



## EURO-LIMPACS

### Integrated Project to Evaluate the Impacts of Global Change on European Freshwater Ecosystems

#### The Challenge

Natural ecosystems, already under stress from land-use change and pollution, now face additional pressures from climate change, both directly and through interaction with other drivers of change. These pose serious threats to human society, as the availability and quality of freshwater determines the functioning of every ecosystem. Understanding how aquatic ecosystems will respond to climate change is also of major practical relevance for the development of policies needed to protect water quality and aquatic biodiversity. Especially with respect to the successful implementation of new European legislation, including EU Water Framework Directive (EU 2000) and the EU Habitats Directive (EU 1992) and other national and international conventions and protocols. In order to make this adequate legislation, research is needed on the impact of the climate change on the freshwater ecosystems, including the exact current status of the systems, their interaction with other climate change drivers and the indicators for what is needed to re-naturalise them.

#### Project Objective

The project focuses on the key drivers of aquatic ecosystem change (land-use, nutrients, acid deposition and toxic substances) and examines their interactions with global change using time series analysis, space-for-time substitution, palaeolimnology, experiments and process modelling. It also identifies approaches for achieving good ecological status in freshwater habitats, according to the Water Framework Directive (WFS).

#### Key Points

- Freshwater ecosystems, under stress from land-use change and pollution, face additional pressures from climate change, directly and through interaction with other drivers of change. Euro-limpacs is concerned with the science required to understand and manage the ecological consequences of these interactions. It is relevant to the Water Framework Directive and other international directives and protocols and supports the Ems Charter on Sustainable Development. The Project comprises a consortium of leading scientists to integrate river, lake and wetland ecosystem science at the catchments scale.
- Euro-limpacs focuses on the key drivers of aquatic ecosystem change (land-use, nutrients, acid deposition and toxic substances) and examines their interactions with global, especially climate, change using time-series analysis, space-for-time substitution, palaeolimnology, experiments and process modelling.

#### EATiP Thematic Area of Relevance

- TA1: Product Quality, Consumer Safety and Health
- TA2: Technology and Systems
- TA3: Managing the Biological Lifecycle
- TA4: Sustainable Feed Production
- TA5: Integration with the Environment
- TA6: Knowledge Management
- TA7: Aquatic Animal Health and Welfare
- TA8: Socio-Economics and Management

#### Key Words

Climate change, freshwater systems, rivers, streams, lakes, nutrient pollution, acidification, organic pollutants, ecosystem management, WFD

#### Project Information

**Contract number:**  
505540

**Contract type:**  
Integrated Project

**Action line:**  
SUSTDEV-2002-3.II.1.1 Improve modelling of climate-water interactions at catchment-regional scale., SUSTDEV-2002-3.II.2.1 Assessment of ecological impacts of global change on freshwater bodies, development of ecological indicators of ecosystem "health" and related remediation strategies

**Duration:**  
60 months (01/02/2004 – 31/01/2009)

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- It considers these interactions at 3 critical time-scales:
  - (i) hours/days, concerned with changes in the magnitude and frequency of extreme events;
  - (ii) seasons, concerned with changes in ecosystem function and life-cycle strategies of freshwater biota;
  - (iii) years/decades, concerned with ecological response to environmental pressure, including stress reduction and ecosystem recovery.

The project is designed to provide a decision support system, considering future changes and to base policy upon.

## Output Highlights

### Toolkit: Improved catchment modelling

An innovative toolkit for integrated catchment analysis and modelling has been developed to simulate hydrological, hydro chemical and ecological processes at the catchments scale for use in assessing the potential impact of global change under different climate and socio-economic scenarios.

These models to improve predictions of ecosystem response to climate change and other stressors provide a tool for managers to predict ecosystem response and design management and adaptation strategies.

### Ecological indicators

A unified system of ecological indicators for monitoring freshwater ecosystem health has been developed as well as new methods for defining reference conditions and restoration strategies. These took into account the probable impacts of future climate change and the need for a holistic approach to restoration based on habitat connectivity.

### Reports & Publications

Over 300 papers, book chapters, books in the peer review literature

### Euro-limpacs book

Summary of project's outputs

**Websites and databases** providing a repository of information on ecosystem response to climate change and other stressors: Provides easily accessible information for managers to support management strategies.

The scientific output from Euro-limpacs has improved the understanding of the effects of climate change on freshwater ecosystems.

### The Full Report:

For a comprehensive description of the research project, visit <http://www.refresh.ucl.ac.uk/eurolimpacs/>

## Next Steps – Suggested Actions/Follow On



### Policy

- In addition to furthering understanding of the way aquatic ecosystems respond to direct and indirect climate change impacts, the output from Euro-limpacs was of practical relevance for the development of policies and implementation strategies needed to protect aquatic and riparian wetland ecosystems especially with respect to the implementation of the EU Water Framework Directive, the EU Habitats Directive, the Ramsar Convention, the UN Convention on Biological Diversity and other national and international conventions and protocols.
- This new understanding enabled the effective inclusion of ecosystem responses to climate change in environmental policy.



### RTD

- Euro-limpacs is a solid base for next level research, including research into climate gradients (lakes and floods in Europe) by two exactly identical experiments to measure climate change. This is a new approach, which will give the opportunity to a unique ecological combination of standard and real world research. However, it has been recognised that the measures that need to be taken to

restore freshwater ecosystems to good ecological health or to sustain priority species as required by EU Directives need to be designed either to adapt to future climate change or to mitigate the effects of climate. Generating the scientific understanding that enables such measures to be implemented successfully is the principal focus of a new Project, Refresh, which started in February 2010. This will build firmly on the foundations laid down in Euro-limpacs.

- More research is needed to understand the effects of interactions between climate change and Nitrogen deposition, on thresholds and on interactions between climate change and toxic substances in aquatic environments.



#### ***Environment***

- The scientific output from Euro-limpacs has improved the understanding of the effects of climate change on freshwater ecosystems enabling the future set up of effective management measures and adaptation strategies.



#### ***Knowledge Transfer***

- Over 300 papers, book chapters, books in the peer review literature have been produced, which, jointly with the website and databases, provide a critical mass of new knowledge. This knowledge is easily accessible.

## **Related Publications/Projects**

For the complete bibliography visit the website: <http://www.refresh.ucl.ac.uk/eurolimpacs/bibliography>