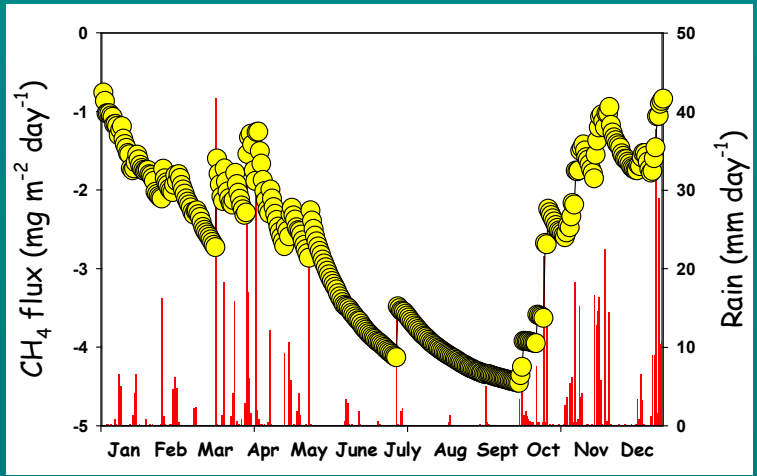
No N flux at Tolfa!

CASTEL VOLTURNO



Measured annual average daily flux

0.5 ± 0.45 mg N_2O m^{-2} day^{-1}

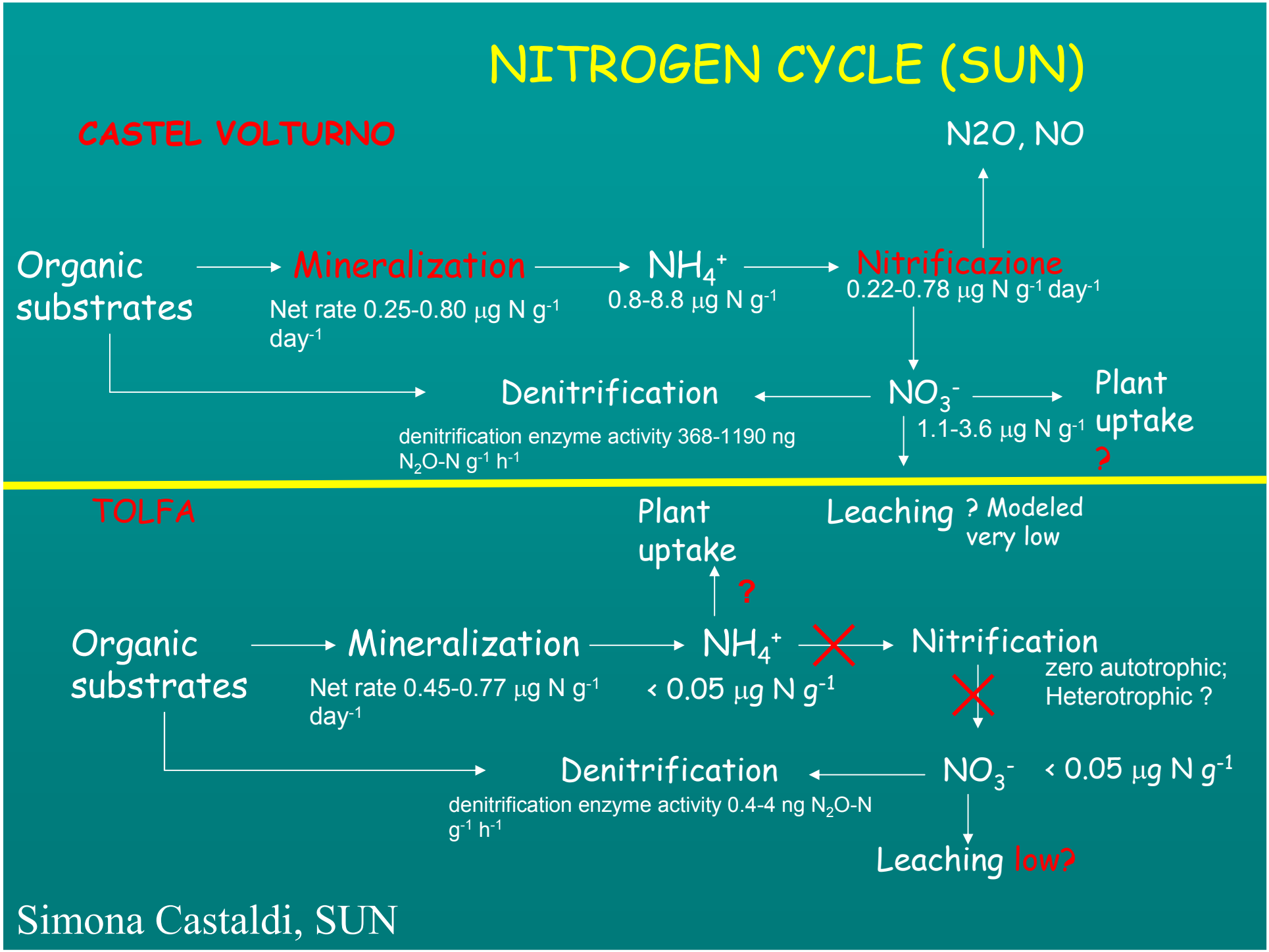


Measured annual average daily flux

-2.20 ± 0.5 mg CH_4 m^{-2} day^{-1}

Simona Castaldi, SUN

NITROGEN CYCLE (SUN)



Simona Castaldi, SUN

Crosscutting measurements

Thursday 16th

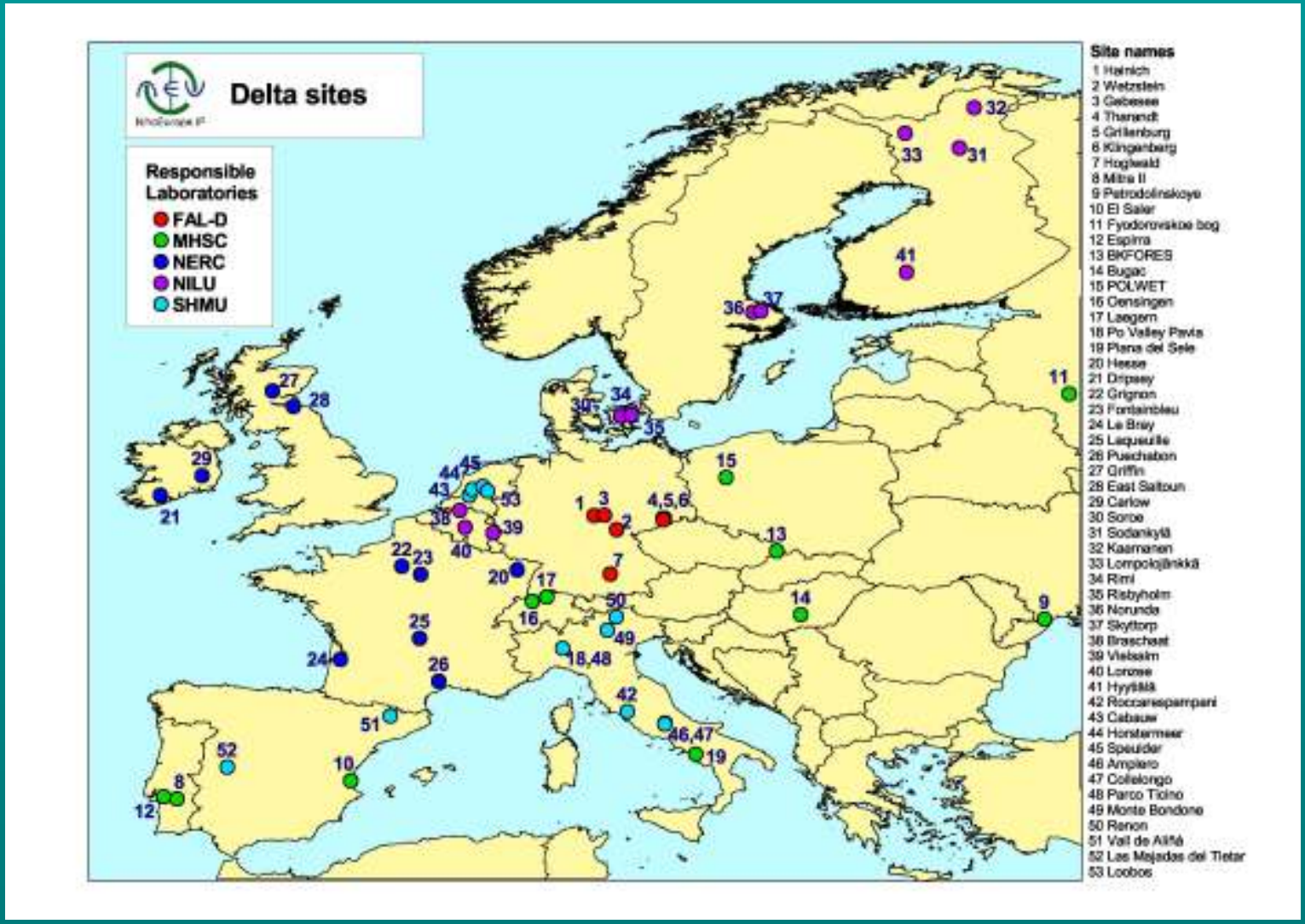
Group session 5

Room A

10:45 – 13:00

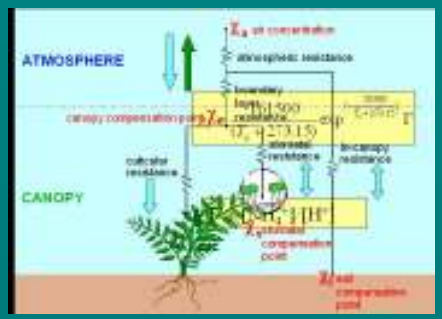
Activity 1.5: Level 1 sites

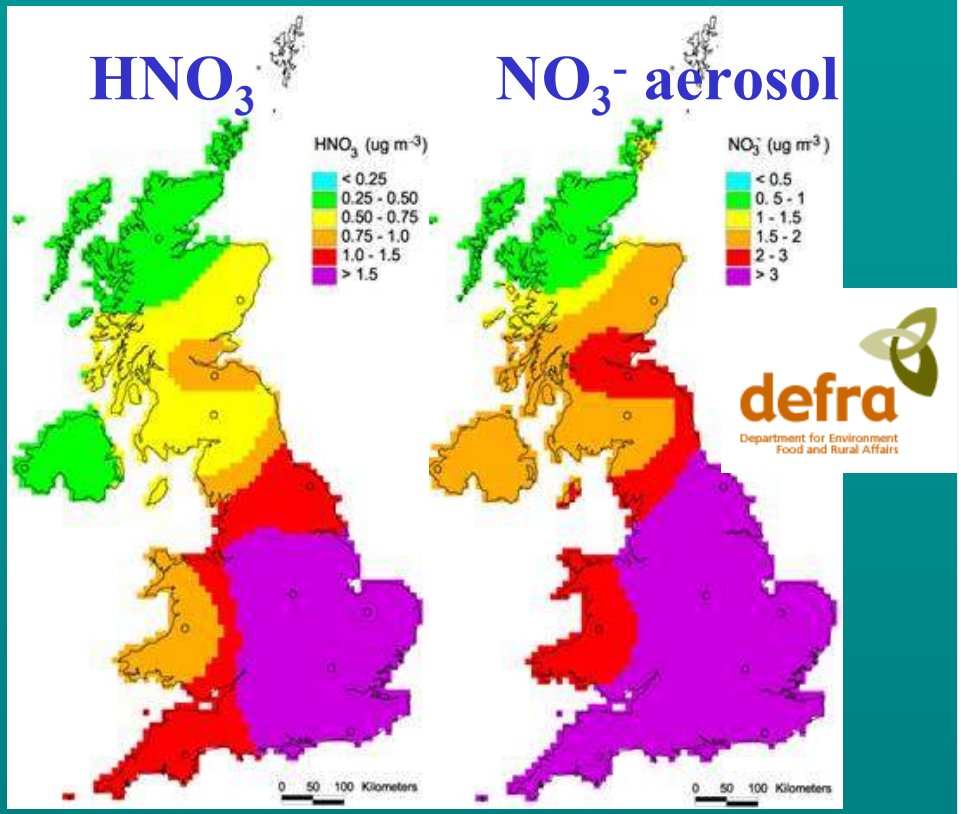
Carboeurope site & additional sites:11, 9, 7



NEU Inferential Network (Level 1)

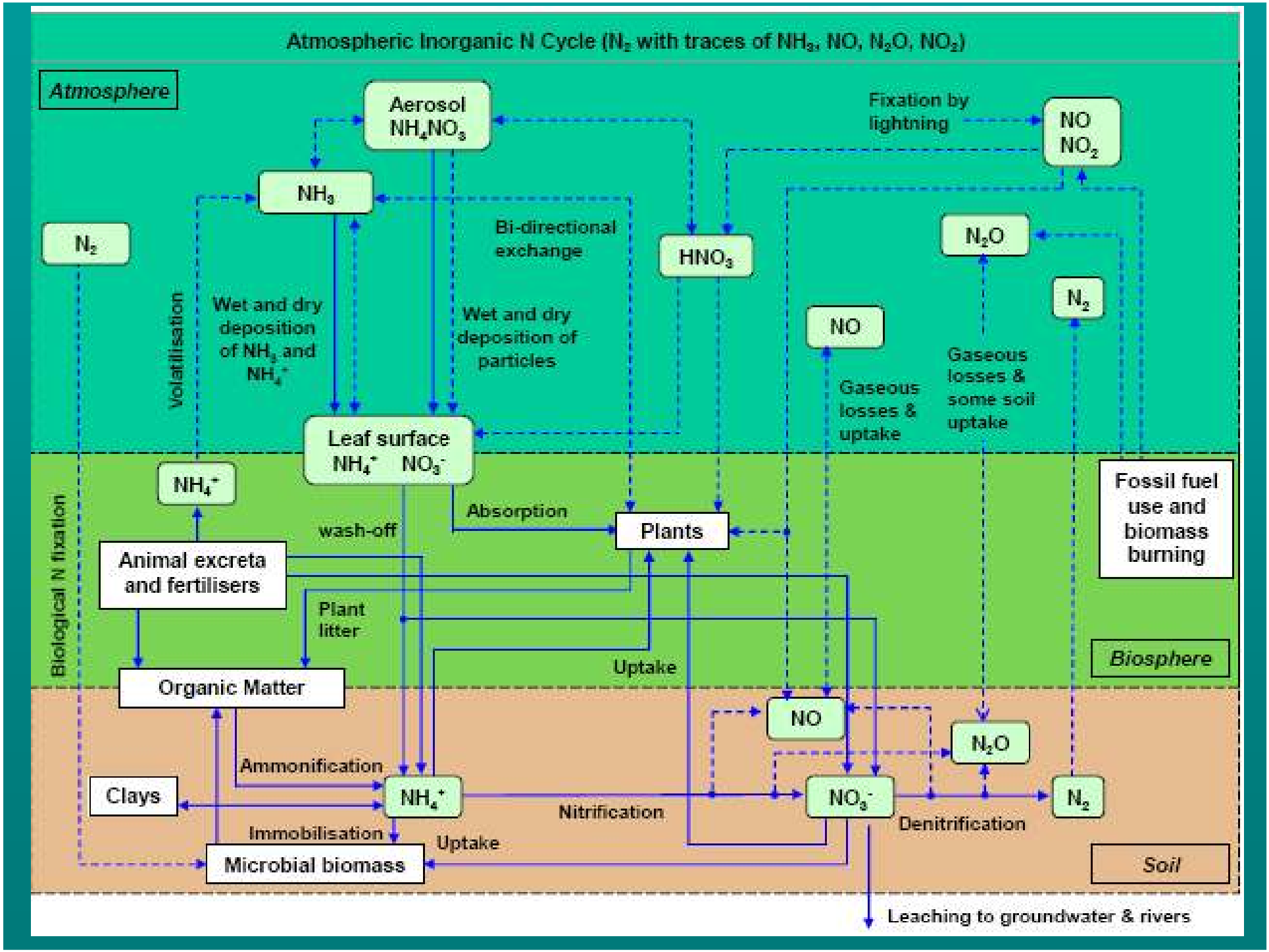
- Add basic N measurements to 50 CarboEurope IP main sites
- Low cost DELTA denuder (NH_3, HNO_3, NH_4^+, NO_3^-, SO_2 / SO_4^{2-}, HCl / Cl^- ,Na^+ / Ca^{2+} / Mg^{2+}), monthly for 4 years
- Wet deposition, where needed
- Soil and plant N bioassays
- Inferential modelling of N inputs to compare with carbon budgets





Results from UK denuder network

Wednesday 15th
Group session 3
Room A
10:00 – 11:30


Atmospheric Inorganic N Cycle (N_2 with traces of NH_3, NO, N_2O, NO_2)
Atmosphere
Aerosol NH_4NO_3
Fixation by lightning
NO NO_2
NH_3
N_2
Bi-directional exchange
HNO_3
N_2O
N_2
Volatilisation
Wet and dry deposition of NH_3 and NH_4^+
Wet and dry deposition of particles
NO
Gaseous losses & uptake
Gaseous losses & some soil uptake
Leaf surface NH_4^+ NO_3^-
NH_4^+
Absorption
Plants
wash-off
Fossil fuel use and biomass burning
Biological N fixation
Animal excreta and fertilisers
Plant litter
Biosphere
Uptake
Organic Matter
NO
N_2O
Ammonification
Clays
NH_4^+
Nitrification
NO_3^-
Denitrification
N_2
Immobilisation
Uptake
Microbial biomass
Soil
Leaching to groundwater & rivers