Impact Objectives

- Wide scale and systematic coverage of major European terrestrial, freshwater and transitional water environments – 200 research sites selected from a wider pool of ≈400 sites
- Integrated observations across the critical zone, supporting whole ecosystem science
- Macrosystem ecology approach, studying interactions of abiotic and biotic ecosystem components at multiple scales, including human-environment interactions
- Enables research into ecosystem processes influenced by multiple drivers, as well as socio-ecological research relating to ecosystem services

A continental view of connected environmental research

Chairman of the global Long-Term Ecosystem Research network ***ILTER Michael Mirtl*** *talks about his work coordinating a bold European vision to link hundreds of environmental observation and research sites*

Can you explain the European LTER (Long-Term Ecosystem Research) and its main components?

LTER-Europe is a regional group within the International Long-Term Ecosystem Research network (ILTER), which was established in 1993. LTER-Europe consists of 26 national LTER networks. Formally founded in 2007, LTER-Europe currently comprises around 450 ecosystem research sites and 35 Long-Term Socio-Ecological Research (LTSER) platforms, which have been collecting data for decades.

Drawing from the large collection of sites and institutions of LTER-Europe, there are projects and processes developing LTER further in Europe both technically (services and tools) and strategically. The technical flagship project is currently the eLTER H2020 project (2015-2019), focusing on standards, tools and services. In parallel, the eLTER ESFRI process aims at developing an over-arching formalised European Research Infrastructure (eLTER RI), which will facilitate scientific access and answer complex environmental questions. eLTER RI was recently included on the 2018 Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) and plans to operate about 200 well-equipped European LTER sites and LTSER platforms.

How does eLTER RI differ from other environmental research that is underway across Europe?

eLTER RI is building on the LTER-Europe network and related projects, to pursue a fundamentally systemic approach to observing and analysing the environment. While several existing thematic environmental research infrastructure projects focus on one or more elements of environmental change, eLTER RI will be the only research infrastructure which takes a holistic view of the integrated impacts of stressors on a wide variety of European benchmark ecosystems. eLTER RI sites are collecting a broad range of terrestrial, freshwater and transitional water parameters across all major geographical systems and climatic zones in Europe. Data gathered will include biological, physical and chemical variables, as well as properly scaled socioeconomic metrics. Ecosystem change caused by long-term pressures and short-term pulses can thus be investigated at all geographical and temporal scales – and across climatic gradients.

What do you hope the ultimate impact will be from this work?

Progress in understanding, managing and securing our vital ecosystems is hampered by dispersed observation sites and single discipline research. Our goal is to close this critical gap by linking multiple user groups to integrated research sites, local expert teams and their long-term data legacies. We are working towards this goal in collaboration with existing regional and subject-specific environmental RIs. In future years, eLTER RI will enable integrated cross-scale and cross-disciplinary analysis of comparable data across time and geographical zones.

Can you explain the global role and impact of the European LTER?

Besides representing the European contribution (Regional group) to the actual global LTER network, the European LTER has lately been setting the pace in several respects. Since 2016 Europe has provided the chairman. Major achievements include the global adoption of the European site classification, standard observation variables and the site registry and accreditation webservice (DEIMS). This service and ILTER´s experiences in a global roll-out caught the attention of GEO. As a result, in 2016, ILTER was invited to become a GEO Participating Organization. It has since engaged in the GEO In-situ Foundational task, working towards a follow-up to the Global Terrestrial Observing System (GTOS) and further developing DEIMS as a pilot for a global GEO site registry. ●

Network addressing global environmental challenges

A collaboration of experts and research and observation sites across Europe is taking a whole system approach to filling a critical gap in top-class science at a continental scale, ultimately building knowledge and resilience against global environmental challenges

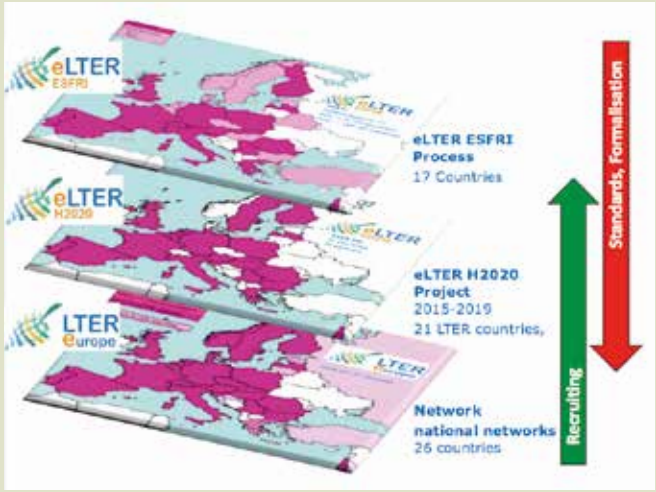
The Earth's critical zone, which extends from the tops of our largest trees down to the bedrock beneath our soil and groundwater, supports the vast majority of life on earth, including humans and a diverse array of fauna and flora. This zone is coming under increasing pressure from major factors such as global climate change and human exploitation. The European Long-Term Ecosystem, critical zone and socio-ecological Research Infrastructure (eLTER RI) coordinator Michael Mirtl of the Helmholtz Centre for Environmental Research and Environment Agency Austria states that 'if humans are to find ways to protect and sustain the ecosystems that in turn nurture our existence, we need to understand all the interacting factors that cause environmental change.' The RI will help researchers address the challenges of biodiversity loss, climate change, eutrophication and pollution, in order to support sustainable environmental management.

The eLTER RI is focused on measuring change in ecosystems over time, and understanding the influential factors causing change, such as human land use and industrial development. The development of eLTER RI builds on the LTER-Europe network and on the eLTER H2020 and other related projects. The research infrastructure will comprise around 200 observation and research sites in a distributed network, to be centrally managed and supported by a cross-disciplinary head office. This central node will act as an interface between users and data repositories, as well as providing strategic support in areas such as data quality assurance, international networking and technical innovation and development.

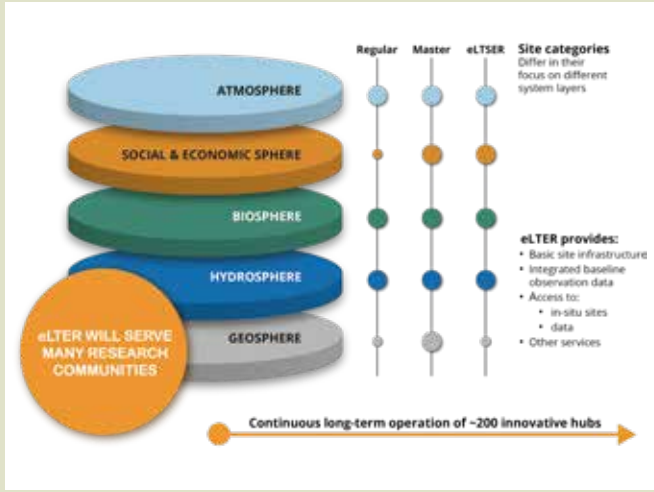
COORDINATED EFFORT

In the context of the global ILTER network and the LTER-Europe network of 26 national LTER networks, many of the LTER sites have operated for decades and hold legacy data covering environmental changes over these extended periods. LTER-Europe´s LTSER platforms were a new dimension in seeking to incorporate research on human-environment interactions. Such research requires cross-disciplinary approaches on environmental and socioeconomic topics. A number of projects have built on LTER-Europe, with the aim of encouraging standardisation, data-sharing via databases and portals, and access to data for researchers, policy makers and other decision-makers. The EU-funded, four-year eLTER H2020 project has made significant steps towards the process of data integration. 'The project has provided the independent national LTER networks and sites with standards, tools and services that otherwise would have been set up in parallel... or never,' says Mirtl.

eLTER H2020 is a key transition project between a voluntary network of sites and the development of a full eLTER Research Infrastructure. Concluding in 2019, the work ▶



Elements of the European LTER process



Whole-system approach supporting interdisciplinary collaboration at top sites

has already begun to identify the major environmental issues and key scientific questions to be supported by the eLTER RI. Also, being developed is a Data Integration Portal with flexible tools through which data can be accessed and a Dynamic Ecological Information Management System (DEIMS) to document research sites, which has been adopted by ILTER. The project has also piloted transnational access to a selection of sites by scientists. 171 research sites have been analysed in detail concerning their scientific programs and equipment. They encompass all the main biogeographic regions in Europe such as Boreal Alpine, Mediterranean and Continental. 'eLTER has co-evolved with a range of sister research infrastructures and monitoring networks in Europe such as ICOS, the Integrated Carbon Observation System, and LifeWatch, which is an e-infrastructure supporting access to and analyses of biodiversity data. Major efforts have been made to clarify connections, interfaces and divisions of tasks, to avoid duplication and ease communications. These systems have been formalised through cooperation agreements,' points out Mirtl.

STANDARDISATION AND INTEGRATION

The eLTER RI will deploy mandatory standard observation variables and harmonise many of the measurements made at the involved sites. Mirtl says it is important that sites taking part in the RI 'are able to comply with strict criteria governing, for example, the minimum set of measurements to be made, measurement methods to be used and the process of exposing data via the central Data Integration Portal'. As per LTER-Europe, the RI will comprise both large-scale multidisciplinary eLTSER platforms and smaller ecosystem research sites.
The two main goals of the RI are to achieve broad geographical coverage and to support excellent science by providing access to comprehensive environmental information. To this end, a hierarchical structure of sites has been developed, capped by the eLTSER platforms, which also host eLTER sites and cascading down through a range of highly instrumented to more simple research sites. Mirtl explains that these sites were incorporated to 'achieve wide-scale systematic coverage of the major European terrestrial and aquatic environments and socio-ecological zones'.

eLTSER PLATFORMS AND MASTER SITES

The eLTSER Platforms and Master Sites are to be the key nodes in the RI. The eLTSER Platforms are designed to be regional hubs for environmental and socio-ecological research and information exchange. As well as building knowledge of socio-ecological interactions, a major objective is for these sites to feed into local and regional decision- making regarding long-term environmental sustainability. Examples could include advising regional planning authorities on the design and location of new housing and industrial developments, or helping environmental agencies prioritise their efforts in a range of areas, such as habitat conservation. The eLTER Master Sites are strategically located, will be highly instrumented and provide facilities for the co-location of multidisciplinary research teams and management functions with sister RIs.

Currently 160 research institutions have joined the eLTER RI ESFRIprocess and 17 countries have so far pledged support. The Head Office, most probably to be based in Germany, will comprise the main point of contact for the RI. One of its important roles will be to coordinate national site networks (National Research Infrastructures, NRIs) and the proposed Topic Centres, which will help deliver the strategic objectives of the RI. Four centres will cover the areas of: data quality assurance, validation and standards; analysis toolkits and a community modelling platform; research outreach and interfaces including fostering cross-disciplinary research; and developing partnerships for innovation and technological development. Many SMEs are involved peripherally, through their work with member institutes and research sites. It is envisaged that RI data could support new decision-making tools and models, which could be commercialised by smaller companies and adopted by environmental agencies, consultancies and regional authorities. Mirtl hopes that the RI will facilitate spatial and temporal ecosystem, critical zone and socio-ecological research by providing a comprehensive platform for holistic interpretation of highly complex environmental systems, in a cost-effective manner, but there is still plenty of work to be done. 'eLTER is currently doing much that can support research, but when eLTER RI is fully operational, the scientific community and other end users will benefit even more.' ●

Project Insights

NATIONAL COORDINATING INSTITUTIONS (SORTED BY COUNTRIES):
• EAA/AT • INBO/BE • IBER-BAS/BG • WSL/CH • CAS CR/CZ • SGN – FZJ – UFZ/ DE • IGN/DK • UGR/ES • SYKE/FI • CNRS/ FR • TUC/GR • MTA OK/HU • BGU/IL • CNR/IT • LU/LV • SOVON/NL • NINA/ NO • MI-PAN- ERCE/PL • SPECO/ PT • UNIBUC/RO • UNS/RS • SLU/SE • ZRC- SAZU/SI • ILE-SAS/SK • ITU/TR • CEH/UK

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