Project Summary

The NitroEurope IP – or NEU for short – addresses the major question: *What is the effect of reactive nitrogen (N_r) supply on net greenhouse gas budgets for Europe?* The project's objectives are to:

- establish robust datasets of N fluxes and net GHG exchange (NGE) in relation to C-N cycling of representative European ecosystems, as a basis to investigate interactions and assess long-term change,
- quantify the effects of past and present global changes (climate, atmospheric composition, land-use/land-management) on C-N-cycling and NGE,
- simulate observed fluxes of N and NGE, their interactions and responses to global change/land management decisions, through refinement of plot-scale models,
- quantify multiple N and C fluxes for contrasting European landscapes, including interactions between farm-scale management, atmospheric and water dispersion, and consideration of the implications for net fluxes and strategies,
- scale up N_r and NGE fluxes for terrestrial ecosystems to regional and European levels, considering spatial variability and allowing assessment of past, present and future changes,
- assess uncertainties in the European model results and use these together with independent measurement/inverse modelling approaches for verification of European N_2O and CH_4 inventories and refinement of IPCC approaches.

These objectives are met by a programme that integrates:

1) an observing system for N fluxes & pools ***Component 1***

2) a network of manipulation experiments ***Component 2***

3) plot-scale C-N modelling ***Component 3***

4) landscape analysis ***Component 4***

5) European up-scaling ***Component 5*** and

6) Verification of European estimates ***Component 6***

In addition to these, the project organisation comprises cross-cutting activities addressing management, databases, training and dissemination.

NitroEurope in Context

NEU brings together 62 institutions from Europe mainly, including partners from China and Africa.

The project maintains close links to other ongoing research activities on nitrogen and carbon, such as

ESF-NinE **INI** **COST 729** **CarboEurope**

NEU will advance the fundamental understanding of C-N interactions at different scales and deliver: process-based models, landscape-level assessments, European maps of C-N pools, N_r fluxes and NGE, and independent verification of GHG inventories, as required under the Kyoto Protocol.

Contact

The project is coordinated by **Dr. Mark Sutton** at the **Centre for Ecology and Hydrology (CEH)**

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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To learn more about NitroEurope, visit the website at:

http://www.nitroeurope.eu

NitroEurope IP

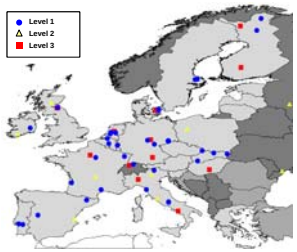
The nitrogen cycle and its influence on the European greenhouse gas balance

Integrated Project (IP) funded under the 6th Framework Programme
Priority 6.3 Global Change and Ecosystems

Component 1

Flux network

The overall goal is to provide a **comprehensive assessment of the fluxes, pools and processes** controlling the N cycle for European terrestrial ecosystems, in order to quantify overall N budgets, interactions with C cycling and net GHG exchange



A tiered 3-level network is established, matching the different questions:

- 13 **Level 3** "*Super Sites*": detailed investigation of N budgets/fluxes & interactions with Carbon-cycling, supported by detailed plant/soil inventorying and process studies;
- 9 **Level 2** "*Regional Sites*": application of low-cost N flux methods, as a basis to establish a future long-term flux monitoring capability at CO_2 flux sites;
- 50 **Level 1** "*Inferential Sites*": allowing the interpretation of measured CO_2 fluxes in relation to inferential estimates of N supply and key soil parameters.

Component 2

Ecosystem Manipulation

The aim is to quantify the **impacts of changes** in external drivers (global change, N deposition, management, land use change etc.) on fluxes and exchange of N, C and GHG in terrestrial ecosystems (relative change rather than absolute budgets).

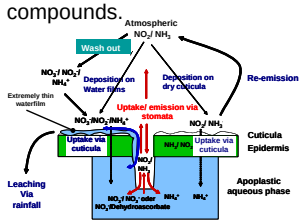
Process understanding & model improvements are the core of this task, in order to provide an improved scientific **understanding of the underlying processes** and their interactions at different scales.

This way, the component will provide **data for evaluation and validation of plot scale models** both for processes and on ecosystem scale (model validation).

Component 3

Plot Scale Modelling

A priori **assessments of the uncertainty of selected existing biogeochemical models** (e.g. PaSIM, BASFOR-EFM, SUNDIAL, DNDC, etc.) will be conducted.The focus is on the development of **recommendations for model improvements** and **protocols to address uncertainty** coming from parameters, driving variables or model structure. The improvement of the NEU core models will help to better understand the processes controlling the biosphere-atmosphere exchange of trace gases and enable predictions of effects of changes in climate, land use and land management on gas exchange of C and N compounds.



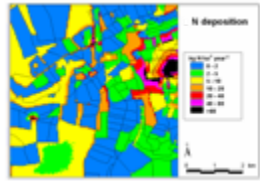
In order to identify and assess the forces driving the biosphere-atmosphere exchange of C and N trace gases, fluxes at NEU measurement sites are simulated and interpreted.

It will serve as well to provide a means for gap filling in the observational record and flux estimation associated with processes that cannot, or are only sporadically, determined experimentally. Finally, the objective is to develop site-specific GHG mitigation strategies for selected land-uses across Europe.

Component 4

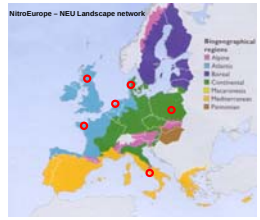
Landscape Analysis

Upscaling from plot to regional scales involves accounting for the complex interactions between individual landscape elements and decision making - typically done at a farm scale.



Modelling the different processes will allow an analysis of interactions at the relevant scales. The work is organised around the development of a landscape model, the **NitroScape** model, its verification on a network of European landscapes and applying it for scenario studies.

Deliverables will be the **NitroScape** model and verification measurements to promote understanding of the complex relationships between N management, N_r and GHG fluxes and environmental conditions.



This will establish a first European network of landscapes to study N cycling and multiple interactions between agriculture and the environment at the scale where N is managed - a strong basis for future research on N issues.

Component 5

European Integration

The objective is to develop/apply GIS-based **integrated agro-ecological assessment tools for the European scale**, in order to:

- Assess present nitrogen and GHG emissions, sources, sinks and their interactions with terrestrial systems.
- Assess interactions between C & N inputs, emissions & sinks in and between agricultural and non-agricultural systems.
- Predict past, present and future N and GHG emissions and sinks in response to various scenarios.

Component 6

Verification

This component will assess the accuracy with which policies concerning the environmental impacts of N_r and GHG emissions can be developed and evaluated, using tools developed in NitroEurope. It will stimulate the discussion on options for improvement of process understanding and data and model needs for N and GHG management across disciplines, by producing a list of major uncertainty areas.

Key methods to do this are **verification** and **uncertainty analysis**. These results will be beneficial to the research community as well as to policy makers.