European carbon fluxes, N interactions and the experience of CarboEurope IP

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Contents

C budget

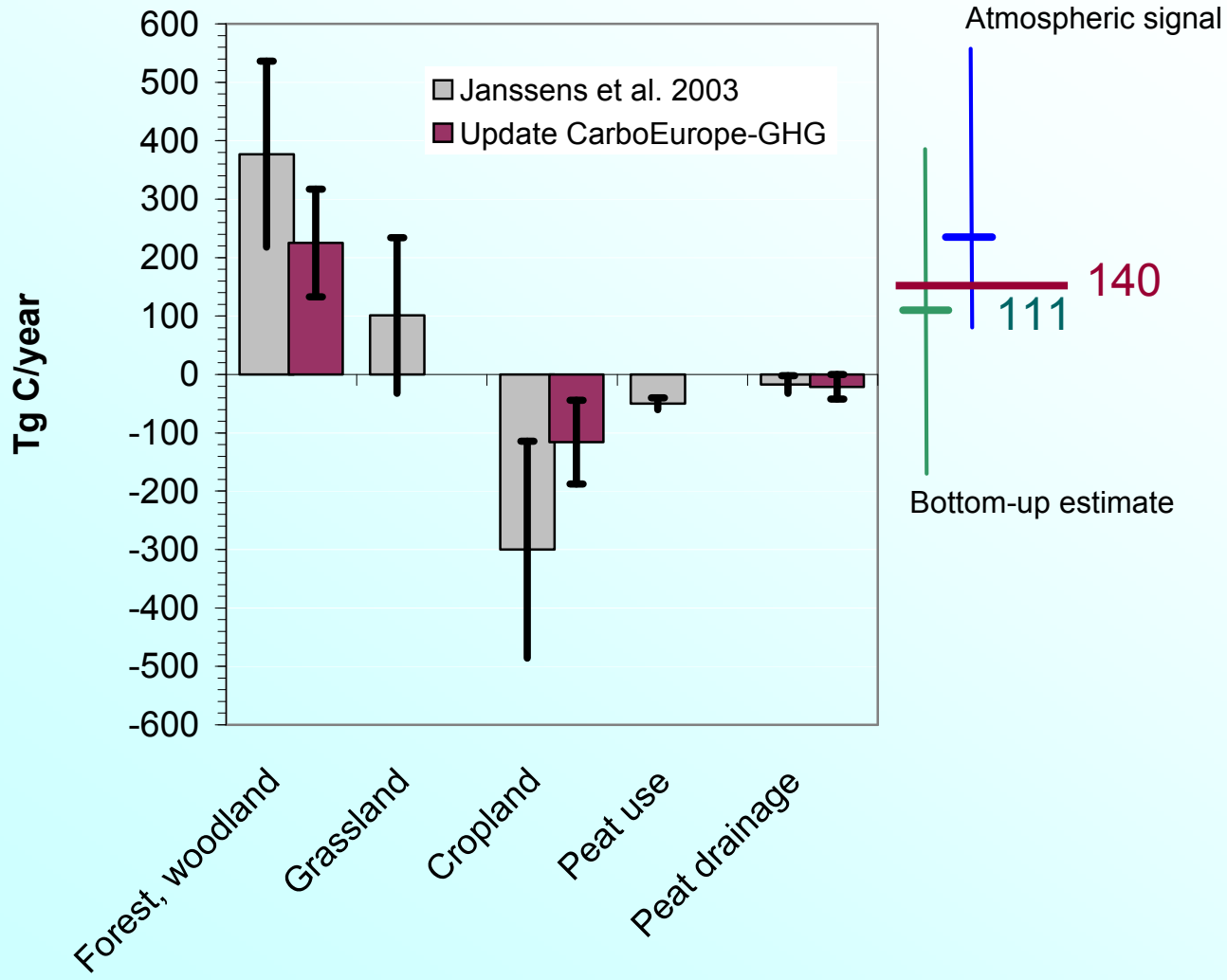
- C budget of European biosphere
- New insights
- Hotspots

C-N interactions

- Productivity and greenhouse gases
- Nutrient imbalances

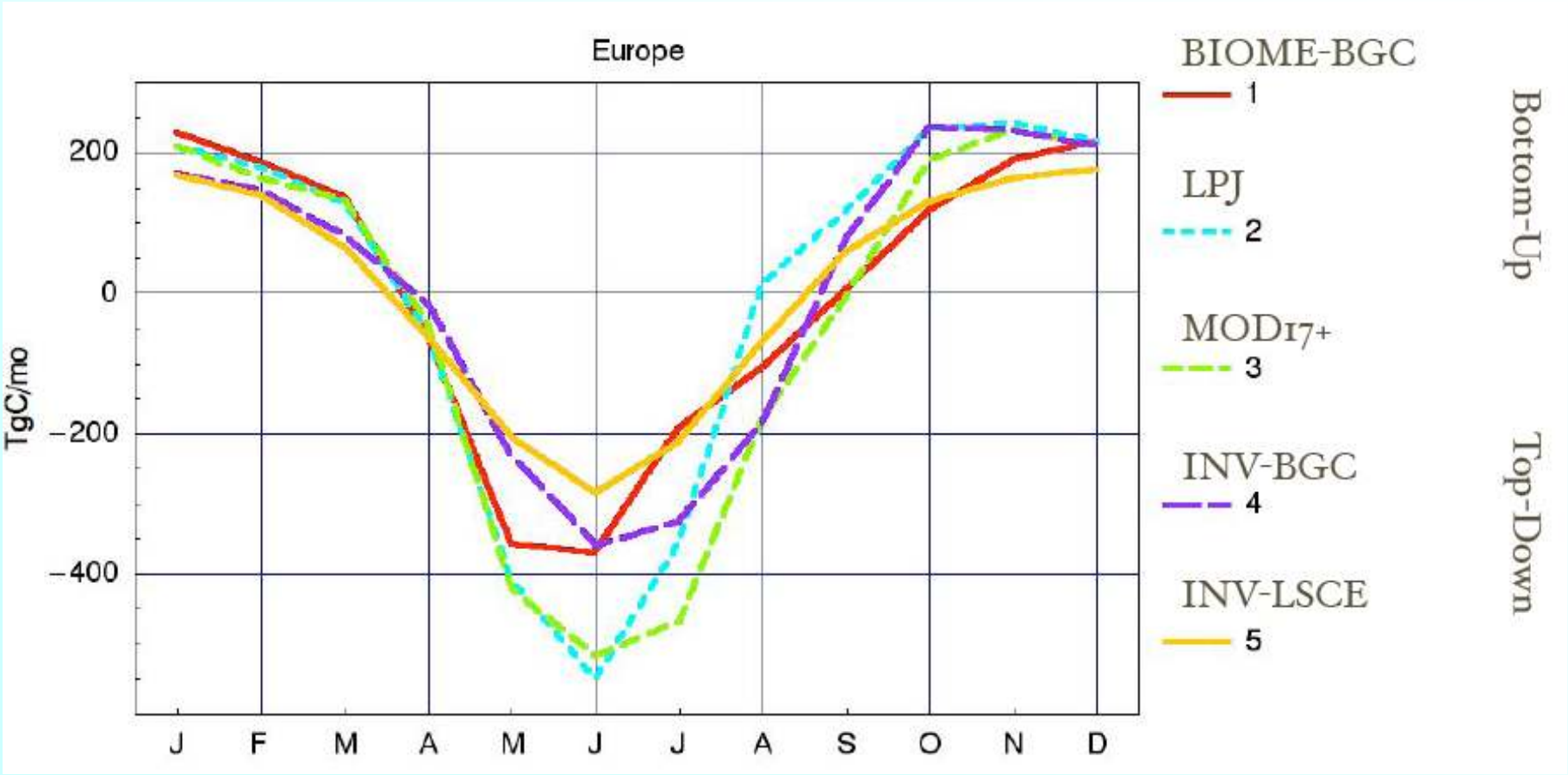
CarboEurope experiences

European C budget – Knowledge now

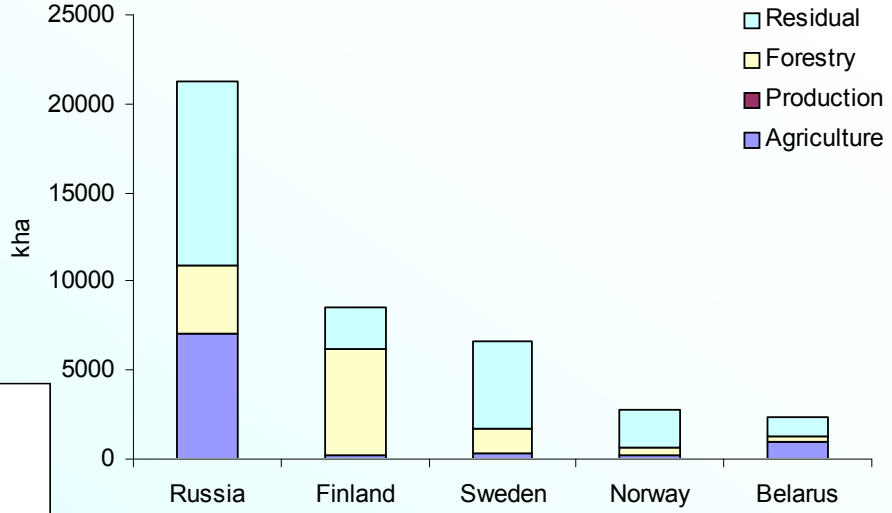


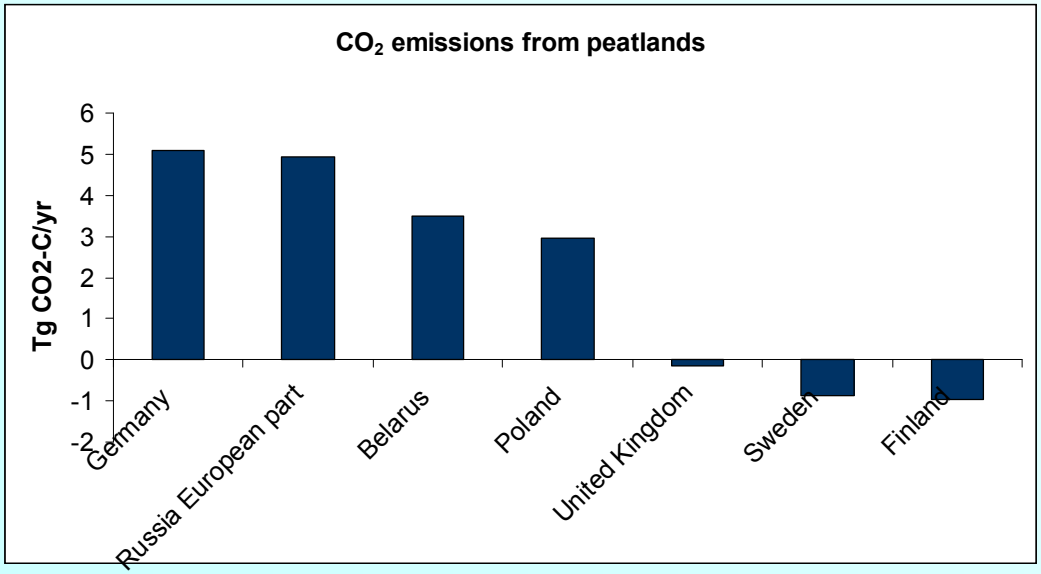
Top-down and bottom-up estimates

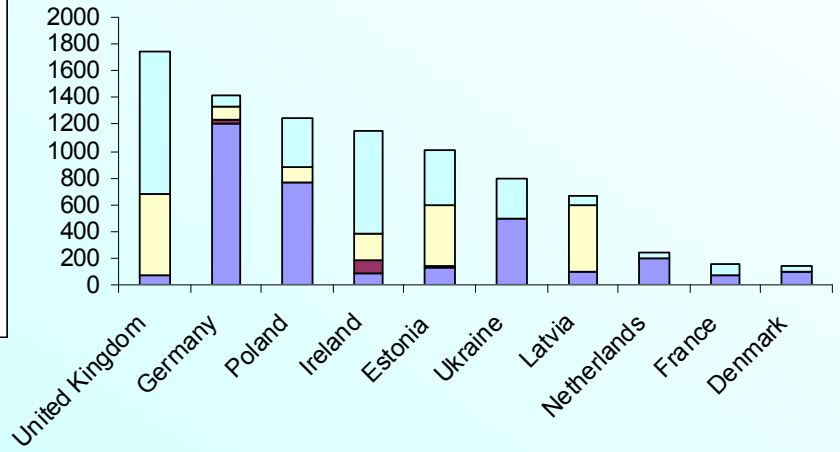
Average seasonal cycle 1998-2002 over continental Europe



Peatlands: GHG Hotspots
Areas and use





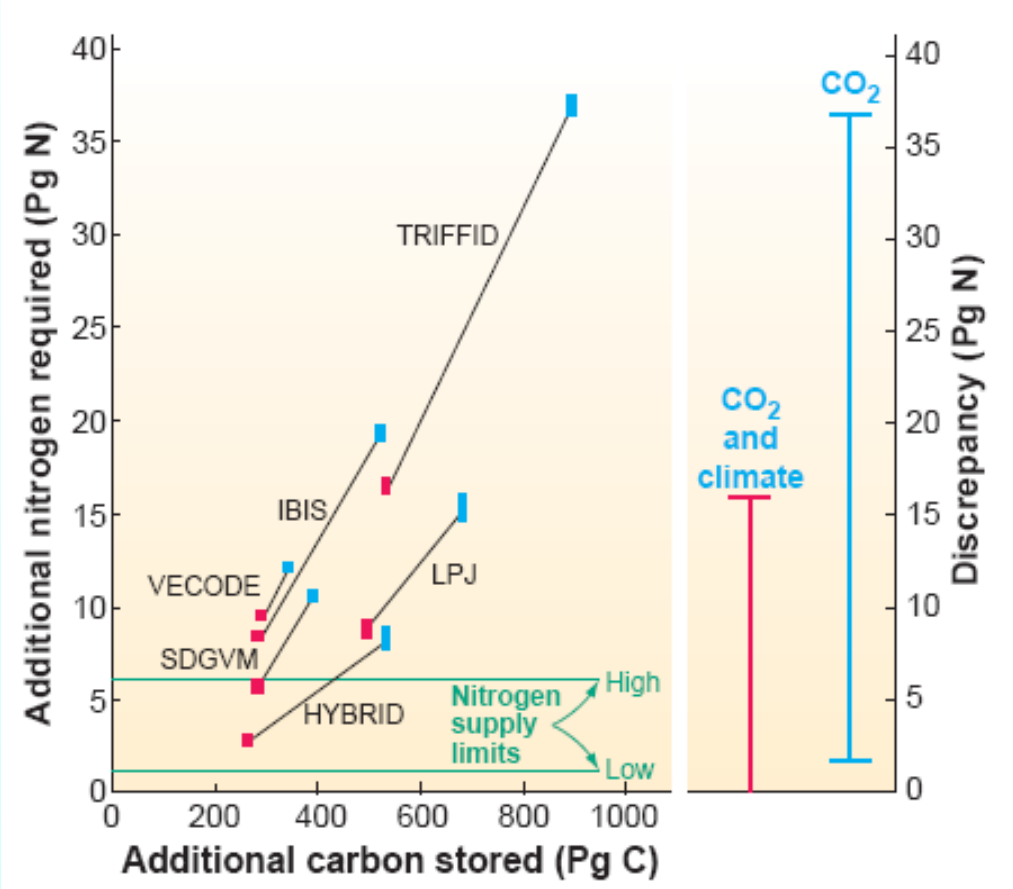


CarboEurope-GHG
Byrne et al. 2004

C-N Interactions

N limitation of global CO_2 effect

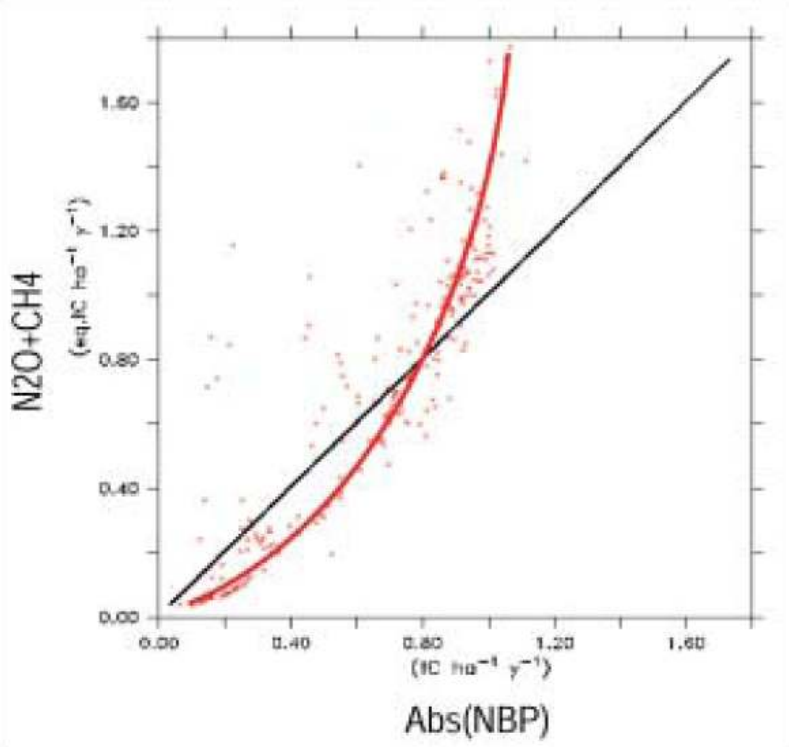
- Global biogeochemical models predict too high CO_2 response of biosphere
  - No acclimation
  - No nutrient limitation



Hungate et al. 2003 Science

Grasslands

- At plot scale across Europe:
  - C neutral or sink
  - C input by manure and animals matters!
- Yet unsolved for spatially explicit models
  - Initial soil C stocks
  - Grassland productivity for rough, extensive grasslands
  - Grassland management



CarboEurope-GHG
Soussana et al. 2004

C/N Thresholds

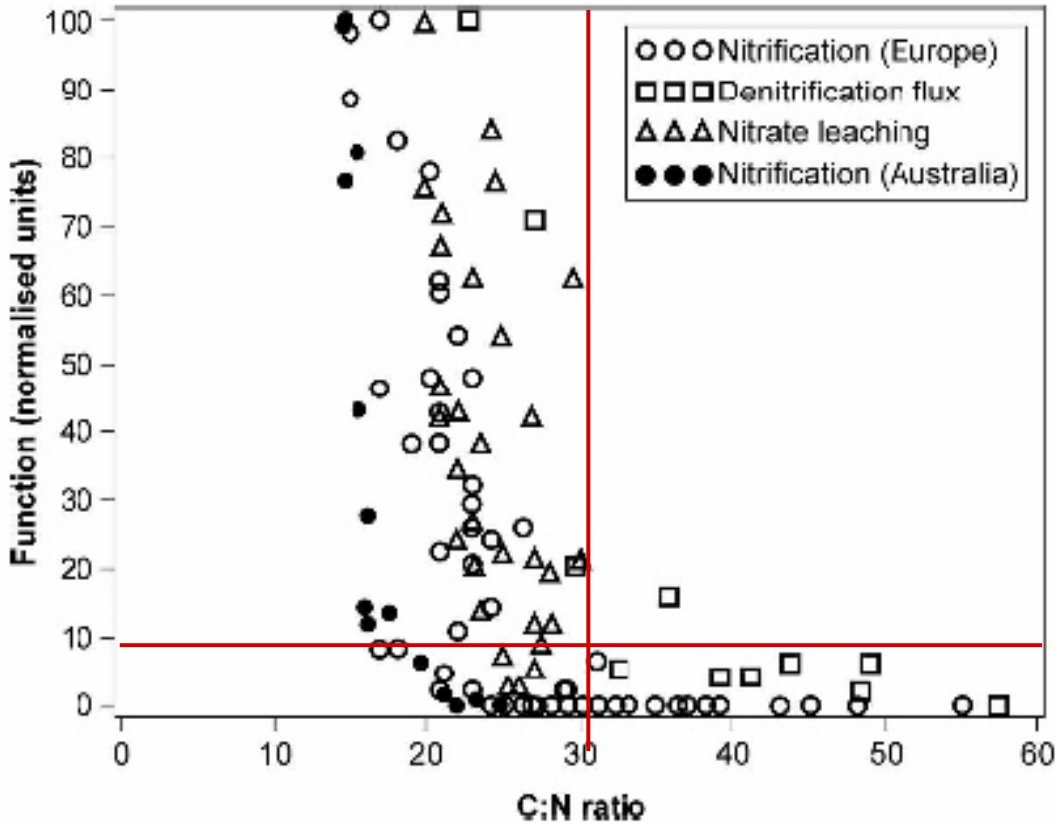


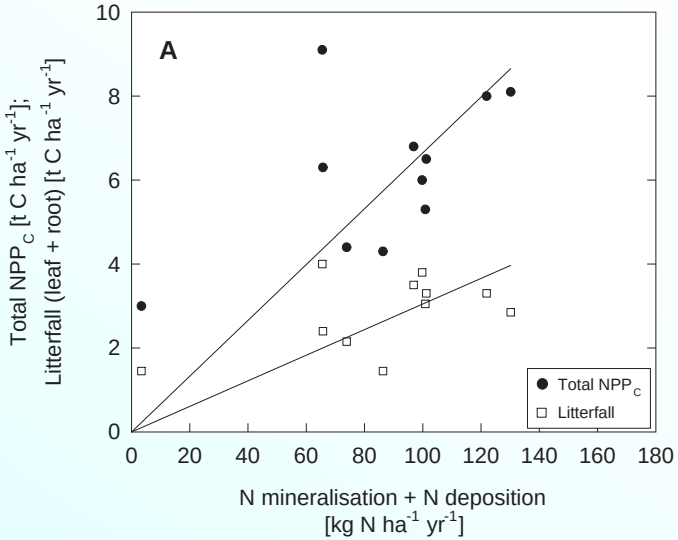
Figure 1. Various nitrogen cycling functions (data points for the different parameters were 'normalized' by calculating the percentage of the maximum value in each case) plotted against the C:N ratio of forest floor/litter layer: (○) nitrate production in humus samples from northwestern German forest soils (100 = 68.1 ppm) (10); (□) nitrogen oxide fluxes (N_2O and NO) from humid wet and semideciduous dry tropical forests soils in Puerto Rico (100 = 14.5 ng N cm^{-2} hr^{-1}) (11); (Δ) nitrate leaching (100 = 40 kg N ha^{-1} yr^{-1}) of forest floor at 33 temperate forest sites (2 broadleaf and the rest coniferous) in Europe from the Element Cycling and Output-fluxes in Forest Ecosystems in Europe (ECOFEE) database (12); (•) nitrification (100 = 0.25 μg g^{-1} d^{-1}) in a range of Australian forest soils (8).

Adams et al., Ambio 2004

C-N interactions in forests

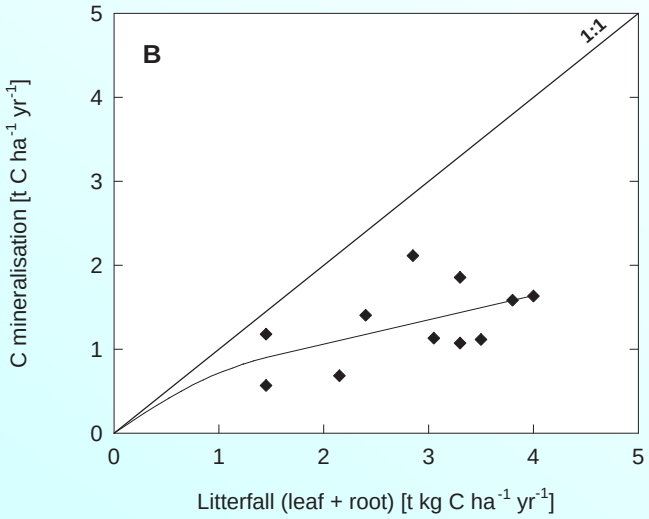
Relationship between growth (NPP, litter) and N supply:

No growth saturation with N



Relationship between C mineralisation and C supply by litter:

Litter accumulation! Why?



Schulze et al. 2000

Does N deposition reduce decomposition?

Faster decomposition in site with higher nutrient availability

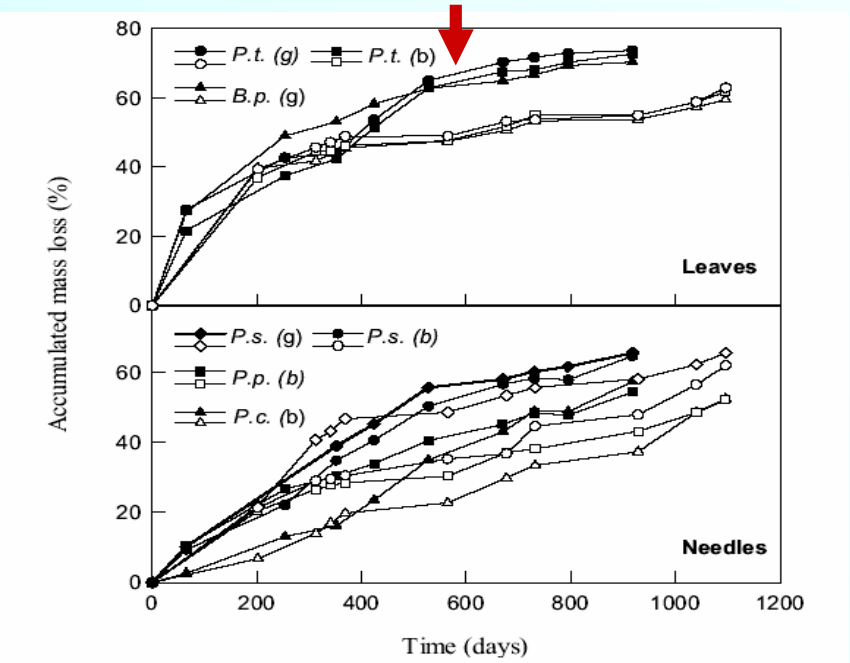


Fig. 1. Decomposition of seven litters types incubated in a silver-fir forest (Monte Taburno—filled symbols) and in a Scots pine forest (Jädraås—open symbols). *Populus tremula* (P.t.), *Betula pubescens* (B.p.), *Pinus sylvestris* (P.s.), *Pinus pinea* (P.p.), and *Pinus contorta* (P.c.). (g) stands for green and (b) for brown.

Berg et al. 2003

Higher N content does not lead to higher total mass loss

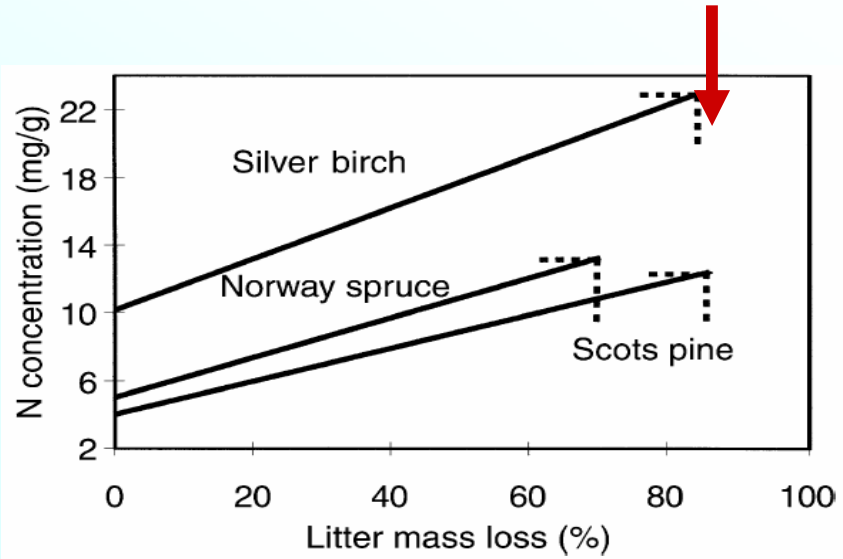


Fig. 1. The relationship between N concentration in decomposing litter and litter mass loss for three different tree species, and their estimated N concentration at the limit value (N_{limit}). At the end of the lines the limit value is indicated (vertical line) and the N concentration at the limit value (horizontal line).

Berg and Dise 2004

Increased N deposition retards mineralization of old soil organic matter

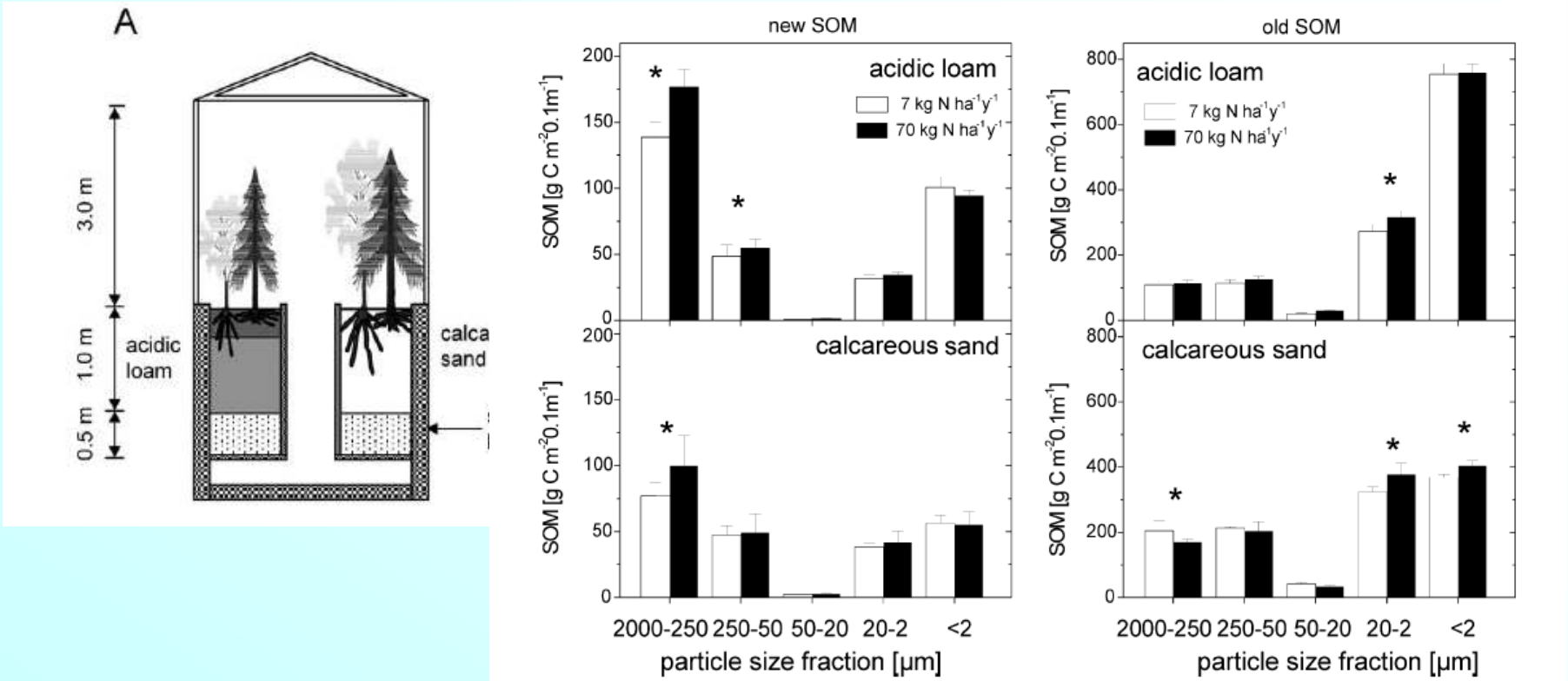


Fig. 5. Amounts of new and old soil organic matter after 4 yr of N deposition. New C was derived from exposure of trees to elevated CO_2 for 4 yr; old SOM represents the carbon older than 4 yr. Means and standard errors of four replicates of the two N deposition levels under elevated CO_2. Significant effects of increased N deposition are indicated by * ($P < 0.05$ with both CO_2 levels included in the ANOVA). Note the different scales of the graphs.

Hagedorn et al. 2003

Collaboration with CarboEurope

Open Science Conference (CarboEurope, NitroEurope, CarboOcean)

On The Greenhouse Gas Cycle in the Northern Hemisphere
Crete , 14-17 November 2006

Sessions on

- C-N interactions in ecosystems
- C and N turnover processes in soil
- GHG hotspot regions
- Policy related research

www.carboeurope.org/conference/

CarboEurope –
A symphonic experience

The Music

Summit
Passion

Aberration

Storm

Work, fight and conquest

Forests,
Streams,
meadows

Ascent

Success and failure

Kick-off meeting

Sunrise

Sunset

Start
Proposal

A few central ideas

Synthesis in Nature

The Orchestra

- The Players
  - Tremendous casting

  - Well-assigned role for each musician
    - Conductor
    - Soloists
    - The „tutti-pigs“

  - Remote orchestra

The Orchestra

- The Challenge
  1. Corporate spirit
  2. Commitment
  3. Rehearsals
  4. The Concert!

- The Project

1. Regular meetings
   - Synthesis across Activities
     - Workshops (call for ideas!)
     - Papers
     - PhDs/PostDocs
2. Synergies with other projects
3. Again, meetings!
4. The Nature paper!