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A Long-Term Biodiversity, Ecosystem and Awareness Research Network

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www.alter-net.info

A Long-Term Biodiversity, Ecosystem and Awareness Research Network (ALTER-Net)

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A Long-Term Biodiversity, Ecosystem and Awareness Research Network

Preamble

As a result of the EC's support in the 6th Framework Programme, ALTER-Net has created a Consortium of Excellence in biodiversity, ecosystem and awareness research. The following text is taken from the Memorandum of Understanding signed by 22 partners in March 2009 and summarises the commitment of the Consortium to supporting biodiversity and ecosystem related research and policy in the future. The remainder of this report summarises the main achievements of ALTER-Net to date and describes how this future commitment will be met.

ALTER-Net for the future: Mission, Goals and Mechanisms.

Extract from ALTER-Net's Memorandum of Understanding March 2009

Strengths: *The ALTER-Net partnership has a unique capacity to undertake long-term, European-scale interdisciplinary research on biodiversity and ecosystems through the application of its combined expertise in ecology, social sciences, economics, information management and knowledge transfer combined with access to pan-European research infrastructures, including Long-term Ecosystem Research (LTER) sites and socio-ecological research platforms (LTSER).*

The mission of the Consortium is to improve the sustainable use, management and conservation of biodiversity and ecosystems through the integration of European interdisciplinary research capacity and knowledge.

Goals: *ALTER-Net's overarching goal is to work in partnership with its main European stakeholders in scientific, policy and public sectors to:*

- a) provide significant contributions to the definition of European and global biodiversity research objectives;*
- b) be recognized as a consortium of excellence in biodiversity and ecosystem research;*
- c) have a leading role in interdisciplinary research on biodiversity and ecosystem issues;*
- d) be recognized as a major European scientific body by communicating with the public and policymakers on biodiversity research issues; and*
- e) offer the highest level of cost effective applied research to its users in policy and resource management.*

Mechanisms: *the Consortium will achieve its goals by means of:*

- a) regularly updated common research and communication strategies;*
- b) institutional agreements on common standards to enable sharing of data, information and knowledge;*
- c) schemes for the sharing of personnel and laboratory facilities;*
- d) support for the establishment of research infrastructures to address pan-European biodiversity issues;*
- e) support for a formal European network of Long-term Ecosystem Research (LTER) (LTER) field sites (which are at least partly dedicated to biodiversity research and monitoring) through co-ordination and harmonisation activities and the maintenance of site research and monitoring programmes;*
- f) joint training and development schemes;*
- g) the creation of opportunities for social scientists, economists and ecologists to work together;*
- h) joint proposals to EU Framework programmes and other funding sources;*
- i) joint mechanisms to communicate with scientific and non-scientific communities as well as with specific stakeholders;*
- j) mechanisms for identifying priority and emerging research issues in collaboration with major European institutions such as the European Commission and the European Environment Agency.*

A Long-Term Biodiversity, Ecosystem and Awareness Research Network (ALTER-Net)

1. Overview

Research on European biodiversity is rich and varied. It is also dispersed and disconnected and cannot be easily marshalled to address major biodiversity issues. These issues include: the sustainable use of biodiversity; loss of biodiversity; the protection of rare habitats and species; adaptation to climate change; assessment and development of policy and management options to enable society to adapt to environmental change; and the improvement of economic and social benefits derived from European ecosystems and landscapes.

As part of the process of improving capability to address these issues on a European scale, ALTER-Net was funded as a Network of Excellence (see Box 1.1) by the European Union's Framework VI programme, to create "A Long-Term Biodiversity, Ecosystem and Awareness Research Network".

In this report we summarise the way in which ALTER-Net achieved durable integration of biodiversity research by implementing research, management and cultural changes within and between its 24 component organisations from 17 countries. We also summarise some of the immediate benefits and outcomes from the work and describe how the structures created by ALTER-Net will provide the foundation for future research and knowledge transfer activities on biodiversity and ecosystems.

Box 1.1 What are Networks of Excellence?

NoEs are multi-partner projects aimed at strengthening scientific and technological excellence on a particular research topic by integrating at European level the critical mass of resources and expertise needed to provide European leadership and to be a world force in a given domain. This expertise should be networked around a joint programme of activities aimed primarily at creating a progressive and durable integration of research capacities of network partners while at the same time advancing knowledge on the topic. The main result should be a durable restructuring and reshaping of the way research is carried out in Europe in a given area.

As a Network of Excellence, ALTER-Net aimed to provide durable integration of research and communication capabilities addressing the following topic specified by the EC:

"The development of a network for European long-term terrestrial and fresh-water biodiversity and ecosystem research, based on existing facilities. The role of this network should be to structure and integrate research carried out to assess and forecast changes in biodiversity, structure, functions and dynamics of ecosystems and their services, and thus facilitate the development of conservation options. Research will focus on the interplay between species, biodiversity change (species and genetic levels) and on the interplays between biodiversity and ecosystems, considering the likely impacts of the main drivers (anthropogenic and natural). Socio-economic implications and public attitudes must be considered".

2. Project process and organisation

ALTER-Net was organized as a set of 14 inter-linked integration, research and spread of excellence workpackages (Box 1.) co-ordinated by the Centre for Ecology and Hydrology in the UK. The main focus of the research was on the socio-economic drivers of biodiversity, the assessment of biodiversity and its change, the impact of the main drivers and pressures on biodiversity, the development of conservation options, public attitudes to conservation, and forecasting change in biodiversity, structure, functions and dynamics of ecosystems and their services.

To enhance the process of integration, these workpackages were structured into a set of 4 over-arching goals (Figure 1.) reflecting the main areas of activity. These 4 areas aimed to create:

- Priority Area 1: Durable institutional integration
- Priority Area 2: Durable communication and knowledge transfer
- Priority Area 3: Development of the European LTER network
- Priority Area 4: Durable inter-disciplinary research

Full information about ALTER-Net and access to background reports and publications can be found on the ALTER-Net web-site at www.alter-net.info.

Box 1. ALTER-Net's Workpackage Structure and main objectives

WPs Covering Integration Objectives:

I1: To create from existing centres a distributed, multi-disciplinary institute to improve our understanding of the dynamics and evolution of biodiversity and to help assess and develop relevant EU policy.

I2: To develop and apply methods to integrate environmental and socio-economic research on biodiversity conservation and the sustainable use of its components.

I3: To build, integrate and harmonise a multi-functional, inter-disciplinary ecosystem research network of sites to investigate long-term biodiversity processes at relevant spatial and temporal scales.

I4: To develop a partnership of biodiversity research scientists, science communicators and science-based visitor centres.

I5: To encourage wide understanding and application of relevant scientific knowledge about biodiversity by generating, promoting and taking part in dialogue between scientists, policy-makers and other stakeholders in fora such as the European Platform for Biodiversity Research Strategy (EPBRS).

I6: To construct a framework within which can be built a system to manage biodiversity data, information and knowledge from the NoE, and to make them available to scientists, policy makers and the public.

WPs covering over-arching programmes on spread of excellence:

E1: Mobility and training and measures to promote and measure durable integration.

E2: Communication and dissemination.

WPs covering a cross-cutting programme of research:

R1 Socio-economic drivers of biodiversity change. To identify the relevant socio-economic drivers of biodiversity change, to analyse their social, political and economic dynamics, and to identify policy options to mitigate the negative impacts of these drivers.

R2: Biodiversity assessment and change. To develop standard methodologies to monitor and analyse trends in biodiversity in terrestrial and freshwater ecosystems, taking into account the different levels (genetic, species etc.) and components of biodiversity (taxonomic and functional) and the services they provide.

R3: Impacts of the main natural and anthropogenic drivers and pressures on biodiversity. To establish a scientific framework to understand and quantify the integrated impact of natural and anthropogenic drivers and pressures on biodiversity and its relationship to the structure and function of ecosystems

R4: Biodiversity conservation options. To provide, through inter-disciplinary teams, science based assessments, decision support systems and management tools for the practical implementation of the Convention on Biological Diversity, the European Biodiversity Strategy and associated policies and actions.

R5: Public attitudes to biodiversity and its conservation. To establish understanding of public attitudes and beliefs concerning biodiversity and its conservation. Related to this is the role of communication mechanisms and processes to engage the public in dialogue with scientists, policy makers and other stakeholders.

R6: Forecasting change in biodiversity. To develop tools to forecast change in biodiversity. Such tools will be designed to integrate impacts of the main natural and socio-economic drivers and policy objectives and provide a unifying approach to interdisciplinary research.

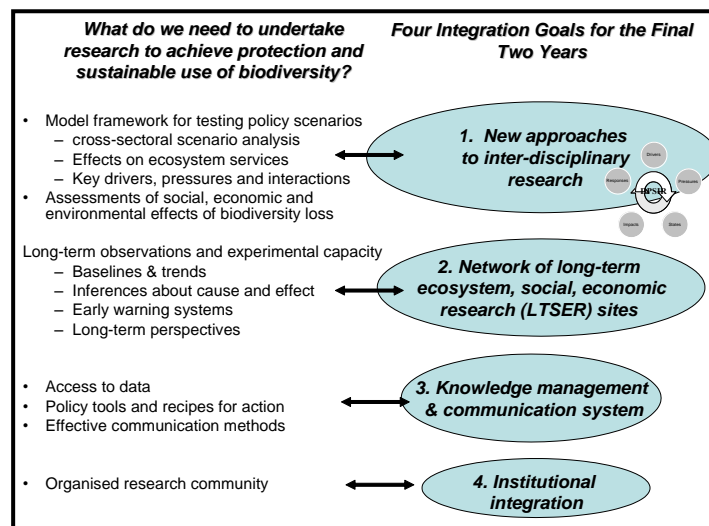


Figure 1. ALTER-Net’s priority areas for integration over its final 2 years in relation to some of the key R&D priorities for biodiversity.

3. Meeting the Challenge of Durable Institutional integration.

At the start of ALTER-Net in 2004 biodiversity research was distributed across research organisations throughout Europe. The challenge was to find creative ways of linking these organisations to provide added value at European level and a critical mass of expertise in biodiversity and ecosystem research to meet European-scale requirements. Furthermore, this integration had to be “durable” and show lasting benefits beyond the end of EC funding.

By the end of the project in March 2009, ALTER-Net had established a firm institutional basis for long-term partnership. Twenty-two of the original 24 partners had signed a Memorandum of Understanding (MoU), formalising their long-term collaboration. The MoU provides an operational framework for maintaining and developing the ALTER-Net partnership. The mission of the partnership will be “to improve the sustainable use, management and conservation of biodiversity and ecosystems through the integration of European interdisciplinary research capacity and knowledge”. The partnership will achieve its goals by means of:

- regularly updated common research and communication strategies;
- institutional agreements on common standards to enable sharing of data, information and knowledge;
- schemes for the sharing of personnel and laboratory facilities;
- support for the establishment of research infrastructures to address pan-European biodiversity issues;
- support for a formal European network of Long-term Ecosystem Research (LTER) field sites through co-ordination and harmonisation activities and the maintenance of site research and monitoring programmes;
- joint training and development schemes;
- the creation of opportunities for social scientists, economists and ecologists to work together;
- joint proposals to EU Framework programmes and other funding sources;
- joint mechanisms to communicate with scientific and non-scientific communities as well as with specific stakeholders; and
- mechanisms for identifying priority and emerging research issues in collaboration with major European institutions such as the EC and the European Environment Agency.

A new Secretariat has been established in the Norwegian Institute for Nature Research (NINA) to co-ordinate ALTER-Net’s future activities. Funding for the Secretariat is coming from contributions from

the partners and from the Norwegian Government. In addition, partners will provide contributions to support a range of future activities, including the Summer School.

3.1 ALTER-Net's Common Research Agenda

ALTER-Net has developed a common research agenda that will provide an overview of its research priorities. It is dynamic in nature and will change either in response to the partners' assessment of emerging research needs or in response to changes in policies or international initiatives, including major funding initiatives. This Common Research Strategy will help partners to harmonise their activities and to identify areas of collaboration in European projects.

The strategy is based on a strategic framework (Table 1.). Within this framework priorities will address key research and policy issues of societal relevance. The current priorities cover:

- Climate change adaptation
- Ecosystem services
- Rural development, land use and biodiversity
- Protected areas, including Natura 2000
- Sharing of environmental data and information
- The policy-science interface and the “Network of Knowledge”
- Horizon scanning

Focus	Strategic objective
<i>Why biodiversity matters:</i>	To understand and assess the role of biodiversity in supplying ecosystem goods and services.
<i>The way things are:</i>	To assess the changing state of Europe's biodiversity and ecosystem services, and public attitudes towards them.
<i>How it got like this:</i>	To analyse the impact of the most significant drivers, including human behaviour, and their interactions on biodiversity.
<i>What to do about it:</i>	To analyse options for the conservation and sustainable use of biodiversity and evaluate the effectiveness of policy and communication instruments.

Table 1. The framework for ALTER-Net's Common Research Agenda

3.2 Internal Communications

ALTER-Net has developed a web-site for internal (LYNX) and external communications www.alter-net.info , 3 hard-copy Newsletters and 32 E-Newsletters. Since August 2006 it has also been delivering monthly E-Newsletters to nearly a thousand colleagues in research and policy. Two editions are produced. The first goes to the internal community of “members” and includes project management information. In addition, there is a separate E-newsletter for external participants (registered users). External users can subscribe to the Newsletter through the web-site. The web-site and E-Newsletters will be maintained as part of ALTER-Net's future activities.

4. The Challenge of Durable Communication and Knowledge Transfer

The dissemination and transfer of knowledge between the biodiversity research community and its stakeholders in public, policy, business and resource management communities is recognised as one of the key processes in addressing biodiversity issues.

ALTER-Net has established a knowledge transfer framework and institutionally agreed mechanisms for delivering biodiversity knowledge to (and where appropriate, from) media, public and policy audiences. The framework is designed to make multiple uses of research outputs and provide incentives for scientists to get involved in knowledge transfer activities (Figure 2.). It contains a number of components and processes that provide access to partner information on expertise,

facilities, data, publications, information and knowledge on biodiversity and enable inputs from stakeholders into the research process. Some of the key components of this framework are:

- A shared website and E-Newsletters (see Section 3.2)
- The International Press Centre for Biodiversity (IPCB) & Greenlink
- A science-policy journal – INSPIREDD by Biodiversity (INSPIREDD is short for International Science Policy Interface for Research on Durable Development).
- A Partnership with science Visitor Centres and the “News and Views” tool
- A Science -Policy Interface: Think-tank
- Direct dialogue with policy makers through policy events and meetings

4.1 Communication with the Media:

ALTER-Net’s International Press Centre Biodiversity Research (IPCB) provides a communication tool for ALTER-Net members and other biodiversity research and biodiversity-related research institutes. The IPCB provides a portal (www.biodiversityresearch.net) to biodiversity research news for the international press community and is also used by scientists as an important source of information. The site offers the latest news related to biodiversity research, press releases on recent findings, background documents on important biodiversity research issues and links to important information sources on biodiversity. At the moment almost 16,000 users make use of the site every month.

The IPCB was first launched in 2006 and, in response to user comments, version 2 of the software has been implemented and was released in March 2009. Version 2 has a new interface (Figure 3.) and provides more tools to the user. It has the capability to add press releases and news events in different languages and this should make the IPCB more attractive to contributors and to the press in the different EU Member States. Version 2 of IPCB now also includes an expertise database (Greenlink) which gives users the possibility of asking for contact information on specific biodiversity related research topics.

The screenshot displays the IPCB website interface. At the top, there is a header with the IPCB logo and the text "international press centre biodiversity research" and "An initiative of ALTER-Net". Below the header, there is a navigation bar with "IPCB in: English | Dutch" and "Last update: Monday, March 9, 2009 9:03 AM". The main content area is divided into several sections:

- TOP NEWS STORY:** A red vertical banner on the left side of the main content area.
- ALTER-Net final conference:** A news story titled "ALTER-Net final conference" with a sub-headline "Leipzig (Germany) - March 4, 2009 - The ALTER-Net final conference - Inter-disciplinary Challenges for Biodiversity and Ecosystem Research" was opened this morning in the Leipziger KUBUS. Participants coming from all over Europe are discussing biodiversity research related topics such as understanding the challenges, changing our thinking and providing solutions to the challenges. See events.
- News Stories:** A section with a green header containing several news items:
 - Diversity Of Birds Buffer Against West Nile Virus:** North American scientists studying West Nile virus have shown that more diverse bird populations can help to buffer people against infection. [More](#)
 - Birds Move North with Climate Change:** ESF Study Says - SURV-ESF Headlines- Mar 5, 2009
 - 75% of common European birds at risk from climate change:** BirdLife International - Mar 4, 2009
 - Threatened Forests Absorb one-fifth of Fossil fuel Emissions:** DigitalJournal.com - Mar 1, 2009
 - Assisted Colonization Key To Species' Survival In Changing Climate:** Science Daily - Feb 27, 2009
 - Pioneering marine scientist sees hope despite increasing ocean acidity:** dailyclimate.org - Feb 25, 2009
- Press releases:** A section with a green header containing:
 - Polar research reveals new evidence of global environmental change:** Feb 25, 2009
 - The State of Polar Research:** Feb 25, 2009
 - (DFG, German Research Foundation) Continues to Strengthen Biodiversity Research:** Oct 23, 2008
- Greenlink:** A section with a green header containing:
 - Greenlink:** If you are a journalist and you want to have contact with a scientist involved in biodiversity or biodiversity related research, greenlink can help you. Send an e-mail to Greenlink and within 24 hours we are sending you contact details of a scientist with the expertise you have asked for.
 - Scientist who are willing to answer questions of journalists can send a short CV indicating their contact information and their expertise to Greenlink.**
- Events:** A section with a green header containing:
 - European Platform for Biodiversity Research Strategy meeting - Prahonice, Czech Republic - May 19-22, 2009**
 - US-IALE conference: Coupling Humans and Complex Ecological Landscapes - Snowbird, Utah, US - Apr 12-16, 2009**
 - Biodiversity in the EU - Beyond 2010 - Athens, Greece - Apr 27-28, 2009**
 - European Platform for Biodiversity Research Strategy meeting - Prahonice, Czech Republic - May 19-22, 2009**
- ADVERTISEMENT:** A section with a yellow header containing:
 - INSPIREDD by Biodiversity Research:** A new journal bridging the gap between biodiversity research and policy
 - INSPIREDD:** A vertical banner on the left side of the advertisement section.
 - Biodiversity Research:** A logo with a blue and red square containing white patterns.

Figure 3. Version 2 of the IPCB Web-site launched in March 2009 provides access to press releases and news items on biodiversity.

By the end of the project in 2009 almost all ALTER-Net partners contributed actively to the content of the IPCB site. The percentage of news items delivered by ALTER-Net partners is around 25%. This reflects the fact that an increasing number of outside organisations are making use of the IPCB (www.biodiversityresearch.net). This includes other European projects (e.g. EDIT, MARBEF, and LifeWatch), European Organisations (EEA, EPBRS) and international organisations and conventions (GBIF, GTI, CBD,). The multi language support in version 2 will further promote this tool for regional and national organisations. At the moment English and Dutch versions are available. A French and German version will be launched before the end of June 2009.

As part of ALTER-Net's future activities the IPCB will be maintained by the Research Institute for Nature and Forest (INBO) in Belgium (with support from the Flemish Government).

4.2 An Interface between Science and Policy

A report on lessons learned from national and international science-policy interfaces provided the basis for the development of a science-policy interface in ALTER-Net. It made it clear that an improved understanding of the way in which information and knowledge on biodiversity influences the policy process, and vice-versa, was required as a step towards creating more effective mechanisms and institutional structures for delivering and communicating the results of research to inform and support policy development.

From its start in 2004, a key aim of ALTER-Net was to contribute to the global target to significantly reduce the current rate of biodiversity loss by 2010, as agreed within the framework of the Convention on Biological Diversity, as well as to the European target to halt biodiversity loss by 2010. It was recognized that science and research are essential to help achieve that goal but that more effective means were required to identify research needs and deliver research knowledge into the policy process.

Throughout the first five years, ALTER-Net has directly and indirectly provided input into a range of policy processes, either focusing on biodiversity conservation or on biodiversity research. Examples include the participation in the meetings of the European Platform on Biodiversity Research Strategy, the representation of policy stakeholders in the ALTER-Net Advisory Committee, the organization of a side-event at the pan-European 'Environment for Europe' ministerial conference, research activities on Natura 2000 and bioenergy issues, presence at the EC Green Week and the Council of the Pan-European Biological and Landscape Diversity Strategy, or the input into the EC process 'The Economics of Ecosystems and biodiversity (TEEB)'. In addition, ALTER-Net is represented in an increasing number of events from various existing platforms (EPBRS, SBSTTA, CBD, ETC/BD, EEA, ECNC SC). ALTER-Net presented its work during the side event of the 2007 6th Ministerial Conference on 'Environment for Europe' (EfE) in Belgrade, Serbia to 40 participants from various policy organizations, including UNEP, EEA, and National Ministers (Figure 4).

With regard to future biodiversity policy in Europe, the ALTER-Net knowledge base can provide valuable input into the framing of the vision for biodiversity and the associated EU policy, in response to the 2006 EC Biodiversity Action Plan. An important step in this process was the high level conference in April 2009 in Athens 'Biodiversity protection – beyond 2010: Priorities and options for future EU policy', held by the EC DG Environment and the possibility for ALTER-Net to contribute to the 'Message from Athens' and to inform the audience of ALTER-Net (Figure 4.). Important steps have also been taken to contribute to a global platform for science input into policy, initially through the IMoSEB (International Mechanism of Science Expertise on Biodiversity) and later through the IPBES process (Intergovernmental Platform on Biodiversity and Ecosystem Services). Specifically at

the European level the ALTER-Net has a lot to contribute to this platform and should become one of its main pillars.

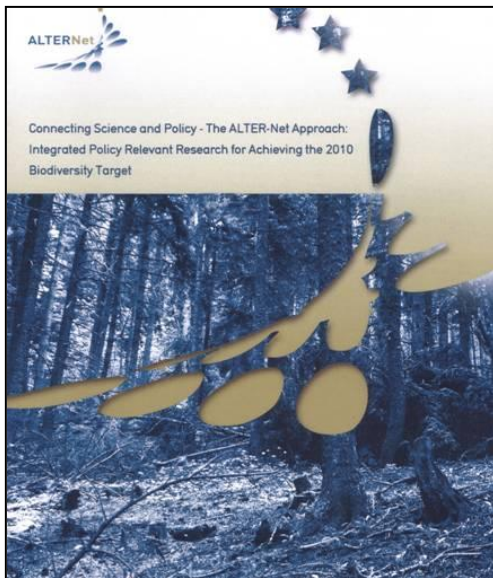
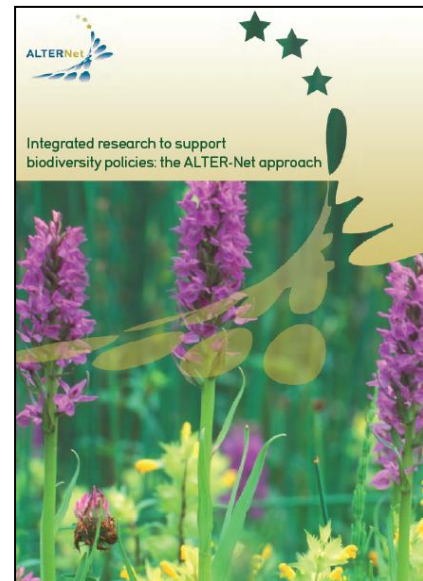


Figure 4. Cover of the ALTER-Net Brochure presented and distributed in the Conference on 'Environment for Europe', October 2007.



Cover of the ALTER-Net Brochure presented and distributed in the Athens Conference on 'Biodiversity protection beyond 2010', April 2009.

ALTER-Net's science-policy interface is still very much 'work in progress'. ALTER-Net will continue to develop its science policy interface over the coming years. It will do this through face-to-face discussions on emerging research and policy issues through ad hoc meetings of a 'Science Policy Interface Think-Tank'. These 'Think-Tanks' will enable ALTER-Net to coordinate its research in close collaboration with the stakeholders and will help ensure that new research results are fed into policy in a direct and timely way. ALTER-Net has also developed tools that will help provide more research knowledge in forms that are more directly accessible to policy and will continue to use and promote these. The tools include the 'Greenlink' experts database (see Section 4.1) and a new science policy journal 'INSPIREDD by Biodiversity Research'.

4.3 A science-policy journal for the communication of research findings

One of the biggest challenges in communicating science to policy is to be able to summarise research findings in a form that is accessible to non-specialist audiences, including policy makers. A tremendous amount of scientific information published in scientific journals is not used effectively because its significance to policy is never highlighted. One of the main reasons for this is that there is usually no strong incentive for research scientists to consider the policy implications of their work. ALTER-Net worked with a private publisher on an innovative science journal linking biodiversity research with policy. The result, "INSPIREDD by Biodiversity Research" (see www.inspiredd.info) is an electronic, peer reviewed, multi-disciplinary journal devoted to the translation of biodiversity related scientific knowledge towards governmental and non-governmental policy makers. The idea is that peer-reviewed research papers will be summarised and presented in a form that highlights their relevance to particular biodiversity related policy areas. Authorship will remain with the scientist so that due credit in the form of publications and citations will provide the incentive for scientists to contribute. "INSPIREDD by Biodiversity Research" is a peer reviewed journal. This makes it possible for the researcher to publish a new scientific article without doing additional research. The first issue should be published in late 2009.

4.4 An Interface with the Public through Science Visitor Centres

The protection and sustainable use of biodiversity requires public involvement. The public must therefore be informed and engaged in dialogue on the conservation and sustainable use of biodiversity. This requires research to understand the nature of the public response to information on biodiversity and the development of new and innovative ways of communicating science to the public. Although at the start of ALTER-Net there was an increasing emphasis in our organisations on promoting the public understanding of science there was a lack of connection with organisations having a specialist role in this field. To improve communication and to reach a greater number of people, ALTER-Net has:

- developed a partnership between scientists and science communication specialists – particularly those based in science visitor centres, museums, botanic gardens and other places that attract large numbers of visitors (i.e. through European network of science-based visitor centres (ECSITE));
- created a new computer system (operating over the Web and in public spaces) for engaging the public in biodiversity science-related issues (The “News and Views” tool); and
- devised and tested a new science communication training course specifically aimed at European biodiversity researchers wishing to communicate with public audiences.

One component of ALTER-Net’s communication framework is a new public communication tool: *News and Views*. It helps connect researchers with people, potentially engaging many people across Europe in current biodiversity issues. The system enables biodiversity topics based on contemporary European research to be presented to a wide public audience with relatively little effort from researchers. Not only can users learn about a range of topics but they can also express their views about the issues raised. Although a web-based system, *News and Views* has potential to be operated in public spaces such as science visitor centres. Interest in using it has been expressed by some visitor centres.



Figure 5. The “News and Views” welcome screen (www.alter-net.info)

The ALTER-Net *News and Views* system works via the Internet. It is easy for a researcher or a science communicator to create content (text, images and web links) which can then be presented to a large number of people. Accompanying guidelines assist scientists in producing content. Users can then find out about biodiversity issues and current research, express their views on issues, and learn about other people’s views. Topics currently being covered are:

- Blooming water
- Lichens – flags of distress
- Are biofuel crops bad for biodiversity?
- The Harlequin ladybird threat

ALTER-Net *News and Views* is available via the ALTER-Net website, www.alter-net.info.

4.5 ALTER-Net's Future Communication Strategy

ALTER-Net has developed a communication strategy that will be delivered using the components described above. It will also be framed by three main approaches to breaking down the barriers to effective communication: incentives, two-way interactions and training.

First, because scientists are often reluctant to spend time on activities that do not directly result in research publications, ALTER-Net is supplying mechanisms to ensure that scientists have incentives that encourage them to make their work more widely available. An example of this is the “the write once use many times” strategy shown in Figure 6 which shows a process by which a single research paper can be used as the source for all of ALTER-Net’s main communication tools to reach many audiences.

Secondly, ALTER-Net recognises that communication is two-way process that is often strongest when undertaken individual to individual. The “Greenlink” tool linking researchers to journalists and policy makers and the development of the Science-Policy Interface Think Tank are designed to encourage this level of interaction.

Thirdly, ALTER-Net is developing training that will help scientists to develop their science communication skills. These include training on drafting articles for the science-policy journal, a joint training course between ALTER-Net and ECSITE that will train scientists to conduct ‘live science’ (‘meet the scientist’) sessions in visitor centres and sessions in the ALTER-Net Summer School.

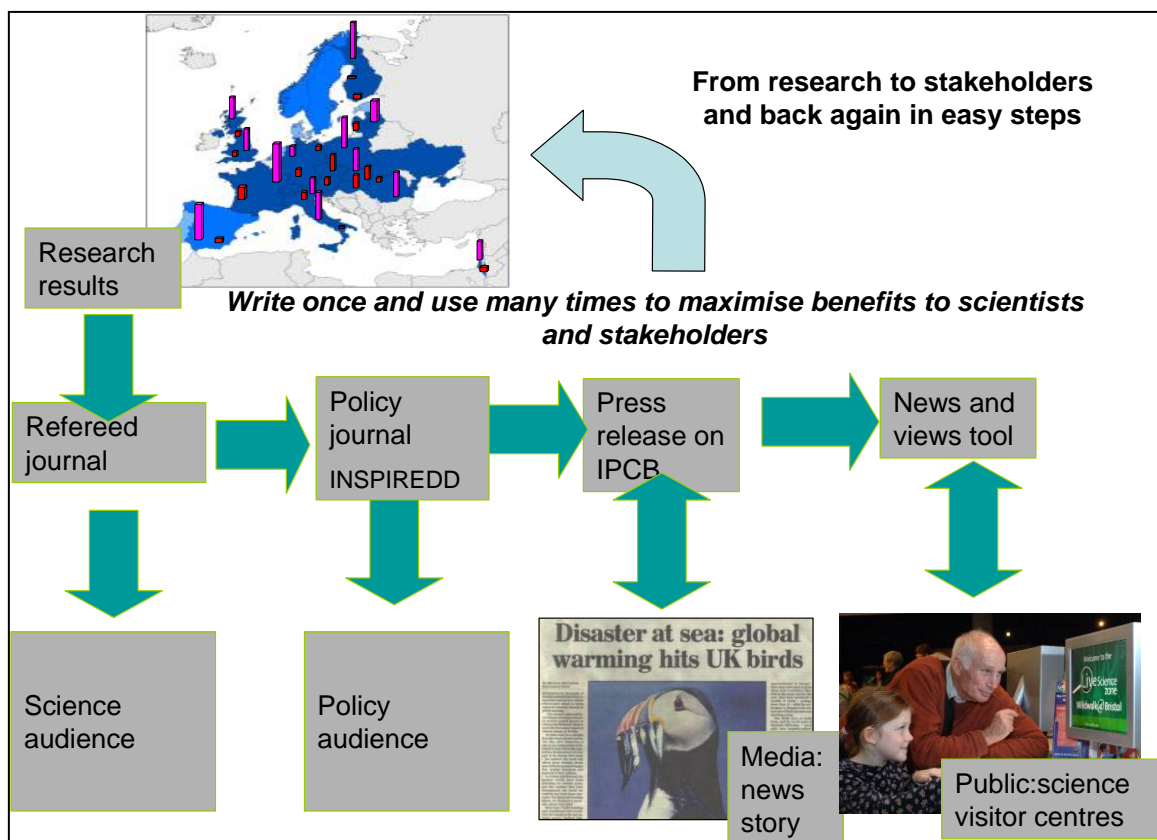


Figure 6. An example of how information from ALTER-Net partners will be used across different used to interact with different user groups.

5. Development of a European Network for long-term ecosystem and socio-ecological research

“Long-term ecosystem research” or LTER is an umbrella term for activities in the field of ecosystem and environmental research but it is also the name for formal LTER networks of research sites and scientists on national and continental levels composing the global LTER Network (ILTER, <http://www.ilternet.edu/>). LTER sites and networks address many contemporary environmental issues particularly climate change; sustainable development; biodiversity and its sustainable use; sustainable use of resources and ecosystem management (including water resource management); and environmental hazards and disasters.

Long-term approaches are required to understand the complex environmental and socio-economic processes that drive changes in ecosystems and the biodiversity they support. Such approaches should integrate the results of ongoing long-term observation and experimentation. Before the start of ALTER-Net many such programmes existed across Europe but these were poorly harmonised and survived precariously from year to year in research environments that generally favoured short-term projects. A major aim of ALTER-Net was to develop and support structures at national and international level to enable long-term ecosystem research to be done in co-ordinated and harmonised ways and to create a European network of long-term multi-functional, inter-disciplinary ecosystem research network of sites (LTER) to investigate long-term biodiversity processes at relevant spatial and temporal scales.

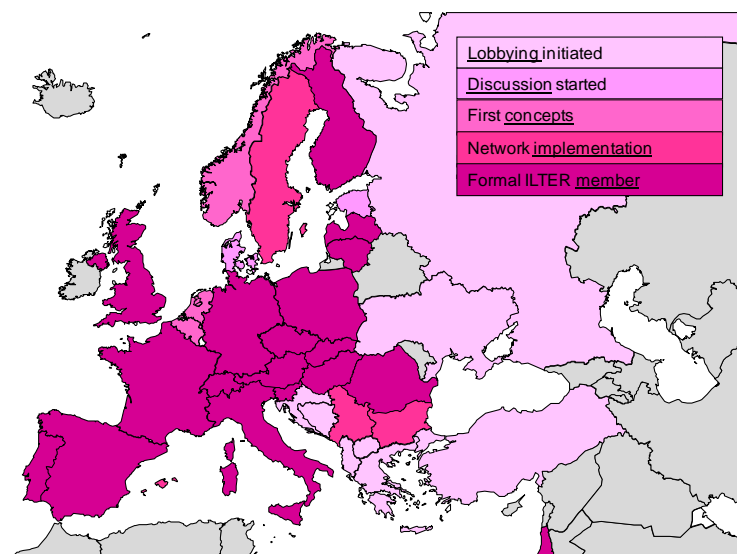


Figure 7. Status of National LTER-Networks in Europe (September 2008)

Before ALTER-Net, LTER in Europe was distributed in just 7 countries divided between Western and Central and Eastern European Network. It had no strategic objectives or role. From this modest position, ALTER-Net has helped to create:

- A Single European Network of National Networks: 18 national LTER networks are formal members of LTER-Europe (Figure 7.) and the global International Long-term Ecological Research Network (ILTER). About 10 other countries are also developing LTER programmes.
- A Network of LTER Sites: LTER Europe has over 400 LTER sites. These serve as open field laboratories for traditional long-term ecosystem research exploring the functioning of ecosystems and the main pressures on them.

- A Network of LTSER Platforms: Long-term Socio-ecological Research platforms (LTSER) have been developed as hot-spot areas for socio-ecological research and large-scale integrated ecosystem assessments. More than 20 LTSER platforms have been established.
- A sampling framework based on a framework of European socio-ecological regions. This classification of LTER-SER regions based on 12 environmental zones and 9 socio-economic zones is being used to assess the capability of the existing network and identify gaps that may need to be filled.
- A Network of Institutions: about 100 European institutions in 38 countries have LTER activities, staff or act as stakeholders for LTER.
- A Network of Scientists: currently about 500 scientists contribute directly to LTER-Europe, although far more are engaged in projects on LTER sites or using LTER data.
- A Network of disciplines: LTER-Europe is a multi-functional in-situ research network which provides processes for structuring a distributed infrastructure and inter-disciplinary research community that makes use of it. LTER-Europe scientists and stakeholders cover all natural science disciplines as well as sociology, economics, history, information technology and others.
- A Network of data and metadata: LTER-Europe's data have been gathered at sites over a long period – frequently over 50 years. Metadata have been collected on sites describing facilities, activities, measurements and available datasets (LTER Infobase). Also, a core ontology for ecological observations as been developed (SERONTO) which will form a basis for future inter-operability between data-sets.
- Part of a network of European networks: LTER-Europe has become the freshwater and terrestrial component in the ESFRI Lifewatch Infrastructure programme which aims to establish a distributed European infrastructure supplying biodiversity and ecosystems related data and information. LTER-Europe is closely linked with all major European monitoring and research schemes that will be needed to form part of this infrastructure.
- A process for integrating long-term research activity: under the auspices of ALTER-Net, LTER-Europe was integrated into a range of European and national environmental monitoring schemes and nature conservation measures such as the UNECE International Co-operative Programme, the UNESCO Biosphere Reserves and Natura 2000 concerning their site networks, databases and overlaps with environmental research. It has become a key element in re-structuring the European Research Area in relation to ecosystem research (Figure 7). LTER-Europe has also developed an inter-disciplinary science strategy and research agenda in collaboration with related international and national networks like ILTER, Diversitas and the US-LTER.Network.
- A communication strategy for maximising the public communication potential of data and information from LTER sites and networks.
- Progress towards harmonisation of measurements. Harmonisation of measurements is one of the most important aims of LTER-networking. The adoption of more consistent approaches to measurement greatly increases the comparability of data and the capability of the network to synthesise data and interpret patterns of change. In 2008 LTER-Europe agreed a set priority measurements. It has reviewed existing LTER measurement protocols and work has been completed on developing new methods and protocols in some new areas including:
 - (i) standard approaches to assessing drivers and pressures;
 - (ii) quantitative measures for assessing public attitudes; and
 - (iii) methods of assessing invasive species.
- Proof of concept: Case studies have been completed to demonstrate how the LTER-Europe network data and infrastructure can be used to provide European-scale outputs. They were aimed at delivering European scale research outputs and providing major demonstrations of research collaboration and data sharing in LTER-Europe. They included:

- (i) reviews and analyses of data from European lakes to investigate the influence of climate change on aquatic ecosystems;
- (ii) meta-analyses using historical data to test theories of community structure and ecosystem resilience;
- (iii) vegetation assessment in 2008 to provide a baseline for a comparison of trends across sites; and
- (iv) a pan-European experiment on the resilience of ecosystems to trampling pressure (Section 5.1).

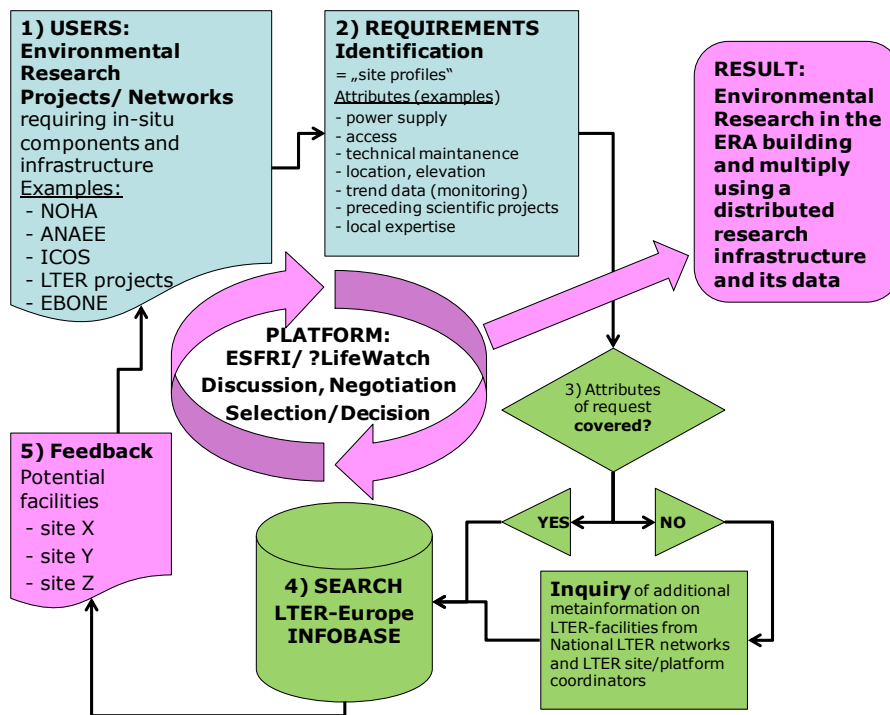


Figure 7. LTER-Europe's role in the optimization and multiple use of in-situ components for environmental research in the European Research Area.

5.1 Multi-site experiment on a European transect: the impact of human disturbance on vegetation

Multi-site research activities across different countries have a high potential for providing novel results. The pan-European Multi-site Experiment (MSE) was set up within ALTER-Net to explore the feasibility of using the LTER network of sites for such an experiment, bringing together 16 partners and 40 sites (Figure 8). There are many benefits of using the LTER site network for a multi-site experiment including:

- Powerful new data: Common experimental data from multiple sites across Europe facilitates robust hypothesis-testing over wide gradients (climate, habitats, management approaches, etc.). This contrasts with the usual difficulties of post-hoc collations and comparisons of data from different origin, originally gathered for different purposes, which generally suffer from poorly harmonized methodology and timing of data collection.
- Cost-benefit-ratio: Using existing networks with good working relationships and existing networks of sites minimizes the efforts required to establish a new project, facilitating site selection and experimental implementation in a stable and efficient way. The financial impacts

and workloads for each partner are much lower than would be the case for a similarly powerful single-site/single partner experiment.

- Standardized protocols: a common experiment is a valuable exercise in which to identify key issues to be considered in designing standardized protocols for easy replication across different countries.
- Training and exchange: Multi-site and multi-partner research promotes integration and exchange of ideas and methods, having mutually-beneficial ‘training’ effects on a large scale.

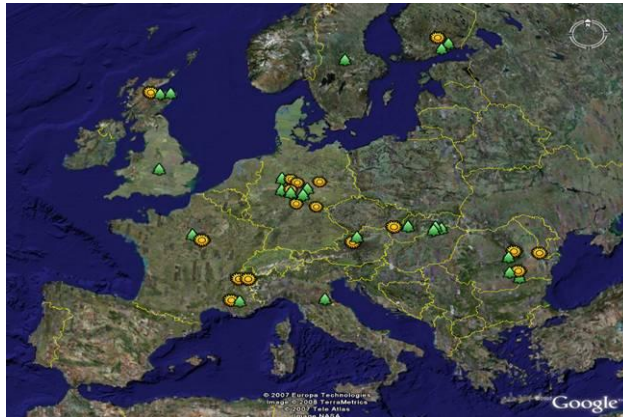


Figure 8. Location of grassland (orange symbols) and forest (green symbols) sites used in the multi-site trampling experiment.

The experiment examined the impacts of a simple pressure (trampling) on two types of vegetation across Europe. The experiment was designed to test whether ecosystems differed in their response to trampling and whether that response showed a latitudinal gradient. Results were analysed in relation to three key indicators of ecosystem function:

- a resistance index indicating the ability of plant communities to withstand the initial disturbance of trampling.
- a tolerance index showing the similarity between the vegetation before and some time after trampling.
- a resilience index estimating the ability of the system to recover.

The experiment provided both the institutional and analytical framework required to undertake more ambitious pan-European experiments on other pressures such as climate change, atmospheric pollution and invasive species.

6. The Harmonisation and Delivery of Data and Information Challenge

At the start of ALTER-Net sources of data, information and knowledge from LTER sites were poorly harmonised, dispersed and difficult to assimilate into the information and knowledge required to inform public and policy responses in relation to biodiversity. New ways of linking up distributed data bases were becoming available and the challenge was to develop a framework that would enable the exchange of data and information, both within the research community and with outside users in public and policy communities.

6.1 Discovery of LTER Sites: Infobase

ALTER-Net has developed a data and information management framework to improve the management, discovery and accessibility of data from LTER sites. As part of this framework, a system called InfoBase was developed to serve as the meta-data system for the European network of biodiversity and ecosystem research sites. It also has the flexibility to deal with the complexity of data

collected at different levels from plots to landscapes and can deal with socio-economic data required in LTSEr facilities. Alongside the development of Infobase there was also a campaign of training site representatives to check and enter new information about their sites into the database was started. The LTER Europe InfoBase is now available online to member networks through the eMORIS site at <https://secure.umweltbundesamt.at/eMORIS/>. There are two main user groups for the LTER InfoBase:

- The scientific user – who checks for the availability of data. He/she is interested in the compartments investigated and the measurements taken.
- The policy user – who checks for the available sites for the planning of research projects to ensure a targeted research

6.2 Towards inter-operability of biodiversity and ecosystem data from LTER sites (SERONTO)

ALTER-Net and LTER Europe and other ecologists need to share biodiversity and ecosystem research data. To be able to do this efficiently a single point of access for distributed data is required and this must be built on a common set of concepts for the description of data. An ontological framework has also been developed which will allow further extensions of Infobase to drill down to site data, using the same ontological approach and semantic data networking now in place for site metadata. The framework will support harmonization between network partners and the further development of domain ontologies and tools which should eventually lead to selected data becoming available online.

SERONTO has been developed as a new approach to deal with the problem of integrating data from distributed data sources stored and collected at different locations within the European Union. SERONTO aims to facilitate meta-analysis, data mining, and data presentation across a wide variety of datasets collected for different purposes. SERONTO consists of a core ontology accompanied by (research) domain specific ontologies. The SERONTO core ontology describes the fundamental concepts, relationships and structure. The domain specific ontologies (e.g. species, geography, water, vegetation) extend these concepts, relationships for their specific needs and requirements.

6.3 LifeWatch: an “e-Science and Technology Infrastructure for biodiversity data and observatories”

An ultimate goal for environmental science is to create a single system providing access to all forms of data necessary to address research and policy needs. As a next step towards this ALTER-Net has worked with other FP6 Networks of Excellence (MARBEF, EDIT and others) in the development of a large scale research infrastructure under ESFRI (the European Strategy for Research Infrastructures). LifeWatch aims to put in place the essential infrastructure and information systems necessary to collate data on biodiversity and ecosystems and distribute this information with analytical and modelling capabilities to the scientific community and to other users in the public, commerce, and policy sectors.

In 2007 the “LifeWatch” partnership was successful in winning EC funding for its preparatory phase during which it will develop its governance, business and implementation plans. Since then, ALTER-Net has continued to contribute to the ongoing design stage of LifeWatch through its development of the LTSEr–Europe Network, informatics developments and through support of national LifeWatch initiatives (e.g. in Norway, Sweden, Hungary and Denmark). If this preparatory stage is successful then the construction phase could begin in 2011.

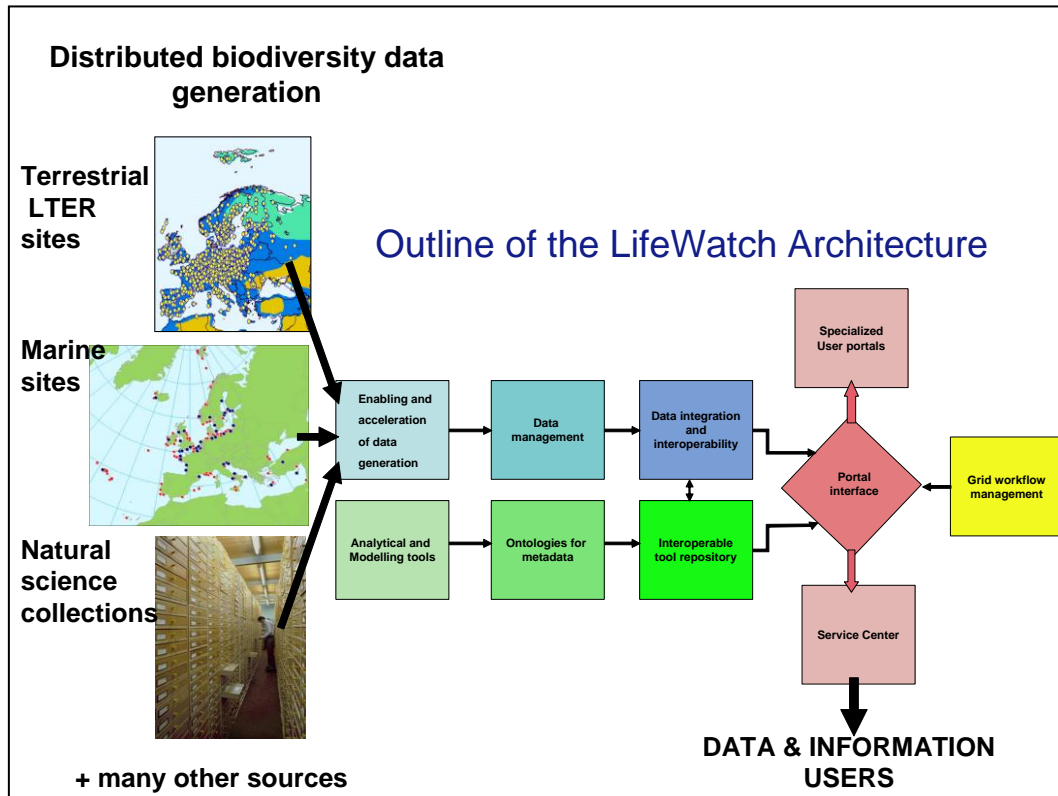


Figure 9. ALTER-Net is contributing to a major biodiversity research infrastructure plan for Europe: LifeWatch. LifeWatch has now moved into its preparatory phase.

7. Progress towards durable inter-disciplinary research

Biodiversity issues are complex in nature and it is no longer appropriate to consider ecosystem dynamics and biodiversity in isolation from society. The principle challenge faced by ALTER-Net was to develop institutional mechanisms and a strong research community to integrate ecological and socio-economic approaches to biodiversity and ecosystem research. ALTER-Net tackled this by:

- a) building a framework for an inter-disciplinary research community;
- b) strengthening social science methodologies;
- c) developing modelling approaches; and
- d) delivering case studies addressing issues of societal relevance.

7.1 A framework for an inter-disciplinary research community

ALTER-Net has established an inter-disciplinary research community with formal agreements and processes bringing together over 400 scientists from environmental, social science, communication and policy related disciplines. At the heart of these processes is an interdisciplinary research framework (Figure 10) for providing syntheses of current knowledge and identifying research needs. The approach offers the European biodiversity research community a broad framework for knowledge production which captures novel signals by bringing researchers, research users and other stakeholders together to contribute. The framework includes a collaborative process where researchers, decision makers and funding agencies identify issues with the most urgent need for an integrated assessment. Through this framework, decision makers can quickly receive a clear picture and a broad understanding of a complex, policy-relevant issue and of the challenges it poses to various policies and management practices.

The framework was tested in a case study on bioenergy–biodiversity interlinkages which asked where and how biomass resources could be cropped and/or harvested without compromising biodiversity, and what the main knowledge gaps are that future research should address. The test showed that the framework worked in practice and that its value, according to the stakeholders, was in its potential to bring various experts and stakeholders together to pool their knowledge, produce interdisciplinary syntheses of scattered knowledge in a cost-effective way, and generate sophisticated research questions based on knowledge needs.

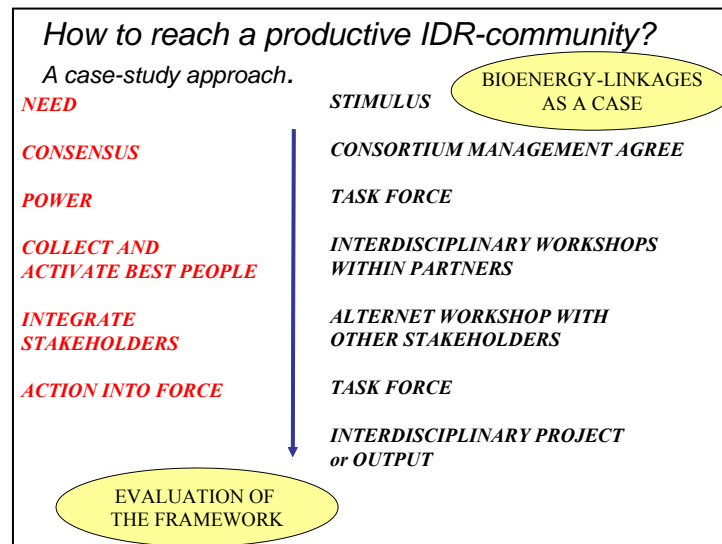


Figure 10. Framework for developing an inter-disciplinary research community

7.2 Strengthening social science methodologies

ALTER-Net has developed a set of common tools and approaches designed to facilitate more consistent and powerful approaches to inter-disciplinary biodiversity research. These included a suite of tools for providing qualitative or quantitative data on some of the key components in the Driver-Pressure-State-Impact-Response (DPSIR) framework including tools for prioritising socio-economic drivers and methods for assessing public attitudes and awareness.

7.2.1 Understanding what biological diversity means to people

To improve biodiversity management, we need to better understand what biodiversity means to people. What do they value about diversity in their natural environment? What changes do they perceive? How is knowledge about biodiversity generated and by whom?

In order to address these questions, ALTER-Net has developed, tested and applied large-scale approaches to better understand public views on biodiversity changes and management, and the ways in which biodiversity knowledge is produced. Previous studies on public understanding of biodiversity have tended to compare respondents' definitions with scientific definitions, and have consequently often disqualified lay opinions on the basis that they were incompatible with the scientific understanding of biodiversity. Rather than assess whether lay definitions of biodiversity were 'right' or 'wrong' in relation to the scientific terminology, ALTER-Net aimed to gain a broader understanding of the views on biodiversity held by the public.

Using deliberative techniques such as focus-group discussions with a wide range of members of the general public, including tourists, local residents, foresters and farmers, we explored people's views on biological diversity in six different sites across Europe. We found that participants expressed rich concepts of biodiversity despite many being unaware of its scientific definition. They embedded their

ideas of biodiversity in the context of notions such as food chains and balance in nature. The participants' statements not only revealed how individuals linked different concepts together, but also what aspects they valued. Their depth and diversity need to be better understood and acknowledged to address biodiversity management issues in a sustainable way.

ALTER-Net also developed a common quantitative approach which can be applied in different contexts all over Europe to gain a detailed overview of public perceptions of biodiversity change, and to obtain indicators of public concern. To test the approach, in eight sites across Europe we investigated public perceptions of, and concern about, changes in species and habitats, and also attitudes towards management approaches and trust in organizations. Across most sites, the majority of our respondents expressed strong concern about global biodiversity loss. At the local level, in contrast, many had observed not only species loss, but also the recovery of species that were previously under pressure. Generally, species that were seen as harmless, valuable and as previously decreasing were those for which a future increase was considered most desirable. A species' perceived nativeness, vulnerability, rarity and attractiveness played only a minor role in informing attitudes towards species. These attitudes were found to be closely linked to respondents' more general world views. Again, people's perceptions of biodiversity change were by no means formulated ad hoc and thus volatile, but embedded in their world views, their beliefs and values – a result that goes far beyond the usual findings of opinion polls. The work aimed to make the values and beliefs that people use to make decisions about biodiversity management more transparent.

By stimulating the consideration of social aspects of the idea 'biodiversity', biodiversity management and policy, the work contributes to a more successful implementation and social sustainability of biodiversity policies. The method could now be used to derive indicators of public concern and opinion (e.g., in the context of the SEBI initiative), or as a basis for long-term studies. Interest in this instrument has already been expressed also by researchers external to ALTER-Net.



Figure 11. *What do you think is going on around here? Use of fuzzy cognitive modelling to analyse stakeholder views.*

7.3 Inter-disciplinary modelling approaches

To halt the decline of biodiversity it is necessary to understand the processes leading to species loss and to discover the root causes driving these processes. This calls for an interdisciplinary research effort and the use of advanced tools for analysis and modelling. Research in ALTER-Net has explored the use of models to analyse complex systems and develop tools for decision support.

7.3.1 Soft models – use of conceptual frameworks

The development of soft or conceptual models in ALTER-Net is largely based on the use of fuzzy cognitive maps (FCM). The purpose of an FCM is to capture and map the belief system of an expert or a stakeholder for a given area and they are well suited to represent relatively unstructured knowledge and causalities expressed in imprecise terms. The FCM also lets us predict how complex situations may evolve if we change some of the initial concept states, add concepts or change the causal links between them and thus verify assumptions against empiric data. An important quality of FCMs is that they handle feed-back which is prominent feature of most real-world systems.

Cognitive mapping methods have been developed and tested by ALTER-Net as a tool for participatory model development. A number of case studies (e.g. in Biosphere Reserves) have been conducted to study possible differences between local perceptions of biodiversity conservation and the scientific view based on input from various stakeholders (users, managers, administrators, etc.). Such process studies are aimed at providing information for conservation planning regarding local perceptions of biodiversity and its management. The process provided a graphic overview of a complex system and contributed to an understanding of other participant's perceptions, values and viewpoints and opened-up a dialogue between participants to help create a common understanding of the system. FCMs have the potential to help creating a culture for participation which may strengthen future public participation in an area.

FCMs also provide a basis for synthesising expert and local knowledge on a European scale and providing a more general understanding of socio-ecological processes and their consequences in, for instance, biosphere reserves and LTSER sites. The FCM approach is now being used to undertake comparative studies across European LTER sites.

7.3.2 Inter-disciplinary computer simulated socio-ecological model based on DPSIR framework

Effective policies to slow the rate of anthropogenic biodiversity loss should reduce socio-economic pressures on biodiversity, either directly or by modifying their underlying socio-economic driving forces. The design of such policies is currently hampered by the limited understanding of socio-economic drivers of and pressures on biodiversity as well as by lacking data, indicators and models.

In order to improve understanding of these issues ALTER-Net developed a conceptual model of socio-economic biodiversity drivers and pressures. The model is based on the DPSIR framework and on the socio-economic metabolism approach (Figure 12). The applicability of the model as well as data availability and research needs was then examined in three European Long-Term Socio-Ecological Research (LTSER) platforms (located in rural areas of the Danube Delta Wetland System in Romania, the Doñana reserve area in Spain and the Eisenwurzen region in Austria).

One aim of the model was to guide research aimed at improving our understanding of socio-economic biodiversity pressures and drivers and to serve as a basis for the development of formal, quantitative models in that field. The case studies identify those actor groups that are responsible for land-use change in the respective rural areas such as farmers, forest agencies, municipal administration and industry. In addition, the definition of framework conditions like agricultural subsidies, agricultural product prices etc. are crucial in order to describe different scenarios of changing framework conditions and their effect on stakeholder decisions concerning land-use. Although these simulation models are simple, they offer a first feasibility test and provide a first attempt on an integrated and formalized analysis of drivers, pressures on land-use and consequently on biodiversity. The analysis of the case studies underlines the potential utility of the conceptual model to guide future research into socio-economic biodiversity drivers and pressures. However, further investments in monitoring and reconstruction of past trajectories and in model development will be required before elaborate mathematical (computer) models of the interrelation processes between society and ecosystems can be more successfully used.

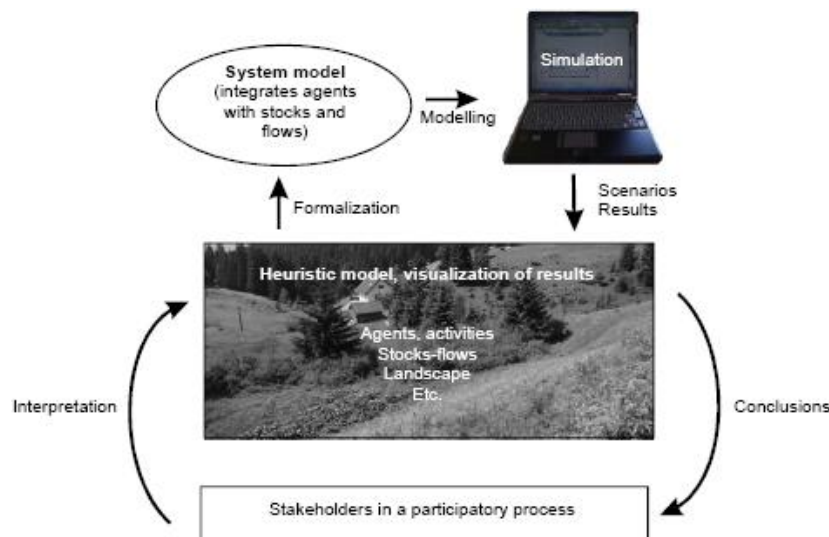


Figure 12. *The process of developing the DPSIR model with stakeholders*

7.4 Applications and outcomes from inter-disciplinary research

The approaches to inter-disciplinary research in ALTER-Net and their use by partners and in LTSER site network across Europe are beginning to produce joint research outputs of relevance to the conservation and sustainable use of biodiversity. Some examples of this work are given below.

7.4.1 Biodiversity conservation in Natura 2000 sites

The protected areas across Europe making up the Natura 2000 (N2000) network lie at the heart of the European Union's strategy to halt biodiversity loss in Europe by 2010. Research and development is needed to support the N2000 network, respond to international agreements and Conventions and deliver actions foreseen in the “Communication from the Commission on halting biodiversity loss”. For instance, this may include examining the coherence and connectivity of the network, its overall effectiveness and developing techniques to enable the combined impacts of future environmental change (e.g. climate change) and sectoral policy scenarios on biodiversity in NATURA 2000 sites.

Many of ALTER-Net’s research and monitoring activities are relevant to the N2000 network (Figure 13). For example, we analysed the cost-effectiveness of management measures in Natura 2000 sites in four countries (Finland, Germany, Poland and the Netherlands). Policy recommendations resulting from this included: the need to guarantee the availability of funds for longer periods; to design administrative procedures in a way that avoids overlapping institutional competencies; and an appropriate allocation of funds between designing and writing management plans and carrying out measures in the field. Management options for payment schemes were also identified.

Secondly, we developed a methodology to identify knowledge needs of conservation management in Natura 2000 areas and in larger and more complex landscapes. The FCM methodology was used to identify the causality among different factors in a landscape, and gain a deeper understanding of the challenges faced by the management. In 6 case studies in Spain, Romania, Austria, Poland, Denmark and Finland, individual and group sessions were conducted to reveal and produce conceptual descriptions of the area. Analyses of the FCMs provided valuable information for decision makers when searching for means which would most efficiently enhance the management in reaching its goals.

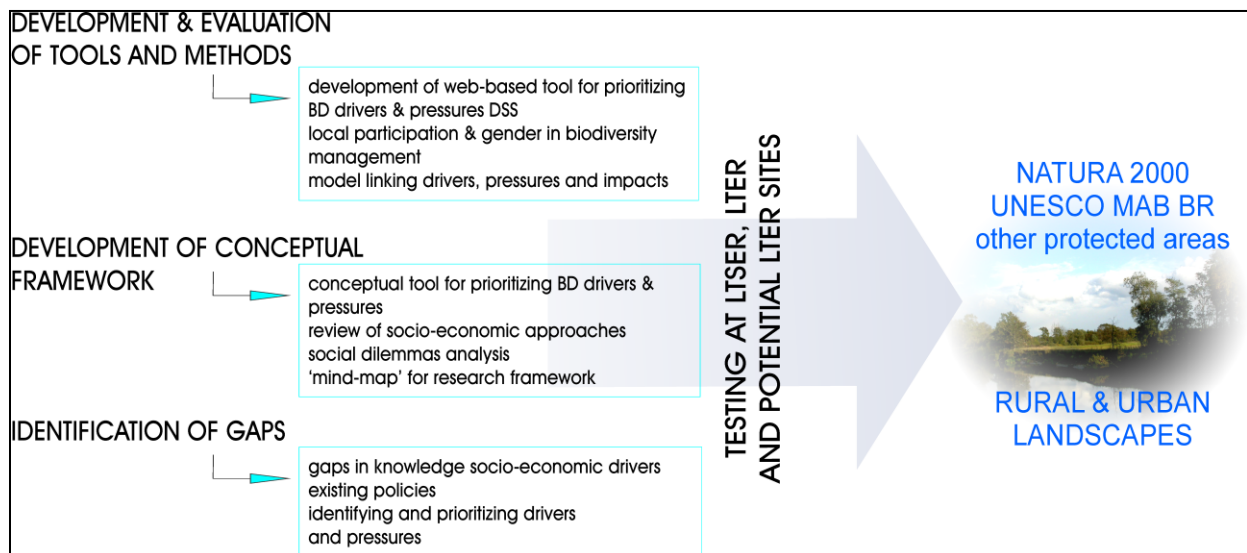


Figure 13. Relevance of ALTER-Net research to the management of Natura 2000 Network

The third area of work is about new approaches to nature management in European regions. Seventy percent of all habitats as well as species diversity in Europe is found in farmed and previously farmed areas. Biodiversity is still decreasing in semi-natural protected areas including the Natura 2000 network (such as heath and grassland habitats) due to either lack of traditional management or abandonment in low populated regions. ALTER-Net has produced a book on “*Crossing Borders*” which describes options to counteract these changes by the introduction of multi-functional land management systems which focus on the provision of ecosystem, cultural and landscape services, providing also new opportunities for farmers and low input farming systems. The book addresses three domains which hamper expansion of the modulation options in the Common Agricultural Policy. The first part is about the various wrong mindsets which prevent to believe that multifunctional land management can provide solutions; the second part provides examples of multifunctional farming already work in practice backed by scientific models, including those developed in the ALTER-Net and the third part presents 3 policy relevant position papers are provided by a Rural European platform in which regional policy makers, farmers and science are cooperating. The “*Crossing Borders*” book will be published in 2009.

7.4.2 Status and trends in biodiversity in N2000 sites

Many sites in the LTER network are also Natura 2000 sites. The long-term observations made at these sites provide evidence of the changes in biodiversity and the main pressures driving these changes. In particular, it is expected that future changes in climate will have a significant effect on the ecology and that this could make the legal requirements of “favourable conservation status” impossible to achieve. However, the definitive observational evidence for assessing past and future climate change impacts on N2000 sites is currently lacking. Programmes of research and monitoring being undertaken through the LTER-Europe network will provide part of the evidence base needed for future policy development in relation to achievable targets for the N2000 network.

7.4.3 Biodiversity conservation options: research underpinning decision support systems and management tools

An analysis on cost-effectiveness in Natura2000 gives many practical suggestions to enhance the conservation of biodiversity. A book was published (in Dutch) on the social and economic benefits of biodiversity management in the largest Dutch nature reserve (also National Landscape) the Veluwe. In addition, a series of research projects was started to explore new issues. These included: benefits of biodiversity and public awareness, ecological adaptation and climate change, and the role of bioenergy in biodiversity conservation and countryside economics. Many of these studies began to make use of

the LTSER platforms in which the social and economic benefits of existing natural ecosystems and their biodiversity are monitored and analysed to support the development of understanding and wise use of ecosystems at the regional level.

7.4.4 Drivers of change in N2000 Sites and the wider countryside

ALTER-Net has developed conceptual frameworks and methods for understanding and forecasting biodiversity change at sites with differing anthropogenic pressures. These can deliver products which could be used at different spatial-temporal scales and with regard to locally identified and prioritized drivers and pressures. For example, the tool for characterizing and prioritizing drivers and pressures is applicable to protected areas. It allows decision making with regard to risk, costs and probability of occurrence of a certain impact.

The management of N2000 sites will also be supported through indicators reflecting the influence of drivers and pressures on these ecosystems. The development of such indicators was considered in an ALTER-Net project on indicators to monitor changes and conservation in “*N2000 sites: A focus on drivers, pressures and states*”.

Impacts of land abandonment and woody colonisation

Changes in Europe’s traditional agricultural systems in the past decades have led to widespread abandonment and woody colonisation of various habitats. As part of work designed to synthesise information across the network, we combined several large-scale vegetation databases from six regions across Europe to test whether patterns of plant diversity changes after land abandonment in different habitats in Europe followed similar trajectories. Semi-natural habitats and former intensively used arable fields were included.

Abandonment of agro-pastoral land use and subsequent woody colonisation were associated with profound changes in floristic composition, although succession occurred along a broadly predictable trajectory of succession. Plant richness varied according to the different habitats and successional stages, but semi-natural habitats differed from arable fields in several ecological traits and vegetation responses. The vegetation of the abandoned arable fields was characterised by a decreasing abundance of R-strategists, annuals, plants reproducing by seeds with overwintering green leaves, insect-pollinated plants with a hemi-rosette morphology and plants of nutrient-rich conditions, but an increase in numbers of protected species. Conversely, changes in plant traits with succession within the initially open, semi-natural habitats showed an increase in plants of nutrient-rich conditions, stress-tolerant plants and plants with sexual and vegetative reproduction, but a sharp decrease in protected species. This study shows a set of similarities in the vegetation and plant trait responses after land abandonment, but also highlights differences between arable fields and semi-natural habitats with succession, emphasising the importance of land use legacy.

Impacts of declines in forest management

Past and present pressures on forest resources have led to a drastic decrease in the surface area of unmanaged forests in Europe. Changes in forest structure, composition and dynamics inevitably lead to changes in the biodiversity of forest-dwelling species. But does biodiversity differ between managed and unmanaged forests? However, the possible biodiversity gains and losses due to forest management, i.e. anthropogenic pressures related to direct forest resource use, have never been assessed at a pan-European scale. We used meta-analysis to review 49 published papers containing 120 individual comparisons of species richness between unmanaged and managed forests throughout Europe. We explored the response of different taxonomic groups and the variability of their response with respect to time since abandonment and type of forest management.

Species richness was slightly higher in unmanaged than in managed forests. Species dependent on forest cover continuity, deadwood and large trees – bryophytes, lichens, fungi and saproxylic beetles – and carabids were negatively affected by forest management. In contrast, vascular plant species were favoured. The response for birds was heterogeneous and probably depended more on factors such as landscape patterns. The global difference in species richness between unmanaged and managed forests increased with time since abandonment and indicated a gradual recovery of biodiversity. Plantations with tree species change had the stronger effect on species richness, but the effects of different types of management on taxa could not be assessed in a robust way due to low numbers of replications in the forest management classes.

In conclusion, our results show that some taxa are more affected by forestry than others, but we also highlight the need for research into poorly-studied species groups in Europe or specific locations. Our meta-analysis supports the need for a coordinated European research network to study and monitor the biodiversity of different taxa in managed and unmanaged forests.

7.4.5 Biofuels

In December 2008, the European Parliament accepted the Directive proposed by the European Commission on the promotion of the use of energy from renewable sources. It sets an overall binding target of 20% renewable energy to be reached by 2020 and a 10% target for biofuels in total transport fuel consumption. The pilot study used in the development of the inter-disciplinary research framework (see Section 6.1), gave rise to number of specific research questions which were evaluated in more detail. One of these was on the question “can we use biomass from farmland, abandoned land, forests and nature conservation areas in synergy with biodiversity conservation?”

7.4.6 Bioenergy, climate change and biodiversity

Two studies were initiated in work package which looked at the climate change and energy policy issue. The first meta-analysis looked at the impacts of climate change on species distribution showing how species appear to be on the move. The second study examines the potential consequences of the biofuel policies of the EU for biodiversity.

7.4.7 The Economics of Ecosystem and Biodiversity (TEEB)

Following a political initiative by the German government under its EU presidency to examine more closely the economic consequences of biodiversity loss, a series of research activities were developed, starting in 2007, in which ALTER-Net partners Alterra and UFZ played leading roles. The ambitions of the so called TEEB (The Economics of Ecosystem and Biodiversity) project coincided very well with the objectives of ALTER-Net’s inter-disciplinary approach. A workshop was therefore organised in early 2009, in which ALTER-Net partners were invited to bring their experience in the area of TEEB to the table. The results of the workshop have been the basis for a special session at the ALTER-Net final conference in Leipzig, March, 2009 and will now be used to make an input to the TEEB publications.

8. ALTER-Net’s policy context and growing relevance

The main policy requirements underpinning the work of ALTER-Net at the start of its programme of work in 2004 were related to:

- The EC’s legal obligation to protect wildlife in designated sites and the wider countryside (*EU Biodiversity Strategy, EU BAPs, Habitats Directive and Birds Directive*).
- The European commitment to ... “Protect and restore habitats and natural systems and halt the loss of biodiversity by 2010” (*EU Strategy for Sustainable Development (Goteborg 2001), Johannesburg Summit on Sustainable Development (2002)*).
- The European and Global agreement on the principles of the ecosystem approach and the sustainable use of biodiversity (*UN Convention on Biological Diversity*)

- *Communication from the Commission: halting the loss of biodiversity by 2010 – and beyond. (COM(2006)216).*

Research knowledge generated by the ALTER-Net partnership continues to be used to inform work related to the UN Conventions through Technical Expert Groups. For example the UNFCCC (Climate Change Convention) and the Convention on Biological Diversity make use of published work on the integration of the conservation and sustainable use of biodiversity into climate change mitigation and adaptation activities.

ALTER-Net’s flexibility and potential is demonstrated by the fact that its work on the development of a European LTER Network and associated inter-disciplinary research puts it into a unique position to provide data and research knowledge in relation to policy initiatives that have developed or expanded since the project began in 2004 (Table 2). This includes contributions to the delivery of a European component of the Global Biodiversity Observation Network, (part of the GEO/GEOSS programme), planning for a future European Ecosystem Assessment, recent EC Green Papers on “European Adaptation to Climate Change” and “Towards a Shared Environmental Information System”. Most recently ALTER-Net has contributed to the TEEB process (The Economics of Biodiversity and Ecosystems).

Table 2. Major new policy areas addressed by ALTER-Net.		
Date	Policy Area	Major ALTER-Net Research Contributions
2006	Halting the Loss of Biodiversity by 2010 and beyond (communication from the Commission)	<ul style="list-style-type: none"> - research and data on CBD indicators and their interpretation - workshop and paper on aggregating indicators for policy purposes - use of LTSER sites to investigate responses and effectiveness of policy measures
2007	GEO/Global Earth Observation System of Systems (G8 commitment) and the Global Biodiversity Observation Network.	<ul style="list-style-type: none"> - LTER-Europe as in-situ data component - InfoBase as contribution to improved data accessibility and inter-operability - LifeWatch biodiversity research infrastructure
2007	Millennium and European Ecosystem Assessments (EEA/Eureca)	<ul style="list-style-type: none"> - use of LTER sites for data on changes in ecosystem services - use of LTER and LTSER Networks to investigate relationships between biodiversity and ecosystem services
2007	Towards a Shared Environmental Information System (EEA & EC Green Paper)	<ul style="list-style-type: none"> - Infobase to provide meta-data and data on biodiversity and ecosystems
2007	European Adaptation to Climate Change (EC Green Paper)	<ul style="list-style-type: none"> - use of LTER network to detect and interpret climate change impacts - use of LTER sites as demonstration sites for adaptation measures
2008	The Economics of Biodiversity and Ecosystems (TEEB)	<ul style="list-style-type: none"> - case study examples of ecosystem service mapping and examples from LTSER sites of valuation of ecosystem services.

9. In conclusion

“Networks of Excellence” were new instruments developed in Framework Programme VI to strengthen European Research capacity. Did they work and has ALTER-Net succeeded in doing this? The overview of some of the achievements of ALTER-Net in this report provide some good indications of success but there are three additional questions that need to be answered before we can reach a definite conclusion:

- is ALTER-Net succeeding in spreading excellence?
- is the network successfully integrating biodiversity and ecosystem research ?
- is ALTER-Net durable?

9.1 *Is ALTER-Net succeeding in spreading excellence?*

One of the main purposes of any Network of Excellence is to share and spread research excellence and to contribute to training the next generation of men and women that will be responsible for research, policy, management and communication activities relevant to biodiversity.

Within all of ALTER-Net's work there was a strong emphasis on sharing best practice and experience. ALTER-Net's "Mobility Scheme" was used to promote staff exchanges between partners by funding short exchange visits to assist with the development of joint approaches and encourage exchange of information about partner organisations. Many of the tools and applications developed in ALTER-Net will also continue to have a role in the spread of excellence particularly in relation to knowledge transfer. For instance, the new journal "*INSPIREDD by Biodiversity Research*", *Greenlink* and the International Press Centre for Biodiversity will all continue to be used to communicate the results of biodiversity research carried out within and outside the ALTER-Net network and to encourage the application of good research.

ALTER-Net's main approach to the spread of excellence was through formal training events. Most of these training events will continue in future years.

9.1.1. Training on inter-disciplinary research: the ALTER-Net Summer School 2006, 2007, 2008, 2009 et seq

As its main training activity, ALTER-Net has organised three Summer Schools on themes around the topic 'biodiversity and ecosystem services'. These two-week schools took place in the village of Peyresq, Alpes de Haute-Provence, France, in facilities owned by a Belgian foundation dedicated to European culture and science.

The specific objective of the Summer Schools was to contribute to the integration and spread of excellence both within and beyond ALTER-Net, with a strong view to developing and promoting interdisciplinary approaches. Themes varied from year to year: 1) *Biodiversity and Ecosystem Services*; 2) *Trends in Biodiversity: European Ecosystems and Policy*; 3) *Biodiversity and Ecosystem Services: Ecological and Socio-economic Aspects*. All three Summer Schools had a strong emphasis on inter-disciplinary approaches.

In total 99 young graduate and postgraduate scientists participated over the three years. They came mostly from the Network partners, but also from South America, Asia and Australia. Participants were selected from a large number of applicants, with the goal of achieving an optimal mix of regions, disciplines and gender. The 43 speakers during these three years came mostly from ALTER-Net partner institutes in 12 European countries. Evaluation by participants showed that, as a consequence of participating in the summer school, there was a shift in their PhD research integrating what they had learned. To develop the participants' network, an alumni website has been created, and permanent cooperation networks are developing.

The ALTER-Net Summer School is a true success story, and its continuation has been secured. Through the personal network created by the summer schools, a new generation of researchers on biodiversity themes is now emerging in Europe, equipped with interest and skills about how to integrate social and natural sciences. We also expect these individuals, and the relationships between them, to be important driving forces in the further process of durable integration in European biodiversity research.



*Figure 14. The ALTER-Net Summer School, Peyresq, Alpes de Haute-Provence, France: poster session.
(Photo: Wolfgang Cramer)*

9.1.2 Training ecological and economic modelling

Students of ecology and economics were offered training in the concepts and methods relevant to the cross-disciplinary issues in the ALTER-Net Training School on Ecological and Economic Modelling. This course is now run by UFZ.

9.1.3 Training in Biodiversity Communication skills

To meet the desire amongst the public to learn about science direct from scientists, ALTER-Net in collaboration with Ecsite (the European Network of Science Centres and Museums) developed a new training course. This provides scientists with the skills and confidence to give ‘meet the scientist’ or ‘live science’ sessions in public spaces such as visitor centres. The course was successfully piloted in 2008 at two science visitor centre venues (one in the UK, one in the Netherlands). Three experienced trainers were used, and explainers at the host visitor centres also contributed to the programme. Twenty-five people were trained during the two pilot workshops. There is clearly an appetite, particularly among younger scientists and students, for good science communication training. Working with Ecsite, ALTER-Net will be exploring ways in which to offer more workshops and develop the course. We will also provide follow-up support to any former students who wish it. Already some are planning events (e.g. in the Netherlands, UK and Ethiopia) that draw upon the skills they have learned.

9.1.4 Training in long-term socio-ecological research

The development of LTSER sites as platforms for delivering inter-disciplinary research needs to be supported by appropriate training. In February 2009, a training workshop took place for platform managers in the Czech Republic, with the goals to share experiences with implementation of LTSER platform in locations where it has already started, to discuss starting implementation of LTSER platform in new locations, to discuss possibilities of sharing experiences, methods, data, and projects among LTSER in future.

9.1.5 Training in database and informatics for LTER sites

During 2008 basic training on the use of the ALTER-Net metadata system was provided at regular intervals with the objective of ensuring that regular updating of the site database “Infobase” would be possible. Training and information is also provided by direct contact via e-mail or Skype and via the ALTER-Net WIKI at the UBA in Austria.

9.2 Is the network successfully integrating biodiversity and ecosystem research?

Two major assessments of the integration process in ALTER-Net were undertaken. Both surveys showed how difficult the process of integration had been and that there is still a long way to go before full integration is achieved. As a research network, ALTER-Net relied on the creativity of its individual scientists. However, individual scientists often had very short-term (but scientifically productive) views of what constituted integration which were at odds with need to develop more durable structures and processes. Although, ALTER-Net did implement several bottom-up initiatives (e.g. a mobility scheme, calls for proposals, open-development workshops) it also had a very strong top-down structure designed to develop institutional components of integration (partnership agreements, formal LTER networks, data management processes, common research agendas). This tension in ALTER-Net between “top-down” and “bottom-up” was the most difficult aspect of the NoE building process.

However, the common conclusion was that ALTER-Net succeeded in creating a partnership, structures and processes that will persist for the next few years and some (such as LTER-Europe) that should last for decades. The extent to which the partnership is durable in the long-term will depend on several factors, including its added value to its partner organisations and the extent to which it can connect with scientists and organisations that were not involved in the network building process.

9.3 Is ALTER-Net durable?

Only time will tell whether ALTER-Net has really achieved its aim to achieve durable integration. But the signs are good. Over a 5-year period from 2004 to 2009 the ALTER-Net partnership considerably improved European capacity to undertake long-term, European-scale inter-disciplinary research on biodiversity and ecosystems through the application of its combined expertise in ecology, social sciences, economics, information management and knowledge transfer combined with access to pan-European research infrastructures, including the establishment of Long-term Ecosystem Research (LTER) site network.

The partnership is committed to working together in the future and many of the activities, tools and procedures developed during ALTER-Net will be supported into the future. Annex A summarises the main durable products of ALTER-Net and their relevance to biodiversity research and policy. One other thing is also clear: the need for research, and particularly inter-disciplinary research, on biodiversity and ecosystems is now even greater than it was at the outset of the ALTER-Net process in 2002 and the current ALTER-Net partnership is in a much better position to respond to that need than it was then.

Annex A: Summary of ALTER-Net's main end-products and their expected contributions to durable biodiversity research capacity.

Product	Product description	Contribution to durable integration and BD research and awareness
PRIORITY AREA 1 DURABLE INSTITUTIONAL INTEGRATION		
Formal institutional integration	Memorandum of Understanding between ALTER-Net partners, and full implementation plan for a continued network.	Continuing partnership for biodiversity research.
Common research agendas	Over-arching BD research strategy for all partners.	Framework governing long-term European-scale BD research across all committed partners.
PRIORITY AREA 2 DURABLE COMMUNICATION AND KNOWLEDGE TRANSFER		
International Press Centre for Biodiversity	Web-based system for distributing press and news releases to global media.	Raised media, public and policy awareness.
Science-policy journal	International research/policy journal on biodiversity.	Enhanced delivery of biodiversity research knowledge to the policy audience. Greater incentives for researchers to identify and explain the policy relevance of their research.
Summer school	Annual two-week training event for graduate students and junior staff.	Training the next generation of influential people in BD research and policy.
Common training programme	A dynamic training programme, focussing on Pan-European and interdisciplinary approaches.	Joint capacity building and sharing of knowledge and training expertise.
Partnership with Science Visitor Centres	Process and tool providing a sustainable flow of public-orientated information between researchers and science visitor centres, for use in public engagement exhibitions and other activities.	A durable partnership between research organisations and science visitor centres, supporting the provision of quality information about contemporary biodiversity issues for use in public communication activities.
'Greenlink' expert database	A common database and online interface allowing journalists and policy makers to find experts via a detailed search mechanism.	Improved science-policy and science-media interface.
Shared website	A website which serves the community of people involved in European biodiversity research & communication.	Effective internal communication and presentation of information to external stakeholders. <i>The</i> website for the European biodiversity research community.
Science-policy think-tank	Work with the current Network Advisory Committee to develop a science-policy think-tank, enabling ALTER-Net to systematically evaluate and adapt its science/policy interface to new needs.	Continuing development of the science-policy interface beyond end of project.
PRIORITY AREA 3 DEVELOPMENT OF A EUROPEAN LTSER NETWORK		
LTER-Europe	Formal European network of national LTER-Networks, with agreed bylaws, strategic plan, research agenda, site criteria, minimum observation set, website, data management processes, public communication strategy, etc.	LTER-Europe will foster biodiversity and ecosystem research by combining efforts on the global, European and national level in a synergistic way.
Network of LTER sites and LTSER regions	Network of LTER facilities comprising LTER sites and LTSER regions (multi-functional research platforms for interdisciplinary research on a regional scale).	Maximum use of resources (data, infrastructure, expertise) to support and focus synergistic ecosystem research across scales and including the human dimension.

Product	Product description	Contribution to durable integration and BD research and awareness
Metadata/data information access and framework	Web-based access to LTER site information and framework for data and information delivery.	Easy access to LTER site information and framework for data delivery.
Data architecture (ontologies)	Description of required data structures for the semantic description of ecological data.	Basis for standardization/harmonization of site data.
Standard observation methods for LTER sites	Standard approaches for key taxa, pressures or services. Standard indicators of change.	System for harmonised data collection.
LifeWatch	Specification for a biodiversity observation and research network (BORN) based on LTER Europe.	Contribution to a long-term European Research infrastructure for biodiversity data and observatories.
Multi-site experiment on pressures	A pan-European experiment on the vulnerability of different ecosystems, experimental protocols.	Case study of the effectiveness of the European LTER network and the co-operation between the main European biodiversity research institutes.
PRIORITY AREA 4 DURABLE INTER-DISCIPLINARY RESEARCH		
An IDR research community	An operational framework for assessing and addressing inter-disciplinary research needs and knowledge gaps.	Facilitation of cross-sectoral policy assessments.
Systems and tools for policy conservation options	Tool for collaborative research in complex managed areas.	Durable forms of collaboration between researchers, planners and other stakeholders.
Tools for assessing public attitudes	Common and agreed qualitative and quantitative methods to assess public attitudes.	Delivering an indicator of public opinion (→ CBD), developing joint research methodology and research agenda, creating basis for long-term social research.
Tool for prioritising socio-economic drivers	Web-based tool for describing and prioritising drivers and pressures. Contribution to long-term BD research, decision making processes and policy formulation.	Availability of common tools and methods providing insights into socio-economic drivers of biodiversity change in LTSER sites.
Inter-disciplinary modelling framework based on DPSIR	An Inter-disciplinary computer simulated socio-ecological model based on DPSIR framework that integrates actors, biophysical flows, land use and biodiversity for policy and decision support.	Better integration of sociological, ecological and biophysical data and knowledge enhancing interdisciplinary research.
Proof of concept - High impact papers demonstrating improved biodiversity research capability	Papers on a range of topics including: <ul style="list-style-type: none"> • Interdisciplinary approaches for biodiversity conservation in Natura 2000 sites • Social and economic benefits of biodiversity management • Understanding what biological diversity means to people • Studies on benefits of biodiversity • Biofuels • Bio-energy, climate change and biodiversity • Ecosystem services and the economics of biodiversity 	Demonstration of relevance of research integration to protection and sustainable use of biodiversity on a European scale.

Annex B: The ALTER-Net Partnership

1. Natural Environment Research Council, Centre for Ecology and Hydrology*, (NERC), UK
2. Centre National de la Recherche Scientifique (CNRS) / (Centre Armoricain de Recherches en Environnement (CAREN)*, France (formerly CNRS/INSU)
3. European Centre for Nature Conservation, (ECNC)*, The Netherlands
4. Norwegian Institute for Nature Research, (NINA)*, Norway
5. Macaulay Land Use Research Institute, (Macaulay)*, UK
6. Umweltforschungszentrum Leipzig – Halle GmbH, (UFZ)*, Germany
7. Alterra*, The Netherlands
8. Forest Ecosystems Research Centre, University of Göttingen, (UNIGOE), Germany
9. Corpo Forestale dello Stato, Servizio (CONECOFOR)*, Italy
10. Department of Systems Ecology, University of Bucharest, (UNIBUC)*, Romania
11. Institute of Landscape Ecology, Slovak Academy of Sciences, (ILE SAS)*, Slovakia
12. The Finnish Environment Institute, (SYKE)*, Finland
13. Centre for Ecohydrology u/a UNESCO International Institute of PAS (ERCE) *, Poland (formerly ICEPAS)
14. Swedish University of Agricultural Sciences, (SLU)*, Sweden
15. Consejo Superior de Investigaciones Científicas, (CSIC)*, Spain
16. Institute of Ecology and Botany, Hungarian Academy of Sciences, (IEB HAS)*, Hungary
17. Research Institute for Nature and Forest (INBO)*, Belgium (formerly IN)
18. At-Bristol Ltd, (At-Bristol), UK
19. French Institute for Agricultural and Environmental Engineering Research (CEMAGREF)*, France
20. Umweltbundesamt GmbH, (UBA)*, Austria
21. Milieu Natuur Planbureau (the Netherlands Environment Assessment Agency) (MNP)*, The Netherlands (formerly RIVM)
22. Potsdam Institute for Climate Impact Research, (PIK)*, Germany
23. Biology Centre, Academy of Sciences of the Czech Republic, (BC-CAS)*, Czech Republic (formerly HBI-CAS)
24. Aarhus Universitet, (AU)*, Denmark (formerly NERI)

*The 22 partners marked by an * have signed the Memorandum of Understanding and have agreed to continue working in the ALTER-Net partnership.*

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