



NitroEurope IP

Nitrogen and the European GHG balance

Summary for the CarboEurope IP Conference
Jena, October 2008

Mark Sutton, CEH Edinburgh.

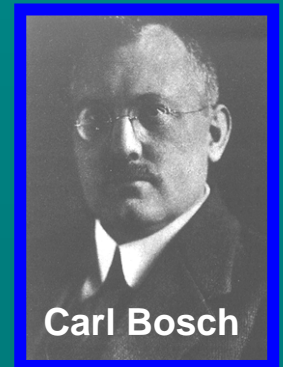
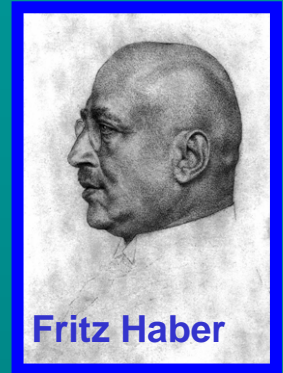
Haber Process Centenary

October 2008

- Limited natural supply of Nr from mined nitrate and guano
- Nr for agriculture and military security
- Haber-Bosch: 200 atmos; 450-500 °C



- Patented 15 Oct 1908 by Fritz Haber
- Commercialized by Carl Bosch
- Basis of the 20thC ‘green revolution’



Nitrogen Spheres of Influence



GHG Balance

N site budgets

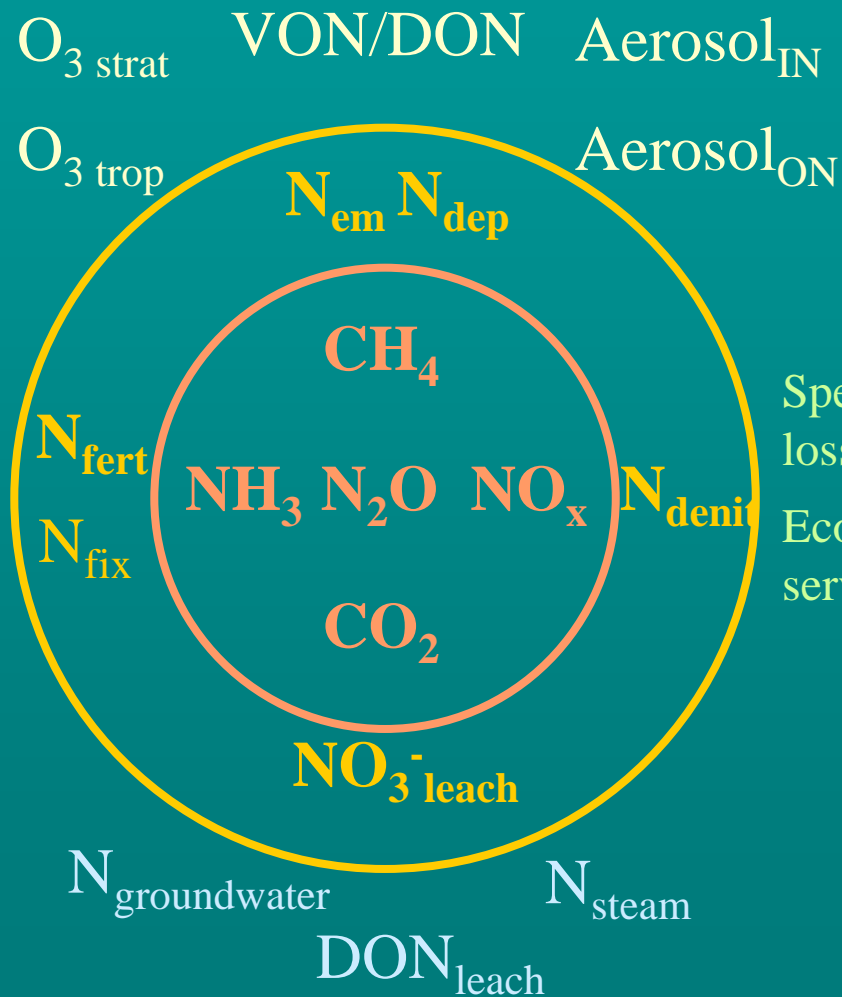
N & atmos chemistry

N & biodiversity

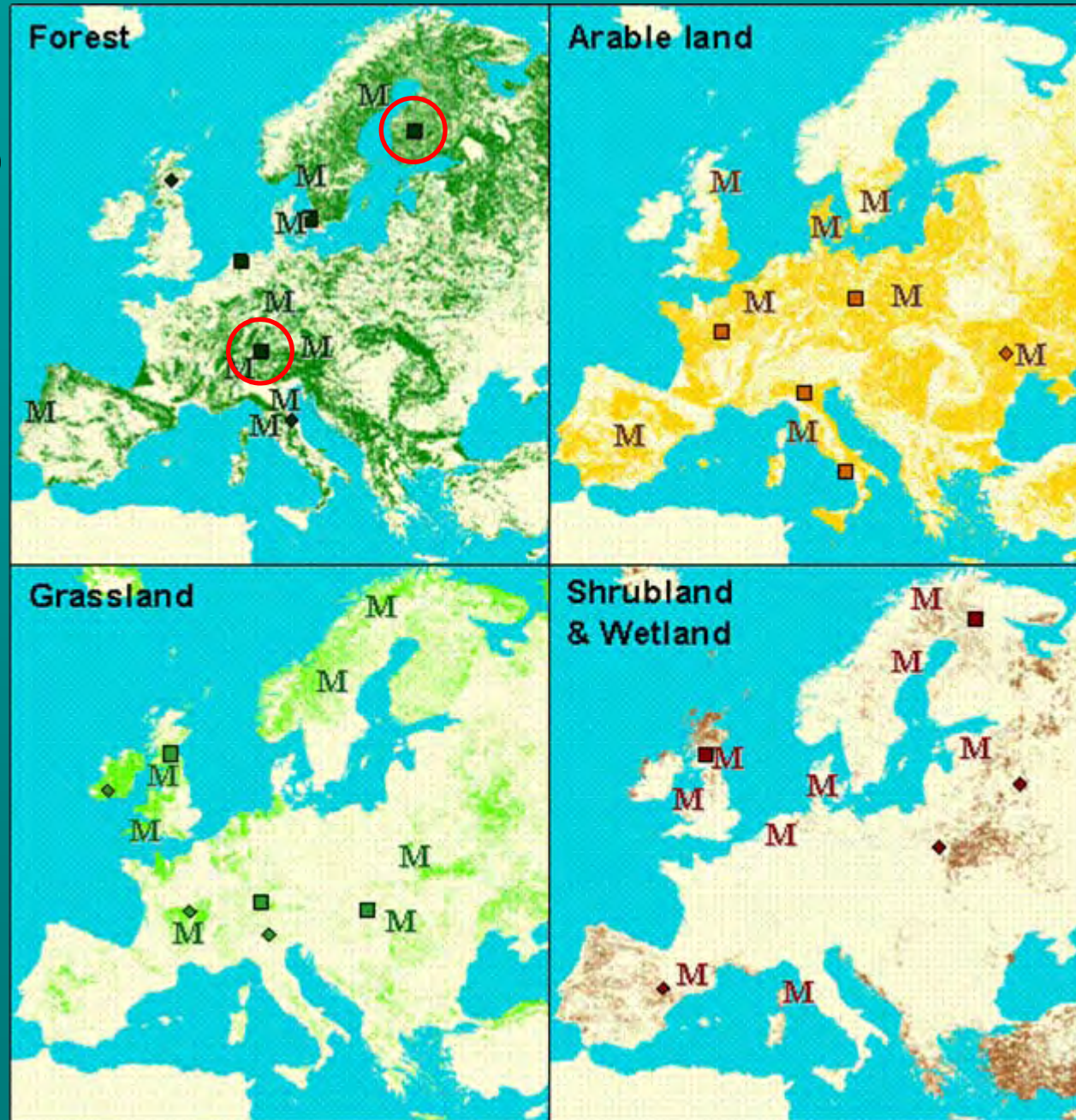
N & water quality

Habitat sensitivity
Ecosystem functioning

Species loss
Ecosystem services



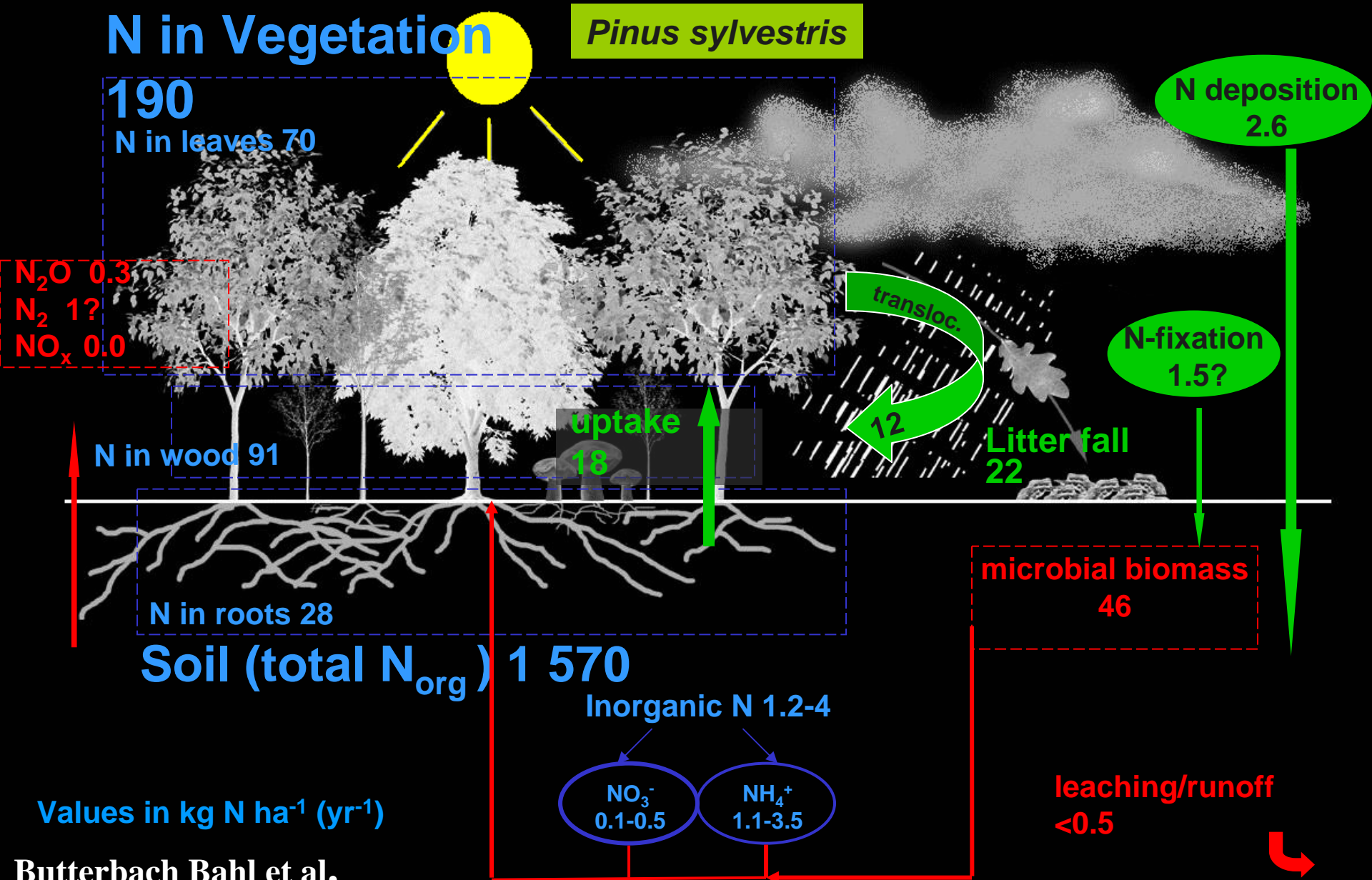
NitroEurope: Flux network (C1) & Manipulation network (C2)



13 Super Sites
9 Regional Sites
50 Inferential Sites

22 Core Manipulation Sites
14 Assoc. Manipulation Sites

Boreal Forest – Hyytiälä, Finland



Butterbach Bahl et al.

Temperate Forest – Högwald, Germany

N in Vegetation

Picea abies

1350

Leaves 240

Bark & branches 414

N_2O ~1
 N_2 10
 NO_x 3-4

N deposition 40

N-fixation 1.5?

N in wood 490

uptake 100

Litter fall 90

N in roots 167

microbial biomass 50-70

Soil (total N_{org}) 9000

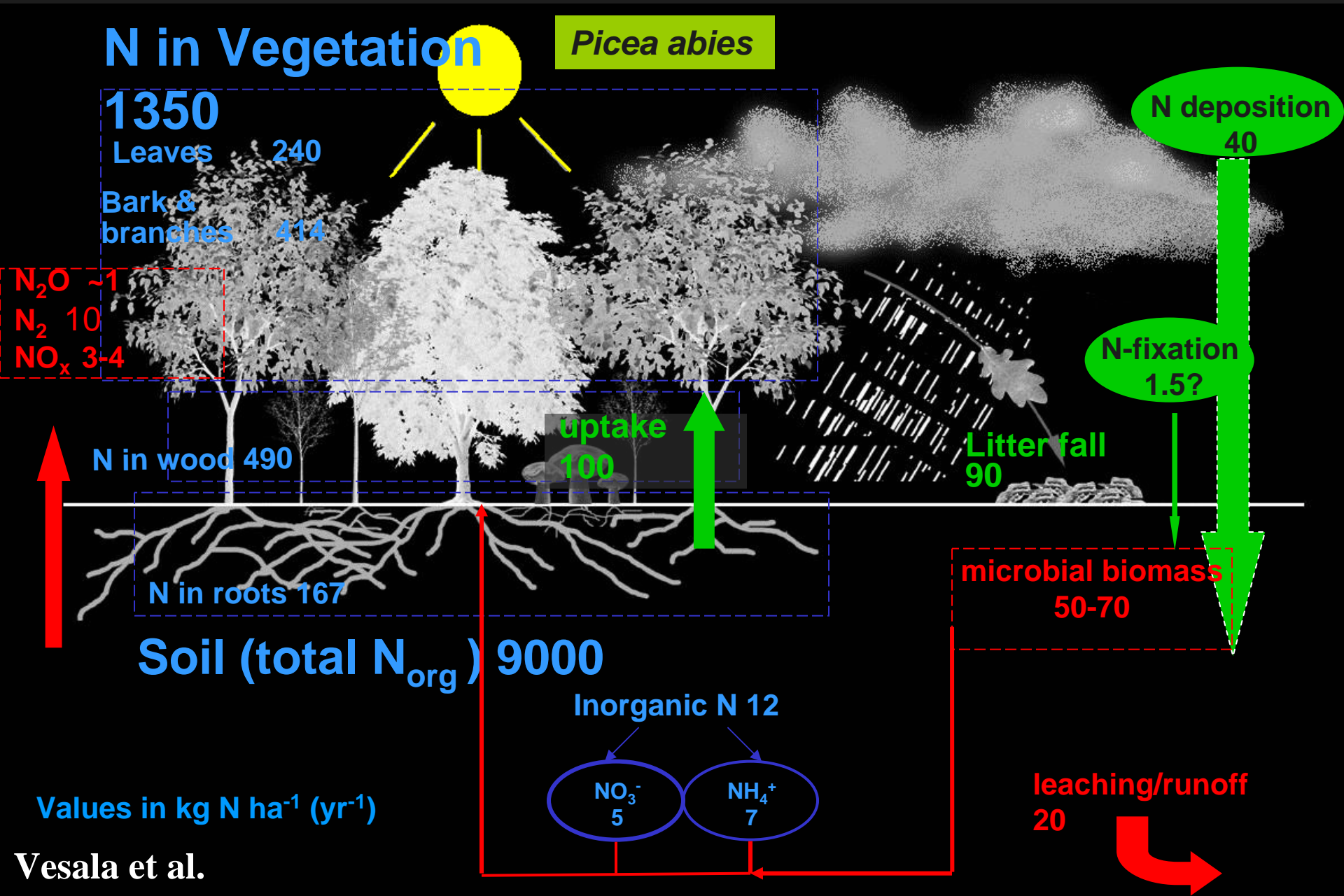
Inorganic N 12

NO_3^-
5

NH_4^+
7

Values in $kg\ N\ ha^{-1}\ (yr^{-1})$

leaching/runoff 20

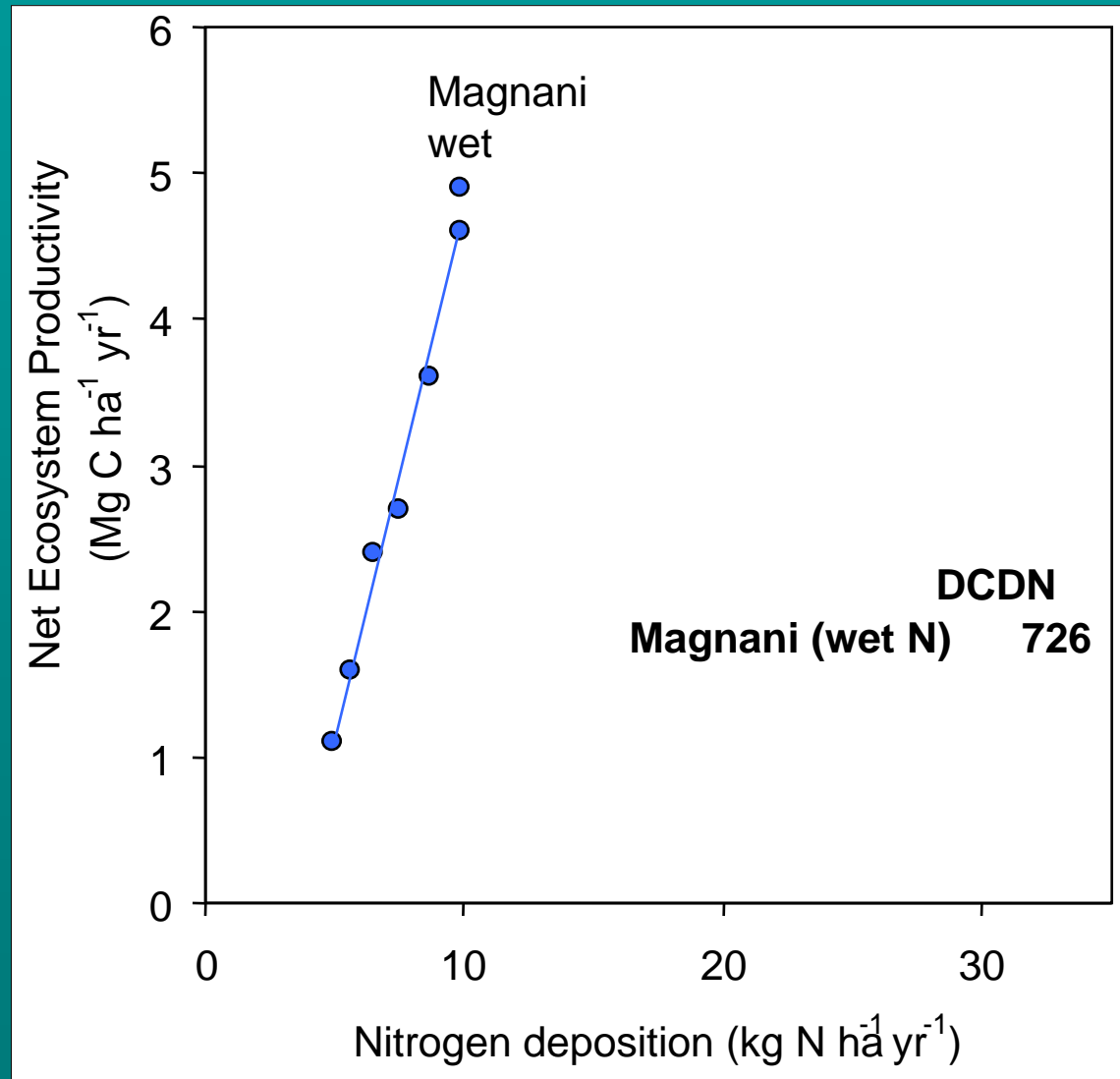


Nitrogen budgets for two contrasting NitroEurope Level 3 forests

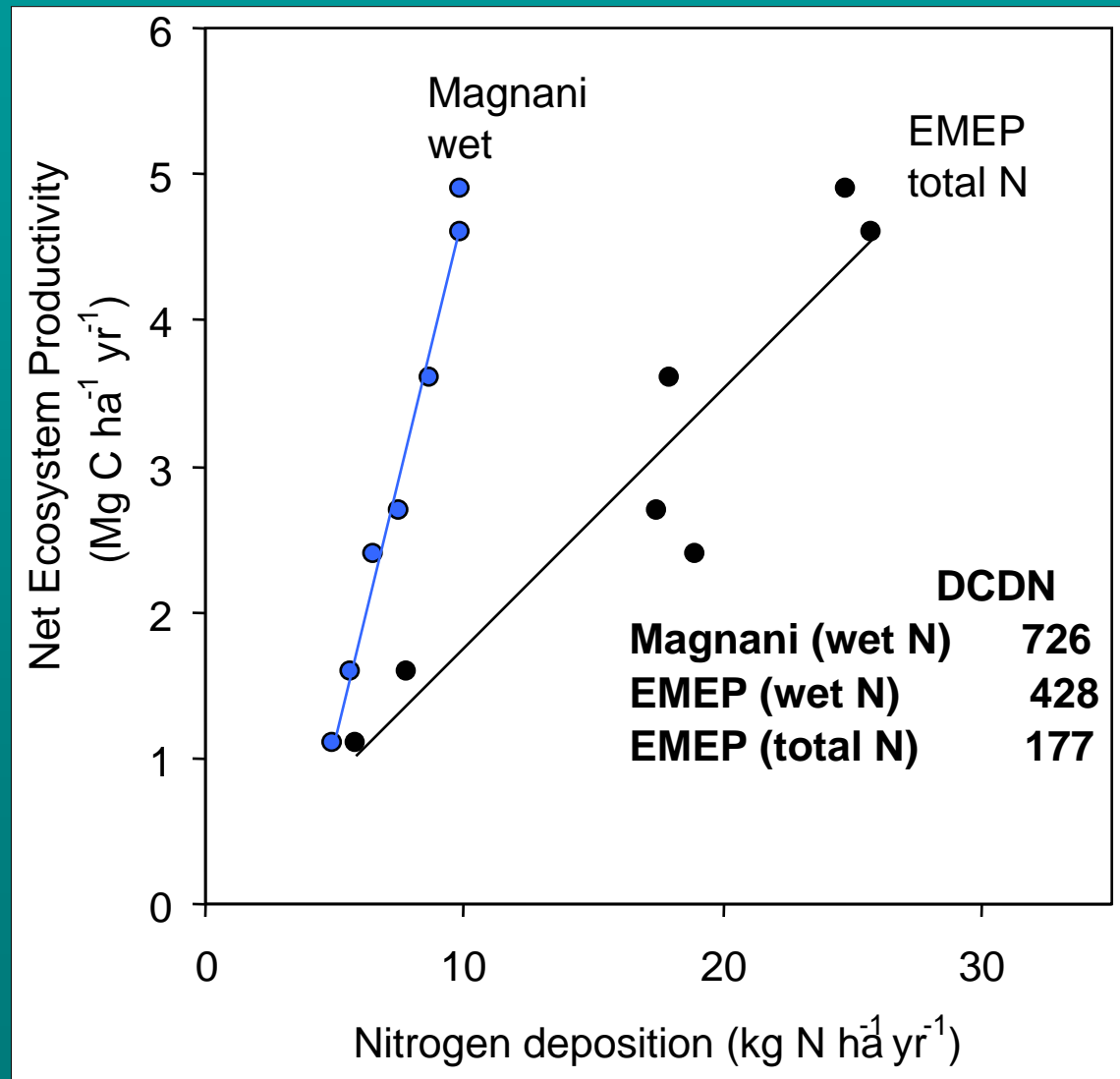


	Finland- Hyytiälä	Germany- Höglwald
N input (kg N / ha /yr)	4.1	41.5
N storage (kg N / ha)		
Vegetation	190	1350
Soil (organic N)	1570	9000
N loss (kg N / ha / yr)	1.8	34
Retained inputs	56%	18%

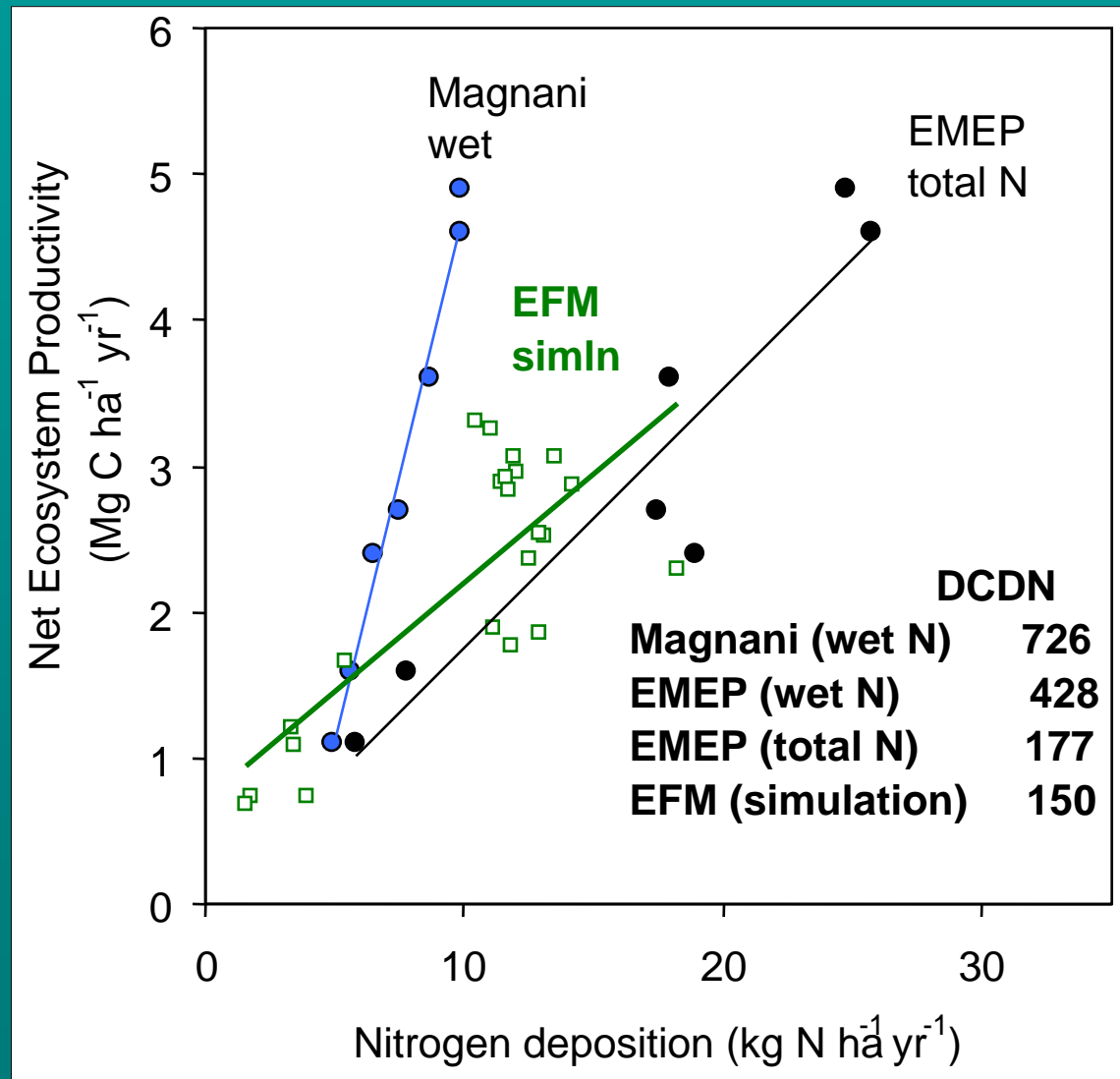
Nitrogen and forest C sequestration



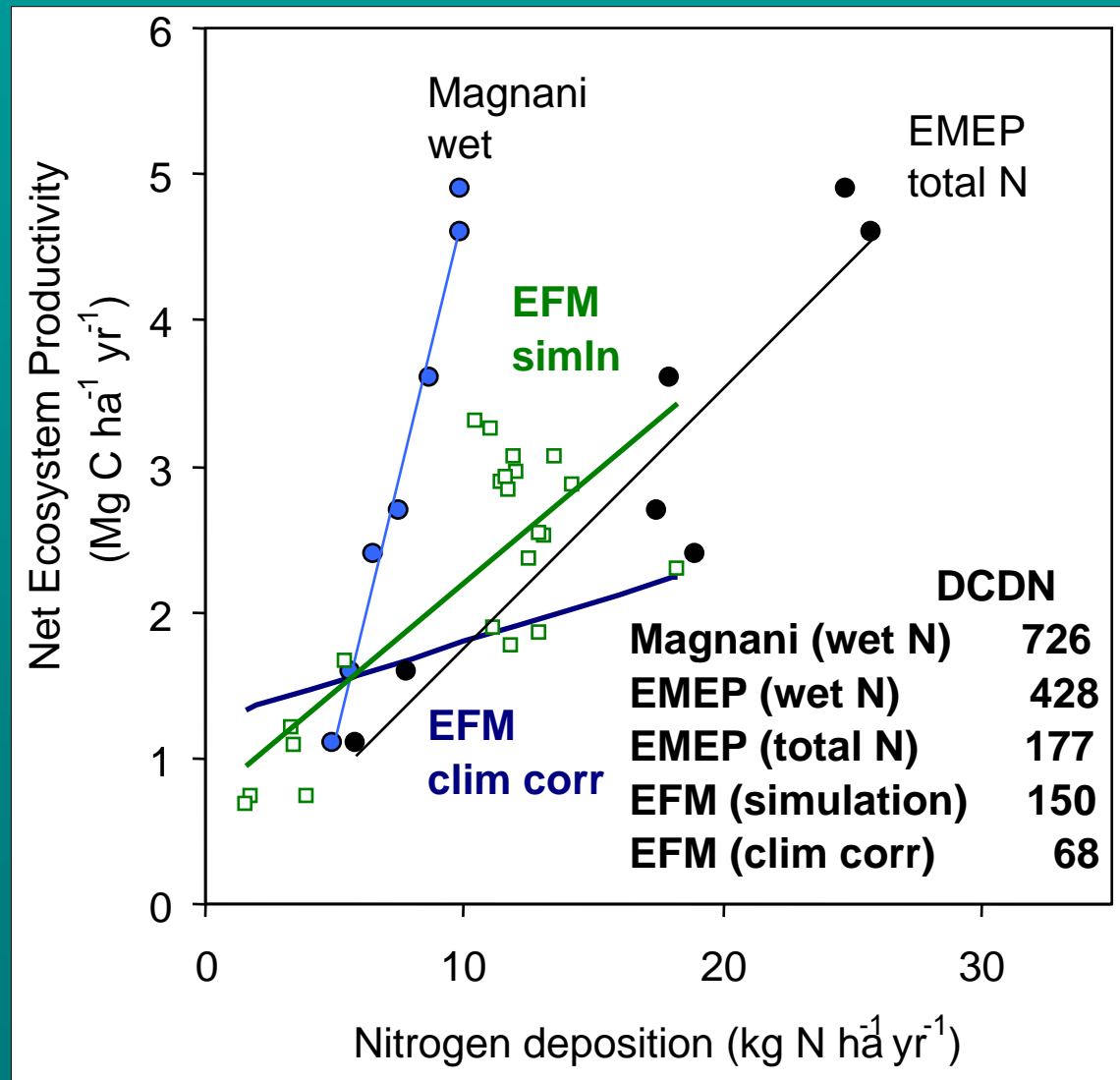
Nitrogen and forest C sequestration



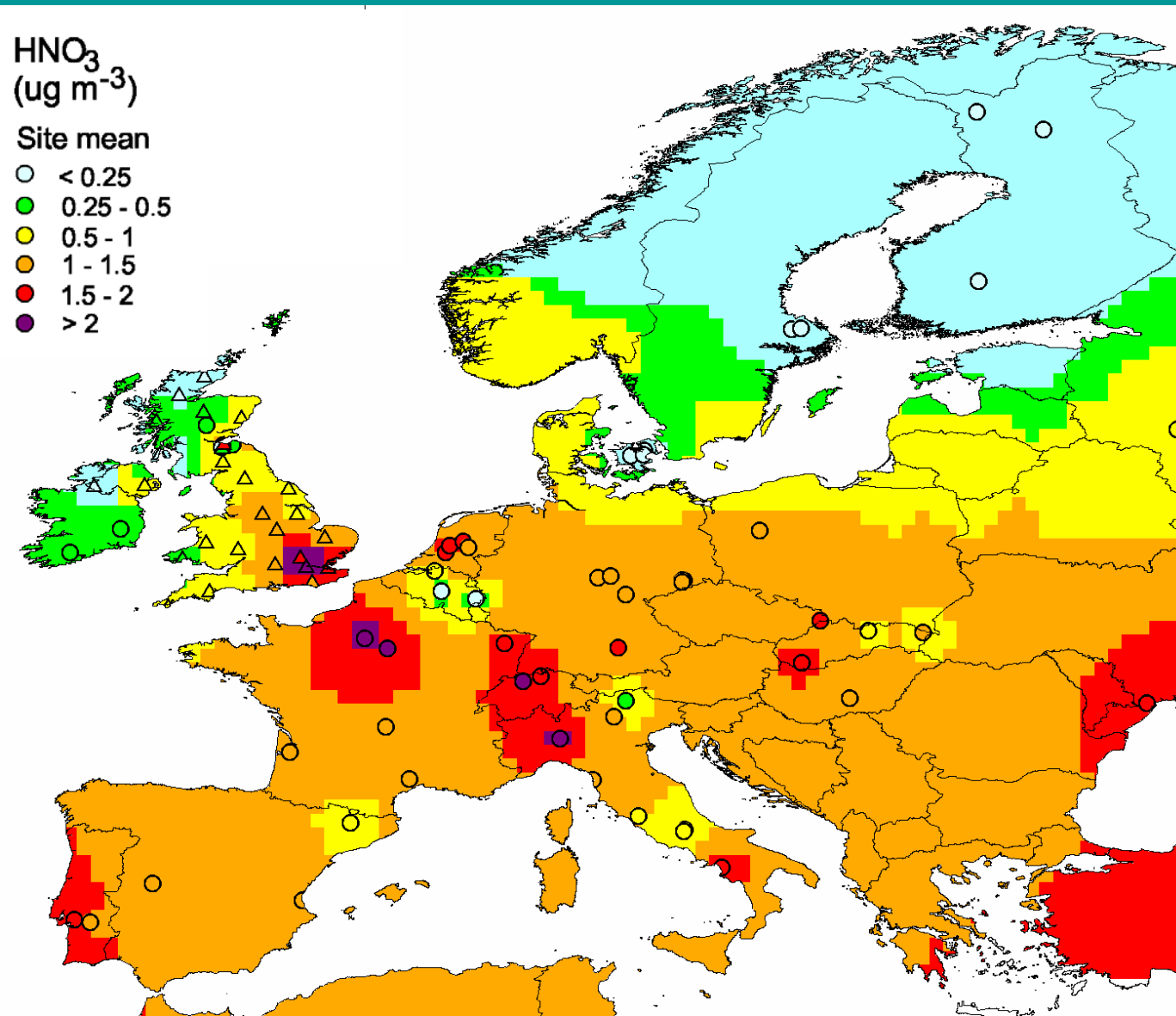
Nitrogen and forest C sequestration



Nitrogen and forest C sequestration



NitroEurope A1.5: First HNO_3 field

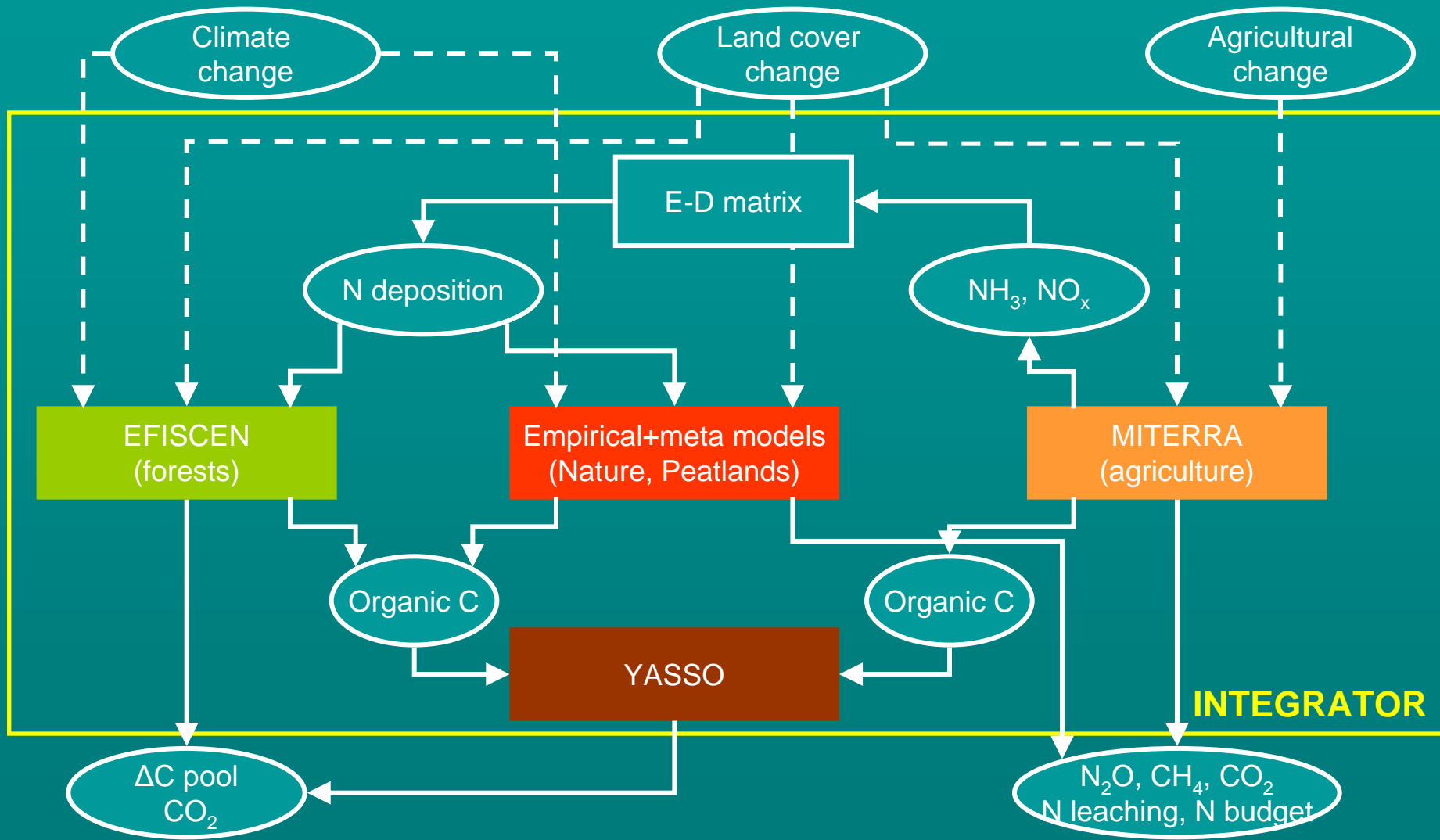


Also for
 NO_3^- , NH_3 , NH_4^+ ,
 HNO_2 , NO_2^-
for N deposition
to Level 1 sites

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

Sutton, Tang et al.

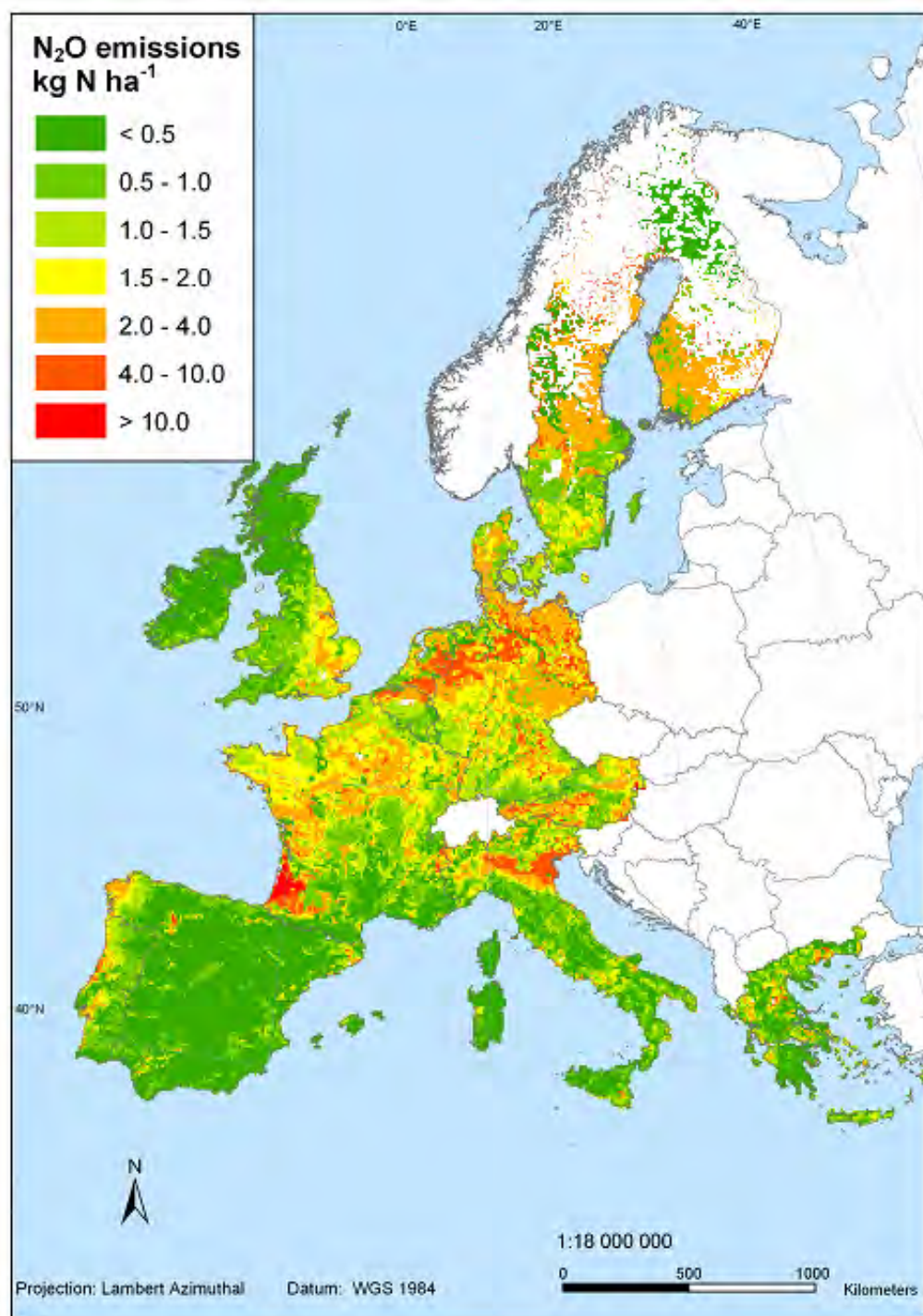
'INTEGRATOR' model



'DNDC' model: N₂O emissions for 2000

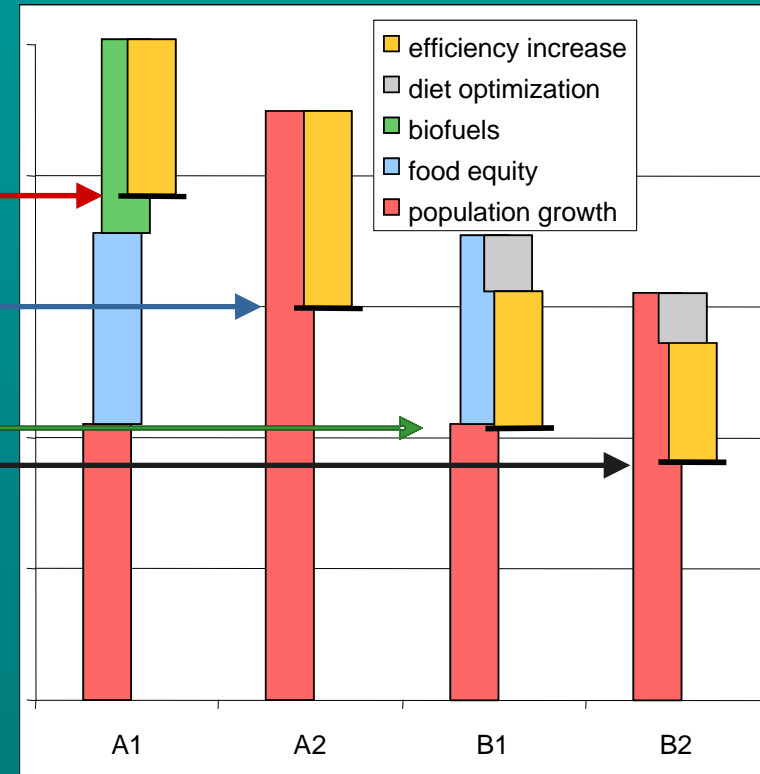
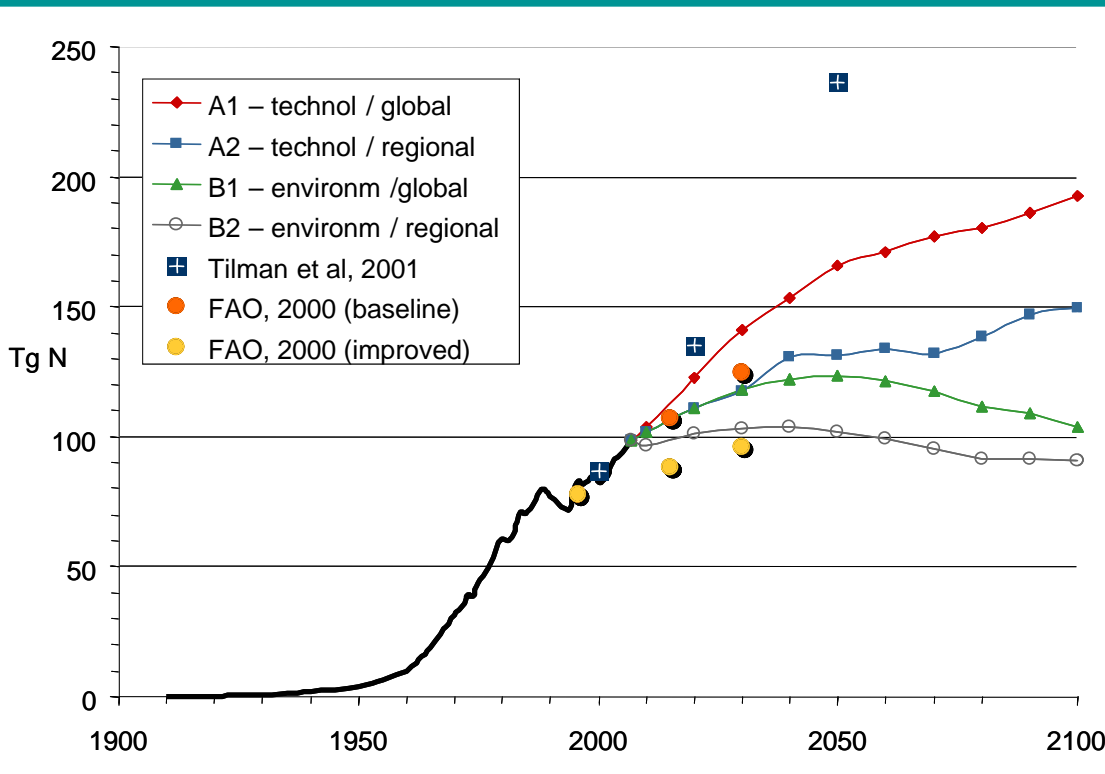


Butterbach Bahl,
Kesik et al.



A century of Haber Ammonia

Global N fertilizer consumption 1900-2100



Nitrogen Synthesis, Policy Development and Public Engagement



- **European Nitrogen Assessment (ENA)**
 - ESF-NinE, NEU, COST 729
- **UN-ECE Task Force on Reactive Nitrogen (TFRN)**
 - Expert Panel on Mitigation of Agricultural Nitrogen
 - Expert Panel on Nitrogen Balances & Budgets
- **Public engagement**
 - The NitroNet Poll: BBC Green Room (July 08)
 - Communication Workshop (Madrid, Oct 08)
 - Nitrogen and food choice...

www.nitroeuropa.eu

www.nine-esf.org

www.unece.org/env/tfrn